

NORTH CAROLINA

MARITIME Strategy

NC Maritime Strategy Final Report

**Prepared for the
North Carolina Department of Transportation**

by

**AECOM
in association with URS**

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ACKNOWLEDGEMENTS

Initiated by the Governor's Logistics Task Force (GLTF), the *North Carolina Maritime Strategy* takes a fresh look at North Carolina's maritime assets and the needs for improvement to ensure that our State remains competitive in the future. A *Maritime Strategy* Executive Team has been formed to oversee this process, evaluate the results and provide an objective technical and economic analysis. The *Maritime Strategy* Executive Team includes: Lieutenant Governor Walter Dalton; the Governor's Senior Policy Advisor, Al Delia; Secretary of Transportation, Gene Conti; Secretary of Commerce, J. Keith Crisco; and Secretary of Environment and Natural Resources, Dee Freeman. The following North Carolina Department of Transportation (NCDOT) and North Carolina Department of Commerce (NCDOC) staff have provided day-to-day direction, guidance and support for study execution: NCDOT Director of Strategic Initiatives, Roberto Canales PE; NCDOT Project Manager, Virginia Mabry; NCDOT Liaison to the Lieutenant Governor, W. Seth Palmer; NCDOT/Commerce Liaison Joseph (Jed) McMillan; and Transportation Consultant to NCDOT and Global TransPark, Charles Diehl.

A Maritime Advisory Council, comprising of State officials and staff, along with industry representatives from ocean shipping, trucking, rail and manufacturing interests, as well as community-at-large representatives, has provided further guidance and support to the study team. A roster of Advisory Council membership is included in the appendix of this report.

Finally, broad-based stakeholder outreach is key to successful development of the statewide *Maritime Strategy*. A comprehensive and ongoing public involvement program has provided additional input to the study by engaging the public, agencies and others through a series of informational meetings, public workshops and focused discussions with industry, as well as environmental and community groups.



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EXECUTIVE SUMMARY

E.1 Goals for North Carolina

The State of North Carolina initiated the development of the *North Carolina Maritime Strategy* to serve as an open evaluation of North Carolina's position, opportunities and challenges as a port for global maritime commerce. The study has examined the role that North Carolina ports play in sustaining and strengthening the state economy and to identify opportunities and strategies to optimize the benefits received from the State's investment in port and associated transportation infrastructure.

The State's ports have the potential to offer access to global trade for export and import of raw materials, in-process manufactured products, and finished goods that originate in North Carolina or are destined for North Carolina consumption. Cost-effective access to the global marketplace can make North Carolina-based employers more competitive and can help diversify the state's economy across many industries. North Carolina-based manufacturers that rely on seaports for export can be particularly effective at generating North Carolina jobs because these industries purchase large amounts of goods and services from the local economy.

Efficient transportation – not only at the port but also to and from landside manufacturing and distribution centers – is a critically important factor for business competition. Targeted investments by the State of North Carolina in maritime transportation have the potential to enhance the state's economy and to provide other public benefits to North Carolinians.

The *Maritime Strategy* identifies maritime market investment opportunities that would support state industries and that would also take advantage of the North Carolina's position in regional and global maritime trade. In consideration of intense market competition and the need to prioritize the use of available public funds, the *Maritime Strategy* presents a set of market opportunities that respond directly to industry needs for maritime transportation and offer the potential to generate the greatest economic benefit to the state.

Resulting from careful examination of likely benefits, cost, and economic impacts to the state, a menu of market position alternatives is presented to define a range of reasonable aspirations for North Carolina. Market opportunities and associated infrastructure investments focus on areas where North Carolina can generate the greatest benefit to the State and its residents. This approach has identified markets that build on the state's existing strengths or that fill gaps in port services offered by nearby ports. Niche opportunities have been identified to respond directly to the unmet waterborne transport needs of the state's shippers.

E.2 Why Ports?

Waterborne shipping continues to be the most cost-efficient means for import and export of most goods. Efficient national and local ports are an integral component of an effective freight transportation system critical to the state's global competitiveness. In fact, more than ninety-nine percent of the nation's overseas trade is transported through US ports.

The importance of ports to the economy and national security was recognized in a recent Congressional resolution that affirms the economic impact of ports. Nationwide, ports support

\$3.95 trillion in international trade which accounts for 11 percent of the US GDP, generate more than \$200 billion in federal, state and local tax revenue, and support jobs for more than 13 million people. Ports are recognized as important contributors not only to their local communities, but to every US congressional district because ports create opportunities for global trade. Federal statistics show that for every \$1 billion in exports shipped through US ports, 15,000 domestic jobs are created.

Ports provide critical access to global trade for raw materials and in-process and finished goods that originate in or are destined for North Carolina consumption. Waterborne imports arriving through domestic ports generate jobs and income as goods are transported to distribution centers for consumption or to nearby plants for further assembly or input to manufacturing processes. Ports help North Carolina's exporters meet the foreign demand for domestically-grown agriculture and timber products, extracted minerals and raw materials, and final or in-process manufactured products – while supporting local jobs and economic development generated by these industries.

Because they are an integral part of the global supply chain, ports play a major role in industrial plant location. Local shippers rely on seaports to support the transport, handling, storage, and inventory of imported and exported goods. Many manufacturing and processing industries, seeking lowest cost options for end-to-end transport of imported and exported goods, locate their plants near port sites or at locations with ready port access. Port-sponsored Foreign Trade Zones can provide incentives for value-added manufacturing services and trade.

Cost-effective access to the global marketplace can make North Carolina's producers and employers more competitive and can help diversify the state's economy across many industries. Consumers and businesses in North Carolina's population centers benefit from reduced cost in delivery of imported goods through nearby port facilities. The availability of local port services helps to support North Carolina's industrial and rural areas by providing market access for manufacturing and agriculture. Proximity to nearby maritime facilities is particularly important to the competitiveness of the North Carolina's agricultural producers, who rely heavily on the state's ports.

Today's ports have an important role in sustaining the state's economy and also have important responsibilities to sustain the environment and the community. Consistent with the objectives of the Governor's Executive Order 99, which calls on the State of North Carolina to consider if potential port uses would be incompatible with economic drivers of the surrounding community, ports are important stewards of the waterside environment and communities within which they operate.

Best practices implemented by North American ports include programs that can allow seaports to both coexist with and also enhance their host communities. Cleaner fuels and cargo handling technologies minimize air quality impacts. While waterborne transport is already the most efficient means to move most cargo, ports continue to advocate and implement operational and technological improvements to make them even greener. Water resource programs, including stormwater and sediment management, provide for responsible operations near sensitive habitats. Harbor developments provide access for fishing and recreation. Navigational improvements support public use and enjoyment of waterways and shorelines. Dredged material removed during channel maintenance is used to protect beaches and adjacent homes and development from storm damage.

E.3 Global Trends

Goods movement patterns in the US have emerged to optimize the supply chain based on sources of goods and consumer market locations – domestic and foreign. A fully functioning system of ports of entry, transportation link, and distribution nodes is needed to efficiently bring goods to market.

At the forefront of recent news in global goods movement is the ongoing expansion of the Panama Canal, which is now scheduled for completion in early 2015. With larger locks and greater capacity, the expanded Panama Canal has the potential to enhance the competitiveness of the all-water route between Asia and the US east coast. The most recent forecasts, however, indicate that much of the anticipated shift of Asia traffic from west coast to east coast already occurred when ocean carriers sought to diversify their North American ports of call following Southern California work stoppages in 2002. It is important to remember, however, that today's trade patterns will shift to match changes in global production and demand. Anticipated economic growth in India and Brazil, for example, would deemphasize the importance of the Panama Canal in reaching US markets.

Updated container forecasts prepared by IHS Global Insight for the North Carolina region, including container demand at ports in North Carolina, Virginia, Georgia, South Carolina, and Jacksonville FL, reflects a compound annual growth rate of about 3.3 percent through 2040. This rate is somewhat larger than forecasted growth in gross domestic product, reflecting a modest shift of containerized goods from other areas to the southeast region.

A global trend driven by vessel economies of scale and enabled by the Panama Canal expansion is the use of larger containerships to serve east coast destinations. The larger Canal locks will allow the transit of "Neo Panamax" vessels that have a deeper draft, wider beam, and greater length. The largest ships, however, will not call on every port. Rather, the industry is expected to dedicate its 10,000 to 12,000 TEU ships to one or two mega ports on the east coast, while 8,000 TEU containerships would be deployed to secondary ports using either a dual rotation or a hub-and-spoke operation. In consideration of population density, regional port facilities and landside freight corridors, North Carolina is most appropriately positioned as a location for a secondary container port.

E.4 Economic Impacts of Maritime Investments

North Carolina's waterborne imports and exports are dominated by trade with China and other parts of Asia, Latin America, and Europe. Economic projections indicate that the pace of expansion and associated demand for goods among North Carolina's Latin American and Asian trade partners will strongly outpace the expansion of the domestic economy in coming decades. The advancement of economic development opportunities within the state, therefore, will depend on the ability to connect with these foreign economies and capitalize on global market potential through the exchange of resources, goods and products.

To remain competitive in world markets and to maintain the growth of jobs in North Carolina, continued investment is needed in the waterside and landside infrastructure that supports goods movement. Although the North Carolina economy is less dependent on goods production than it once was, waterborne trade remains vital for certain industries, including agriculture, manufacturing, mining and aggregates, and forest products. In 2010, one-fourth of the state's

agricultural output was exported to foreign destinations; much of this volume was handled through North Carolina ports.

Port-related investments generate economic benefits through their use and the subsequent market response. Maritime infrastructure investments generate direct jobs during both the construction period and through long-term industry employment. Access to effective and efficient waterways, ports, highways, and railroads further contributes to the economy through state tax benefits, improved earnings, and productivity gains realized through shipper cost savings and logistics benefits.

New maritime construction and operations employment and associated industry purchases will further generate indirect and induced economic impacts by stimulating demand for support industries and generating increased consumer demand for goods and services. Local manufacturers that use seaports for export are effective job-generators because these industries purchase large amounts of goods and services from the local economy.

Other public benefits realized by proposed maritime investments include reductions in truck vehicle miles traveled and associated highway maintenance costs, congestion, and air quality impacts. Additionally, proposed upgrades to the state's road and rail network would improve transportation safety and realize ancillary mobility benefits to non-freight users by reducing overall congestion on roadways shared by passenger vehicles and trucks.

The economic development return-on-investment is a cumulative process. Short-term job and earnings impacts begin with construction, while safety and shipper savings begin once the investment comes into use and grow with the economy. Long-term economic development benefits begin as the market responds to the new facility – firms that locate in the state to be close to the port and producers that can expand the range of their production to include new products.

E.5 Building Trust with the Community

Investments in maritime infrastructure, including port terminals, harbors, and channels can provide great value to the communities within which North Carolina ports operate. The state's port communities, however, have expressed concerns that growth in port operations may generate remote benefits, but could cause local impacts. An open dialog between ports and the surrounding community about current and future port operations is important to building an understanding of port business and to maintaining community trust. As NC Ports partner with NC Commerce to attract new users, for example, the State should weigh the benefits of industry confidentiality against the community's interest in understanding changes that may happen at the port.

Well-designed ports are good neighbors that enhance their communities. By advancing port developments that consider the triple bottom line of economy, society, and environment, North Carolina's maritime-dependent industries can enhance and successfully coexist with tourism and other non-port uses. Attraction of port users and related industry supports a more diverse local economy so that it is less susceptible to downturns within a single, dominant economic sector. Port-related employment also generates demand for local goods and services.

Implementation of port best practices can provide for improved waterfront use and access as well as waterway recreational and fishing opportunities. The Wilmington Offshore Fisheries

Enhancement Structure (WOFES), constructed using rock removed during deepening of the adjacent ship channel, has created a 165-acre fish habitat recognized for consistently good catches. The high-quality sand from harbor maintenance dredging provides material for beach nourishment, shoreline stabilization and habitat restoration in the areas surrounding both the Cape Fear and Beaufort Inlets; 112 miles of North Carolina coastline have benefited from placement of sand dredged from the harbors.

NC Ports and the communities within which they operate will also benefit by promoting a culture within the port organization that seeks to identify port operations solutions before problems arise. Siting of open storage areas, review of processes to be handled at the port, and routing of trucks to and from the port gate are all important operational issues that merit regular review and consideration to minimize potential negative impacts to port neighbors.

E.6 Maintaining Truck Mobility

Goods originating from or destined for use in North Carolina are transported primarily by truck. The state's producers report, and the NC Maritime analyses demonstrate, that landside costs – getting to and from the port gate – comprise 50 percent or more of total overseas delivery cost. As a result, proposed freight transportation system investments identified in the *Maritime Strategy* put a heavy emphasis on highway projects.

Truck freight within North Carolina is carried over a network of interstate highways, US and state highways and four-lane divided roadways that provide access to in-state port facilities and ports in neighboring states of Virginia, South Carolina, and Georgia. Key routes for waterborne truck freight within North Carolina include I-40, I-85, I-95, I-26, I-73/74, I-77, US 17, US 70, US 74/76, and NC 24. I-485 allows for improved mobility around Charlotte. Prioritization or acceleration of funded STIP projects that improve freight mobility along these important freight corridors will provide early benefits to industries that rely on the state's maritime infrastructure. These priority projects include various capacity improvements, bypasses and connectors, as well as upgrades of US or state highways to interstate standards.

Through 2040, freight mobility through North Carolina's highway network will rely on additional improvements that provide direct and timely truck access between inland freight nodes and facilities, including intermodal rail yards, manufacturing centers, agricultural areas, warehousing and distribution centers. While there is need for near term investment in specific "last mile" freight connections, highway improvements identified in the *Maritime Strategy* are driven by increased ambient congestion resulting from the state's anticipated population growth. Improvements to the state's primary truck corridors, therefore, would be needed over time to provide for continued truck mobility through the next 30 years.

Targeted investments along US 70, I-73/74 and I-40 would have the greatest effect in reducing trucking travel times within the state. US 70 provides primary access to the Port of Morehead City and eastern North Carolina. Completion of projects such as the US 70 Kinston Bypass, upgrades in the vicinity of James City, and the North Carteret bypass would enhance access for freight movement to Morehead City.

E.7 Improving Rail Access

While North Carolina is served by an extensive rail network, freight rail service to and from North Carolina's ports is limited and each port site is served by a single rail carrier: CSX provides daily rail service to Port of Wilmington while NS operates three trains a week into the Port of Morehead City. Low historical rail freight volumes to both Wilmington and Morehead City have resulted in high per-unit rail costs, making rail transport less competitive as compared to truck transport within the state.

Efficient freight rail service is an important component of inland distribution for market opportunities that include large or heavy loads, containerized goods, or transport of goods beyond a cost-efficient trucking distance. For the most part, North Carolina's rail network offers sufficient capacity to accommodate additional rail trips that would be generated by the market opportunities identified by the *Maritime Strategy*. The completion of several projects under development such as the Pembroke Turn and the Fayetteville Connector will improve the operational efficiency of the rail network.

Additional, targeted capital investments in rail infrastructure would support the transport of goods produced or consumed in North Carolina and minimize impacts of goods movement on non-freight mobility and uses. The *Maritime Strategy* identifies improvements to port rail access as well as new or improved port terminal connections that would enhance rail transport of various commodities to and from the state's port facilities. Market strategies that would significantly increase in rail traffic to Morehead City include the proposed relocation of the rail line to reduce impacts to the port community. The development of inland rail ramps at targeted industrial sites would allow for more cost-efficient transfer of heavy or oversized manufactured goods destined for export. The state's containerized imports and exports would benefit from the development of a new intermodal container facility east of Charlotte, to replace the undersized and poorly-located CSX terminal in west Charlotte.

NC Ports and in-state shippers contend that the lack of rail competition contributes to high quotes for rail transport to the state's port facilities. Implementation of shared rail service, whereby CSX and NS would enter into agreement to transport the other's cars on their trains, would allow shippers to contract with one railroad while obtaining access to the other railroad's operating lines; an interchange of cars would be required between the two railroads. Implementation of shared service could also benefit NC Ports in attracting ocean carriers, who may enter into exclusive agreements with a single US rail carrier to provide point-to-point transportation service to shippers.

Evaluation of the rail service needs within North Carolina reveals opportunities for North Carolina Railroad (NCRR) to play a more active role in advocating, promoting, or even operating freight rail service along State-owned rail corridors. While examination of the feasibility and viability of a new short line service was beyond the scope of the *Maritime Strategy*, NCRR could lead the effort to evaluate such a proposal in advance of renegotiation of the NCRR-NS trackage rights agreement. Rail freight mobility within North Carolina could benefit by refocusing or clarification of certain provisions of this agreement, which expires December 31, 2014.

The ongoing integration of NCDOT and NC Ports and GTP will enhance the coordination of these entities to advance their shared goals. The state-owned railroad, however, has not been included in this integration. Close alignment of NCDOT, NC Ports, GTP and NCRR objectives will ensure a coherent strategy for the movement of goods and people within the state.

E.8 Market Opportunities for North Carolina

North Carolina's existing port facilities at Wilmington and at Morehead City handle significantly less volume overall than do other regional ports that also support North Carolina shippers. Port selection is influenced by proximity (particularly for heavy or highly perishable goods), total delivered cost, frequency of carrier service, the variety of ocean service (origins and destinations) available to shippers, and other business advantages that may be offered in different locations.

North Carolina offers lower labor and energy costs relative to its coastal competitors, providing a competitive advantage to businesses located in the state. Through targeted investments in handling capabilities as well as improved access to port facilities, North Carolina can further enhance the competitive advantages to in-state shippers that, in turn, can generate economic benefits for the state. For example, although North Carolina's ports offers some capability to handle refrigerated cargo and Ro/Ro, enhancement of these facilities and investment in specialized equipment would provide much-needed regional capability and capacity to support the state's agricultural production and manufacturing industries.

Proposed maritime investments support North Carolina's growth markets as well as legacy industries that could be at risk. New jobs are an important goal, but it is also vital to protect legacy jobs and North Carolina industries that are under increasing pressure from out-of-state and overseas competition. The state's agriculture and wood production as well as US military operations in North Carolina are examples of existing industries that would benefit by public investment the state's port capability and accessibility.

Over the next three decades, North Carolina will be presented with both transformational and incremental maritime opportunities, as summarized in the table below and on the pages that follow. Transformational opportunities require immediate investment to enter the market, but could change the face of maritime trade in North Carolina. In some cases, stepwise investments could be made while more capital-intensive projects are underway. Evolutionary growth opportunities would allow the ports to slowly improve over time, and would require less upfront investment. There is also "low hanging fruit," which would not require significant investment but could offer immediate benefit to the state. Development of a cold storage facility near the port, for example, would meet an immediate need identified by North Carolina producers. Prioritization and advancement of certain highway projects that are already in the seven-year State Transportation Improvement Plan would enhance near-term port access for North Carolina goods.

Upside opportunities and downside risks exist for each market scenario. Greater than projected wood pellet growth, for example, would warrant allowance for expansion beyond the *Maritime Strategy's* conservative projection for this new market. Attraction of container demand beyond North Carolina state boundaries could attract greater volumes than indicated in this study to support the state's demand for imports and exports. If, on the other hand, the State elects to construct a new greenfield container terminal and projected demand does not materialize in the near-term, NC Ports may be unable to cost-effectively operate the terminal at a low utilization. While wind power manufacturing is an opportunity under evaluation by the State and could be supported by investments in oversize cargo infrastructure, this industry may be undercut by low-cost Chinese producers.

Table E. 1: Overview of Alternative Market Scenarios

	Grain	Wood Pellets	Other Wood	Container	Refrig Cargo	Ro/Ro & Oversize
MARKET VOLUME						
2040 import / export	730,000 ton	450,000 ton	1,320,000 ton	1,260,000 TEU	73,000 TEU	192,000 ton
INFRASTRUCTURE NEEDS						
Ports & waterways	New bulk export terminal	New bulk export terminal	--	Expanded terminal Dredging	Cold storage at or near port	New Ro/Ro & oversize terminal
Highways	All scenarios, except refrigerated cargo, call for multi-year highway capacity improvements, bypasses, and upgrades along primary truck corridors					
Railroads	Improved port rail connections and service, including rail relocation in MHC where high train volumes anticipated					
Inland facilities	--	--	--	E Charlotte terminal	--	Rail ramps
ECONOMIC IMPACTS (\$ in millions)						
Construction jobs	21,194	5,803	4,885	52,214	--	35,125
Construction-related earnings & revenues	\$ 771	\$ 211	\$ 178	\$ 1,900	--	\$ 1,278
Average operating employment 2017-2046	90	41	289	2,721	173	99
Operations earnings	\$ 71	\$ 34	\$ 242	\$ 2,283	\$ 146	\$ 121
BENEFITS 2017-2046 (\$ in millions, discounted from year of benefit to 2011 at 3 percent)						
Shipper savings	\$ 92	\$ 125	\$ 60	\$ 1,334	\$127	\$ 64
Supply chain benefits	\$ 5	\$ 8	\$ 4	\$ 91	\$ 9	\$ 4
Accident savings	\$ 30	--	--	\$ 99	--	\$ 51
Travel time savings	\$ 2,103	\$ 628	\$ 693	\$ 2,998	--	\$ 4,872
Hwy maintenance	\$ 12	\$ 14	\$ 14	\$ 115	\$ 5	\$ 5
Emissions reduction	\$ 14	\$ 17	\$ 17	\$ 138	\$ 6	\$ 3
Grade crossing	\$ 49	--	--	--	--	\$ 27
Total Benefits	\$ 2,437	\$ 825	\$ 820	\$ 5,060	\$ 147	\$ 5,245
COSTS (\$ in millions)						
Capital costs (\$ in millions, 2011)	\$ 1,523	\$ 417	\$ 351	\$ 3,752	\$ 24	\$ 2,525
Freight share of capital cost (\$ in millions discounted from year of cost at 3 percent)	\$ 86	\$ 62	\$ 7	\$ 627	\$ 22	\$ 145
Freight BCR	2.01	2.64	13.71	2.69	6.69	0.75
Benefit-Cost Ratio	2.64	3.13	4.04	2.09	6.69	3.38

1. Future-year benefits and costs incorporated into BCR and Freight BCR are discounted to 2011 at 3 percent. Refer to Table 75: NC Maritime Market Evaluation Matrix, at the end of this report for more detail.
2. Benefits and costs illustrated for representative set of capital maritime investments that meet infrastructure needs.
3. Residual value of infrastructure not shown.

Grain

Greater capacity to export grain and soybean through North Carolina ports would support one of the State's existing economic strengths. Soybeans account for ten percent of North Carolina's agricultural exports; adding in wheat and feed grains brings the total to 18 percent of the state's exports at a \$490 million contribution to the state's economy. World demand for grain and soybean is projected to grow strongly, so increased exports would attract more income to the state.

The opportunity for export through North Carolina ports comprises 730,000 tons by 2040. North Carolina soybeans are attractive to export customers because of their higher protein and oil content than other sources. North Carolina soybean growers indicate that they could produce more if soybeans could be more economically transported to market. They also report that the state's soy products receive a higher price in the export market.

Today, there is no in-state bulk grain facility to serve North Carolina exports, even though the state's soy-growing region lies very close to NC Ports. Except for a small volume of containerized grain shipments that is handled through Wilmington, the state's growers must truck their product to out of state ports for export. Even a small savings in transportation cost could yield significant savings for this industry, with multiplier effect for the North Carolina economy.

To realize export opportunities, new bulk grain terminal facilities are required, including grain storage, on-terminal truck and rail unloading facilities, and specialized vessel loaders. Dry bulk vessels typically require no more than a 40-ft water depth and can be accommodated at both of North Carolina's existing ports. A new bulk grain terminal with 3.2 million bushels of storage capacity and on-terminal rail with loop track is proposed at either Radio Island or the Port of Wilmington north property. Environmental permitting and USACE berth dredging permit would be required.

Improved highway access to North Carolina's soybean regions would generate delivered cost savings to the state's growers. Proposed highway improvements to reach eastern North Carolina soy-producing counties that lie within trucking distances include US 70 North Carteret Bypass and others. Growing areas further west could be reached via the existing rail network.

Maritime investments that are supportive of grain and soybean exports out of North Carolina, totaling \$1.5 billion in port, road, and rail improvements over 30 years, could realize \$97 million in shipper savings, including higher export pricing and associated supply chain benefits. Non-freight users would realize \$2.1 billion in travel time savings as a result of proposed highway network improvements. Proposed highway network investments would further benefit the State through reduced accidents, emissions and highway maintenance totaling \$56 million.

In considering targeting port facilities for use in grain export, the seasonality of soybeans should be weighed. Capital investments required to support grain exports would be most heavily used for only three months of the year (October through December), when 65 percent of North Carolina's soybeans are brought to market.

Wood Pellets

North Carolina boasts a high concentration of the US production of wood products; however its competitiveness has been weakened in recent years. The emerging wood pellets market in Europe offers a new potential for growth to the state's timber industry. The push to convert European Union power plants to renewable sources has generated a global demand for wood biomass. This demand for wood pellets is expected to grow strongly in the next 10 years.

Supported by North Carolina's strength in timber production, a successful wood pellet industry requires export facilities to include covered on-port storage and bulk handling equipment as well as rail access from wood growing regions to the port. A new wood pellet terminal is proposed at either Radio Island or the Port of Wilmington north property, which would require environmental permitting and USACE berth dredging permits. Dry bulk vessels typically require no more than a 40-ft water depth, which can already be handled at both of North Carolina's ports.

Highway network investments are proposed on truck routes providing access to timber growing areas in the eastern regions of the state to improve delivery of wood pellets to port. European buyers call for wood pellet exports be moved through a low-carbon-emitting mode such as rail in order to meet overall greenhouse gas reduction goals. Improved rail connections are proposed to support needed rail service from western North Carolina to the wood pellet export terminal.

The growth forecast for wood pellet exports from North Carolina has significant upside potential. Several producers have already expressed interest in developing facilities with greater capacity than indicated by initial forecasts for this emerging market so the projected 450,000-ton annual export market in 2040 may be realized much sooner. The Enviva facility in Southampton County VA, for example, has reported that it will produce 550,000 metric tons of pellets annually; two similar facilities are proposed by others in North Carolina. This new market could evaporate, however, if the EU initiative is abandoned or redirected to another energy source. In consideration of the upside potential for this market, some allowance for expansion beyond the deliberately conservative 2040 forecasted volumes may be warranted.

Proposed investment of \$417 million in wood pellet facilities and access infrastructure over 30 years would result in shipper savings and supply chain benefits of \$133 million. Non-freight users would realize \$628 million in travel time savings as a result of proposed highway network improvements. The State would further benefit through reduced accidents, emissions and highway maintenance totaling \$31 million.

Other Wood Products

Increased export of traditional wood products through North Carolina ports, including wood chips and wood pulp, would support an important existing industry in the state. Heavy commodities like wood are particularly sensitive to transportation costs so improved landside access and handling facilities at North Carolina's ports would support the ability of this large industry to capture its maximum share of the world market.

Growth of North Carolina's traditional wood products market, comprising combined import and export demand of nearly 1.3 million tons in 2040, can be accommodated within available NC Ports terminal capacity. The same highway and rail networks that support the wood pellet would enhance North Carolina's export of other wood products. Proposed highway improvements would enhance access to timber areas in southeastern North Carolina. Rail access to timber areas in western North Carolina is available on the existing rail network, providing that adequate rail service is available.

Proposed investments in wood-supportive infrastructure, totaling approximately \$351 million over 30 years, would result in shipper savings and supply chain benefits of \$64 million. Non-freight users would realize \$693 million in travel time savings as a result of proposed highway network improvements. The State would further benefit through reduced accidents, emissions and highway maintenance totaling \$31 million.

Containerized Cargo

For container operations, the *Maritime Strategy* forecast is focused on in-state import and export demand, to support North Carolina industry and consumption. This contrasts with previous forecasts for the North Carolina International Terminal which was proposed as a gateway to the larger US South and Midwest market in competition with large container ports in Norfolk VA and Savannah GA.

The movement of containerized goods supports export and import activity across a large variety of industries — including goods destined to local retailers and increased export of North Carolina products. Investments in in-state container facilities can allow for balance of exports and imports, with inbound containers available for outbound use by North Carolina's exporting industries. Containers are used to transport a variety of goods exported from the state; North Carolina shippers must now transport their products to more remote ports because empty containers and scheduled containership service are not as readily available at NC Ports. By advancing North Carolina as a secondary container port, the State can provide for more cost-effective access to container imports and exports for the North Carolina shippers.

Today, the Wilmington Container Terminal can handle about 530,000 twenty-foot equivalent units (TEU) per year, less than one-third of 1.3 million annual TEU projected demand of North Carolina-based shippers in 2040. The state's container needs could be met through a variety of approaches, including expansion and modernization of the existing Port of Wilmington container terminal or construction of a new greenfield container port at either Radio Island in Morehead City or at River Road or Southport in Brunswick County. The Port of Wilmington container alternatives would allow for incremental investments to be made over time, but would require further deepening of the 26-mile Cape Fear Channel. The Radio Island site is only four miles from open ocean and would require less dredging, but would require significant investment in landside road and rail access; the lack of land available on Radio Island preclude future expansion possibilities. The two sites in Brunswick County have more available land, but would require high up-front capital investments that increase the near term risk to terminal profitability. Under any of the options, potential environmental impacts and technical feasibility of various channel-deepening alternatives would require further study.

Larger "Post Panamax" or "Neo Panamax" ships expected to call on the US east coast in the future will need a deeper and wider channel than offered by the existing 42 ft-deep Cape Fear River. Depths of up to 51 feet would be required to accommodate the largest expected containerships; however, 8,000 TEU vessels anticipated to call on North Carolina ports may require less water than this.

Highway and rail investments are needed to improve the efficiency of container movement between the port and North Carolina's inland terminals and distribution centers. A new intermodal terminal east of Charlotte would meet future capacity demands and move container operations out of the congested urban center.

The total capital investment and associated construction jobs required would vary by port location – ranging from nearly \$3.8 billion over 30 years at Port of Wilmington to nearly \$5 billion at a new Greenfield site in Brunswick County. The ability to attract increased container service to North Carolina ports is estimated to result in more than \$1.3 billion savings to the state’s shippers, who now truck their goods to remote ports. Enhanced use of local ports would realize additional supply chain benefits of \$91 million. Non-freight users would benefit from \$3.0 billion in travel time savings as a result of proposed highway network improvements. Additional combined savings to State citizens through reduced accidents, emissions and highway maintenance exceeds \$352 million. In all, it is estimated that the State of North Carolina could realize \$2.09 in benefits for each dollar invested to meet the state’s 1.3 million TEU demand for container imports and exports.

Refrigerated Cargo

Investments in cold storage warehousing facilities would support export of pork, chicken and sweet potatoes, all of which present growth opportunities for North Carolina producers. Local refrigerated exports may be delivered to cold warehouse and distribution facilities at or near the port, prior to being stuffed into containers.

An immediate \$24 million investment in a cold storage facility is proposed to realize the projected 73,000 TEU export and import market for refrigerated containers. A modular facility could be built in phases as demand grows over time. Existing and any future expansion to North Carolina’s container capabilities should include reefer plug-ins.

Provision of cold storage facilities would allow North Carolina ports to meet local shippers’ needs for refrigerated cargo exports, thereby realizing, over 30 years, \$136 million in shipper savings and related supply chain benefits. Additional combined savings to North Carolina citizens due to reduced accidents, emissions and highway maintenance exceeds \$11 million.

Ro/Ro and Oversize Cargo

Producers of manufactured goods, especially those that make large bulky products such as Caterpillar and Spirit AeroSystems, rely on port access to receive parts and to deliver products to customers. In-state roll-on/roll-off as well as lift-on/lift-off facilities to handle oversize cargo would support local manufacturing of heavy construction and mining equipment, for which there is strong demand overseas. This sector also includes wind power components to support on-shore or off shore wind energy, for which there is significant growth potential.

Large, bulky goods can be costly to move because of their weight and physical dimensions. Without in-state port facilities to support the cost-efficient transport of these goods, North Carolina’s manufacturers may be less competitive in the global market. New manufacturers will be attracted to locations that offer the nearby capability to handle Ro/Ro and oversize cargo.

To meet forecasted Ro/Ro and oversize import and export demand of nearly 200,000 tons in 2040, a new Ro/Ro and Lo/Lo terminal is proposed at either Radio Island or the Port of Wilmington north property. Development of either property would require environmental permitting and USACE berth dredging permits. No additional channel deepening would be required.

Focused investments on oversize highway corridors would benefit manufacturers of this export cargo. Rail is often the best means to handle heavy and oversize loads; direct rail connection from manufacturing sites to port would facilitate export of these goods.

Manufacturers of capital goods are attractive contributors to the North Carolina economy because they not only hire workers directly, but they also make large purchases of goods and services from within the state. Proposed \$2.5 million in terminal and port access investments to support Ro/Ro and oversized cargo would result in shipper savings and supply chain benefits of \$68 million. This value increases when benefits to the state's military facilities are factored in. Analysis conducted for the North Carolina Defense Logistics Initiative showed that moving the port of entry and location of the equipment reset facility can yield meaningful savings to the Armed Forces and support the state's economy. The savings included travel costs, faster travel times allowing equipment to be used more efficiently, and carbon savings. The study reports that "with the port of entry and reset facility located in North Carolina, distance and travel time were reduced at least 80%, and travel cost was reduced over 70%. If the port of entry remained the same (a non-North Carolina location) but the reset activities are performed in North Carolina, significant savings can still be realized," reducing costs by roughly 40 percent. The margin between 70 percent cost reduction for changing both port of entry and reset location and a 40 percent reduction for just changing the reset location highlights the importance of the ports to the military logistics supply chain and the potential savings that could be realized by greater utilization of the state's port facilities. Non-freight users would realize \$4.9 billion in travel time savings as a result of proposed highway network improvements. The state would further benefit through reduced accidents, emissions and highway maintenance totaling \$59 million.

Support for Military Cargo

Both the Port of Wilmington and the Port of Morehead City are designated as Strategic Seaports, two of just fifteen nationwide. This makes North Carolina an important location for military investment and the associated spin-off employment that is supported by military centers.

The economic return on investment to preserving the NC Ports' attractiveness to the military is important. Military facilities support over 416,000 workers through military or jobs supported by military installations in the State, representing about eight percent of total State employment. Proposed investments in Ro/Ro and oversized cargo, as well as containerized cargo, will also support the needs of the Military.

Analysis conducted for the North Carolina Defense Logistics Initiative showed that use of North Carolina ports of entry and equipment reset facilities can yield meaningful savings to the Armed Forces – and support North Carolina's economy. Projected benefits included reduced travel costs, faster travel times allowing equipment to be used more efficiently, and carbon savings. In all, it is estimated that military logistics costs could be reduced by 70 percent if North Carolina bases and ports are used, with nearly half of this savings directly attributable to use of ports that are closest to the state's military bases.

Support for Chemicals and Phosphates

Chemicals, including industrial chemicals as well as fertilizer and animal feed components, are a comparative strength within the state economy and have solid export prospects into the future. These products comprise more than 80 percent of the total volume handled by the Port of Morehead City and support North Carolina-based extraction and production in nearby Aurora.

Preservation of existing capacity and allowance for additional investments in privately-developed and operated bulk storage facilities at Morehead City will support a commodity that is important to North Carolina and that complements the State's strong agriculture industry. It is anticipated that 2040 volumes will require an additional bulk phosphate storage area of 94,000 square feet.

E.9 Funding Maritime Infrastructures

Today, capital improvements to North Carolina's maritime infrastructure are funded through a variety of sources and programs. The multi-year STIP is used to program most highway improvements from state and federal gas tax revenues and other federal grants. Improvements to railroads and inland facilities may include joint funding by NCRRA, NCDOT, private railroads, as well as federal and local sources. Improvements to NC Ports have typically been funded by revenues from operations or project-specific state and federal grants.

Maritime infrastructure is capital-intensive, increasingly requiring project sponsors to assemble funding from multiple sources to meet maintenance and expansion needs. Given the multi-modal nature of goods movement infrastructure, and its many beneficiaries, numerous funding options exist for federal, state and local participation. Several federal grant and loan programs can be used to support maritime infrastructure investments, including those sponsored by the US Departments of Homeland Security, Agriculture, and Transportation. Federal cost-sharing for navigational improvements is available through the US Army Corps of Engineers, while other US Department of Defense funding can support investments that benefit US military institutions and strategic seaports. The US Economic Development Administration supports public works and developments to help distressed communities attract new industry and diversify local economies.

Private investment opportunities and benefit capture strategies can also be used to leverage non-governmental revenues. Direct investments by railroads, user fees, sale/leaseback of rail assets, and public-private partnerships are all potential means for funding maritime investments that have demonstrated private benefit.

E.10 Marketing North Carolina's Maritime Mission

Involvement of the maritime industry and community stakeholders was an important element of the *Maritime Strategy* development. Maritime stakeholders provided valuable input – by participating on the Maritime Advisory Council, through industry workshops, and as part of focused stakeholder meetings -- that supported the identification and evaluation of a variety of maritime market alternatives. Members of the Advisory Council, who included industry representatives from ocean shipping, trucking, railroads, manufacturers, academia, and community interests, have expressed a willingness and desire to provide continued input to the strategic direction of North Carolina's ports and maritime-supporting transportation and facilities. Additionally, port staff and local residents agreed that greater interaction and understanding of port operations would establish a stronger, more supportive relationship between NC Ports and the surrounding port communities.

Continued efforts to engage both the maritime industry and the port community are important components of the State's future success in advancing one or more proposed maritime market opportunities. This can be achieved through an ongoing role of the Advisory Council or the Governor's Logistics Task Force working to support and advise NCDOT's newly established Statewide Logistics Office, which has been tasked to facilitate a more strategic approach to the State's transportation assets, including NC Ports and the Global TransPark.

A clear and unified mission and vision is paramount to advancing North Carolina's maritime industry. Other regional ports are perceived to have realized a closer alignment between overall state vision and the goals of host communities, yielding successful partnerships that benefited

both the host communities and the ports. A joint economic development and marketing plan, such as has been developed by the South Carolina Ports Authority in collaboration with the City of Charleston, would demonstrate broad-based support for a single mission.

Through a collaborative marketing and economic effort, the State, GTP, the Port, and the port community can advance a single mission—leveraging resources and providing a unified message to potential relocating firms that need reliable port access, to ocean carriers whose competitive service must be supported by complementary port and landside infrastructure, and to landside transportation providers who seek cargo volumes that can justify their own capital and operating investments.



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LIST OF ABBREVIATIONS

AMH	America's Marine Highway Program
APOE	airport of entry
ARRA	American Recovery and Reinvestment Act
ASC	automated stacking cranes
ATB	articulated tug barge
BACT	Best Available Control Technology
BCA	benefit-cost analysis
BCR	benefit-cost ratio
BEA	US Bureau of Economic Analysis
BIMP	Beach Inlet Management Plan
BTS	US Bureau of Transportation Statistics
CAFTA	Central American Free Trade Agreement
CAGR	compound annual growth rate
CARB	California Air Resources Board
CBSA	Core-Based Statistical Area
CFS	container freight station
CIC	Cordele Intermodal Center
CIT	Charlotte Inland Terminal
CLT	Charlotte-Douglas International Airport
CMAQ	Congestion Mitigation and Air Quality Improvement Program
CMT	Carolina Marine Terminal
COBRA	Coastal Barrier Resource Act
CPI	Consumer Price Index
CSX	CSX Railroad
C-TPAT	Customs Trade Partnership Against Terrorism
DC	dock cranes
DERA	Diesel Emissions Reduction Act

DLO	Defense Logistics Organization
dwt	dead weight tonnage
ERTG	Electric Rubber-Tired Gantry Crane
FAF	Freight Analysis Framework
FEC	Florida East Coast Railway
FHWA	Federal Highway Administration
FL	Florida
FRA	Federal Railroad Administration
FRSGP	Freight Rail Security Grant Program
FTA	Federal Transit Administration
FTZ	foreign trade zone
FY	fiscal year
GA	Georgia
GARVEE	Grant Anticipation Revenue Vehicles
GDP	gross domestic product
GHG	greenhouse gas
GIS	geographic information system
GLTF	Governor's Logistics Task Force
GPA	Georgia Ports Authority
GTP	Global TransPark
HMT	Harbor Maintenance Tax
HMTF	Harbor Maintenance Trust Fund
HSIP	Highway Safety Improvement Program
HTF	Highway Trust Fund
ICTF	intermodal container transfer facility
ILP	International Logistics Park
IWR	US Army Corps of Engineers Institute of Water Resources
JAXPORT	Port of Jacksonville, FL

KORUS	Korea United States Free Trade Agreement
LATTS	Latin America Trade and Transportation Study
LEED	Leadership in Energy and Environmental Design
LNG	liquefied natural gas
Lo/Lo	lift-on/ lift-off
MARAD	US Maritime Administration
MCAS	Marine Corps Air Station
MHC	Port of Morehead City, NC
MOU	memorandum of understanding
MPO	Metropolitan Planning Organization
MSA	Metropolitan Statistical Area
NA	not available or not applicable
NAFTA	North American Free Trade Agreement
NC	North Carolina
NC-CREWS	NC Coastal Region Evaluation of Wetland Significance
NC DMC	North Carolina Division of Coastal Management
NCDOC	North Carolina Department of Commerce
NCDOT	North Carolina Department of Transportation
NCIT	North Carolina International Terminal
NCRR	North Carolina Railroad
NCSPA	North Carolina State Ports Authority
NEPA	National Environmental Protection Act
NHS	National Highway System
NHTSA	National Highway Traffic Safety Administration
NOx	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPX	Neo Panamax
NS	Norfolk Southern Railway

O&M	operations and maintenance
ODS	Operation Desert Shield
OEF	Operation Enduring Freedom
OMB	Office of Management and Budget
P3	public-private partnership
PCS	PCS Phosphates, Inc.
PHA	Port of Houston Authority
POW	Port of Wilmington, NC
PAM	Piedmont Atlantic Megaregion
PPX	Post-Panamax
PRECAP	AECOM Preliminary Capacity model
PTIT	Piedmont Triad Inland Terminal
RIMS II	Regional Input-Output Modeling System
Ro/Ro	roll on / roll off
ROW	right-of-way
RRIF	Railroad Rehabilitation and Improvement Financing Program
RS	reach stacker
RTG	rubber-tired gantry crane
SAV	submerged aquatic vegetation
SC	South Carolina
SCPA	South Carolina Ports Authority
SPOE	seaports of entry
STIP	State Transportation Improvement Program
STP	Surface Transportation Program
STRACNET	Strategic Rail Corridor Network
Strad	straddle carrier
TAA	Trade Adjustment and Assistance
TEU	twenty-foot equivalent unit

TGS	twenty-foot ground slots
TIFIA	Transportation Infrastructure Finance and Innovation Act
TIGER	Transportation Investment Generating Economic Recovery
TP	top pick
TRANSCOM	US Military Transportation Command
UK	United Kingdom
UNC	University of North Carolina
US	United States
USACE	US Army Corps of Engineers
USDA	US Department of Agriculture
US DOD	US Department of Defense
US EDA	US Economic Development Administration
US EPA	US Environmental Protection Agency
USFWS	US Fish & Wildlife Service
USG	US Government
USGS	US Geologic Survey
VA	Virginia
VIP	Virginia Inland Port
VISA	Voluntary Intermodal Sealift Agreement
VIT	Virginia International Terminal, Inc.
VMT	vehicle-miles traveled
VOC	volatile organic compounds
VPA	Virginia Port Authority
WRDA	Water Resources Development Act



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1 STRATEGY BACKGROUND AND PURPOSE

1.1 Governor's Executive Order No. 32: Governor's Logistics Task Force

The *North Carolina Maritime Strategy* is driven by the goals and recommendations of the Governor's Logistics Task Force (GLTF). The GLTF was established by Governor Beverly Perdue on December 8, 2009 under Executive Order No. 32 with the following mission:

- To conduct a thorough inventory and evaluation of existing public and private transportation and commerce assets, including ports, inland ports, airports, highways, railroads, major distribution centers, and business and industrial parks.
- To report on the current system for moving goods and people, including the condition of the system, its overall performance, and its safety.
- To project future needs for the state's multi-modal transportation system and explore challenges and opportunities in meeting those needs.
- To identify relevant research and best practices in transportation and logistics from other states.
- To inventory current laws, rules, policies, processes, and organizational structures that affect the movement of people and goods across the state and make recommendations for changes to improve the efficiency and safety of our transportation system.
- To explore innovative ideas in transportation and economic development that can help support the state's logistics capacity, including public private partnerships.
- To make additional short-term and long-term recommendations to create an integrated logistics plan for North Carolina.

The GLTF has been tasked to inventory and evaluate the State's existing transportation and commerce assets, to report on the current system for moving goods and people, and to project future needs for the state's multi-modal transportation system. Additionally, the GLTF has identified relevant research and best practices in transportation and logistics and make recommendations for changes to current laws, rules, policies, processes, and organizational structures that affect the movement of people and goods across the State. The GLTF further explored innovative ideas in transportation and economic development and made short-term and long-term recommendations to create an integrated logistics plan for North Carolina. Results of the GLTF efforts are documented in the Seven Portals Study and accompanying regional reports.

Due to the unique issues and requirements of maritime goods, the GLTF recommended that a separate study be undertaken to examine North Carolina's ports and to identify options to enhance the effectiveness and economic benefit of the State's maritime assets. The *North Carolina Maritime Strategy* supplements and complements the efforts of the GLTF to specifically examine North Carolina's needs for the efficient and effective movement of waterborne goods.

1.2 Project Objective

Efficient transportation is a critically important factor for business competition. As trade patterns change and the global marketplace becomes more competitive, the State of North Carolina is presented with important challenges and opportunities to work with the maritime industry to determine ways to lower variable transport costs in a manner that will draw business to North Carolina's maritime gateways and support statewide economic growth.

Through the *North Carolina Maritime Strategy*, the State of North Carolina has conducted an open evaluation of the role that ports play in the State's economy and an assessment of benefits that could be realized through strategic investments in maritime infrastructure.

The State's ports have the potential to offer access to global trade for export and import of raw materials, in-process manufactured products, and finished goods that originate in or are destined for North Carolina consumption. Cost-effective access to the global marketplace can make North Carolina-based employers more competitive and can help diversify the state's economy across many industries. North Carolina-based manufacturers that rely on seaports for export can be particularly effective at generating North Carolina jobs because these industries purchase large amounts of goods and services from the local economy. This *Maritime Strategy* examines the relative economic benefits – including potential to support or generate jobs – of various investments in the state-owned ports and other infrastructure that carries waterborne goods.

1.3 Overview of Project Scope

The *North Carolina Maritime Strategy* was developed through the following primary tasks:

- Facilitated collaboration of freight transportation, economic development and community interests as input to the statewide strategy,
- Definition of North Carolina's economic context and maritime market positioning strategies that would offer the greatest economic benefit to the State, and
- Identification of infrastructure investments and policies that would most significantly enhance North Carolina's economy through improved performance of the State's maritime gateways and related trade corridors.

The *North Carolina Maritime Strategy* defines maritime market scenarios in which the State could realize economic and public benefit. Opportunities explored include those associated with import and export of containerized cargo, as well as the potential for expanded bulk, breakbulk, petrochemical and military cargos. Special emphasis has been made to link potential market positions with industry in the State.

For each viable market scenario, the Strategy defines its infrastructure needs. Transportation investments have been examined to include reconfiguration or modernization of existing port facilities, new terminal developments, wharf and channel improvements, road and rail connections, and inland intermodal facilities. A comparative analysis of development alternatives was then conducted to measure the relative benefits, effectiveness and costs associated with various alternatives for market positions and associated infrastructure.

1.4 Maritime Strategy Outcomes

The *Maritime Strategy* is intended to support the State of North Carolina in its investment decision-making process by offering a data-driven analysis of the state's maritime market opportunities -- and the related infrastructure needs and potential economic impacts of each. Potential strategies to provide for a more efficient, more effective and safe movement of the state's waterborne cargo are presented. The *Maritime Strategy* identifies specific near-term and long-range infrastructure projects that would enhance the competitive position of the state in the global marketplace and offers quantitative measure of economic benefits that could be realized by specific investments.

1.5 Statewide Logistics Plan

House Bill 1005, Session Law 2007-551 instructed the North Carolina Office of State Budget and Management to develop a statewide logistics plan that would address the State's long term economic, mobility, and infrastructure needs. The plan, completed in 2008, includes three main components: 1) priority commerce needs, 2) transportation infrastructure actions, including multimodal solutions that will support key industries vital to the State's long term economic growth, and 3) a timetable to meet these identified needs. It is based on input received from a wide range of stakeholders including State agencies, shippers, carriers, and other private parties.

The completed plan identified agriculture, textiles, and defense-related industries as key features of the future North Carolina economy. Other key sectors include information and communications technology, motor vehicles and heavy equipment, business and financial services, and chemicals, plastics, and rubber.

The 2008 Statewide Logistics Plan made several infrastructure recommendations relevant to the *Maritime Strategy* that were evaluated or incorporated into the current analysis. Among others, the Statewide Logistics Plan recommended that the following efforts be advanced in the State of North Carolina:

- Facilitate Pass-Through Traffic: support the needs of the traffic traveling north-south, particularly on I-95, I-85, and I-77.
- Support Import/ Export Activity: make investments in the Ports of Wilmington and Morehead City. Provide on-site improvements and better truck and rail access. Continue to support the development of the North Carolina International Terminal. Redouble efforts to "scope" the port. Carefully determine what customers it should serve and how large it should be.
- Partner with Military Investments: make the state's transportation infrastructure align with military logistics needs.

1.6 Seven Portals Study

Consistent with the objectives of the *Maritime Strategy*, the Seven Portals Study seeks to identify opportunities for North Carolina to tie its transportation infrastructure investments to economic development and, more specifically, to the creation of jobs. The study examines the state's infrastructure as a whole and examines the strengths, weaknesses, opportunities and constraints of the transportation infrastructure within each economic region as compared to the

needs and objectives of each regional economy. Among the many ideas presented in the study are the following recommendations:

- Coordinate transportation planning with land use planning,
- Build upon the state's strong agricultural industry,
- Invest in infrastructure that will support North Carolina's many military bases,
- Consider the unique transportation needs of the emerging aerospace sector, including transport of equipment and parts,
- Improve highway access to the state's ports via US 70 and US 74; consider the potential for new logistics and distribution centers along these corridors, and
- Partner with the private sector to realize common economic objectives.

1.7 Executive Order No. 99

Executive Order No. 99, issued by Governor Perdue on July 27, 2011, calls for the *Maritime Strategy Study* "identify activities at and uses of the Wilmington and Morehead City ports that are not incompatible with the underlying economic base and existing predominant economic sectors supported by the surrounding community." Such a determination first requires an assessment of the surrounding community and identification of the predominant economic sectors.

In response to the Governor's directive, the *Maritime Strategy* identifies specific community interests and concerns regarding existing or proposed port uses. Economic drivers of the surrounding community are evaluated for potential inconsistency with maritime market and investment alternatives. The *Maritime Strategy* also identifies port best practices that could be employed to enhance the benefits and minimize the impacts of port operations to surrounding non-port uses.

1.8 Maritime Strategy Report Organization and Overview

The *North Carolina Maritime Strategy* report is organized into the following chapters:

This chapter (**Chapter 1**) describes the *Strategy* background and purpose, including related and parallel efforts advanced by the State of North Carolina.

The *Maritime Strategy* built and expanded upon previous studies where possible. **Chapter 2** identifies existing studies and reports that were reviewed and evaluated as initial input to *Strategy* development. Additional references and documentation were identified and assembled as part of the study effort.

Chapter 3 presents an overview of the industry and stakeholder outreach efforts conducted as part of the *Maritime Strategy* development.

Global and regional market conditions and trends are presented in **Chapter 4**. North Carolina's market position as compared to other regional ports is also discussed.

Chapter 5 describes alternative market scenarios that offer potential opportunities to provide economic benefit to North Carolina, building from global forecasts, regional market context and stakeholder input.

Chapter 6 presents an overview of the existing and planned (programmed or funded) infrastructure that exists in North Carolina to support maritime trade. Port facilities, waterways, highways, the rail network, and inland facilities are each addressed. Infrastructure that supports US Military activities within the state is also discussed.

A series of potential infrastructure investments are described in **Chapter 7** to support North Carolina in its realization of the candidate market opportunities as presented earlier in Chapter 5. Infrastructure investment alternatives, either at Morehead City or along the Cape Fear channel, are considered to support a given market opportunity.

Chapter 8 provides an overview of environmental considerations to be addressed in the evaluation of various infrastructure alternatives. “Green ports” strategies, which represent current industry best practices, are also discussed.

The potential economic benefits and impacts of each market opportunity are presented in **Chapter 9**. Construction impacts, operations and maintenance impacts and economic development impacts are quantified.

Chapter 10 presents the results of the benefit-cost analysis for each maritime investment alternative.

Options for federal, state, and local funding as well as potential for private participation in infrastructure improvements are described in **Chapter 11**.

Finally, **Chapter 12** presents recommendations for further action, including a decision matrix of alternatives that highlights major benefits, costs, and implications of various alternatives as well as a discussion of supporting policies and strategies for consideration by the State to advance maritime goals. Potential configurations of port-terminals at Morehead City and at Wilmington are presented to illustrate how the State could implement multiple market scenarios and benefit from complementary maritime investments.



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2 PRIOR STUDIES AND DATA SOURCES

2.1 Review of Existing Documents

As an initial activity of the *Maritime Strategy* development, information available in existing and concurrent studies was assembled and reviewed to assure that current work built upon these prior efforts where appropriate. This review included more than 100 total documents representing a range of available port studies, statewide economic and goods movement studies, and reference materials identified by stakeholders as potentially relevant to the goals and objectives of the *North Carolina Maritime Strategy*.

The inventory of existing documents to support development of the *North Carolina Maritime Strategy* was identified based on input from NCDOT, members of the Governor's Logistics Task Force, Advisory Council members, other stakeholders, and team research. Each of these documents was collected, tabulated and reviewed as the starting point for efforts under subsequent project tasks.

The intent of this document review was to identify source data upon which the study team could base its further analysis. Available documents and reports were evaluated to determine whether claims, results, and conclusions have been fully supported in the text or by reference to other documentation, or are reasonable and reproducible based on the study team's professional experience and expertise. When possible, authors or sponsors of prior reports were consulted to obtain clarifying information on scope, methodology, and intent.

A complete list of documents reviewed along with summaries of each document can be found in the *NC Maritime Action Plan for Further Data Collection and Analysis*.

2.2 Market Data

Numerous previous economic analyses have been completed to assess the likely market demand for and potential economic impacts of port-related improvements. Reference documents reviewed also included studies that consider the methodology and approach to defining economic impacts of port and freight transportation investments.

Previous research and analysis was particularly helpful in suggesting both approaches and in providing benchmarks for this current analysis as it developed. As recommended in the *Economic Contribution of the North Carolina Ports*, the estimation of economic impacts was deliberately structured in a basic and transparent way that avoided a complicated model. As the data analysis advanced, early findings were compared with those of prior work. For example, the *LATTS I* study and *Morehead Port Grain Loading Opportunity* recommendations regarding the nature and location of port-related investments proved fruitful in the analysis of market access for phosphates and grains to realize benefits to employment and output. *Total Value of North Carolina Agricultural Exports* provided greater detail on the variety of agricultural products as well as an early indication of the non-cost factors that affect port selection such as lack of container loading facilities; lack of grain storage and loading equipment; limited farm storage in North Carolina limits delivery options later in the season.

2.3 Infrastructure Data

Document research did not reveal any comprehensive, statewide analysis of North Carolina's goods movement needs across port, railroad, and highway infrastructure. Several existing documents, however, provided useful information regarding site-specific infrastructure improvements.

To the extent that previously identified transportation improvements were determined to meet the infrastructure needs of defined market scenarios, those concepts and alignments were used as inputs to the set of infrastructure investments needed to advance the market scenarios defined in the *Maritime Strategy*.

Existing reports included valuable information on North Carolina's existing port infrastructure as well as navigational challenges along the Cape Fear Channel as identified and under evaluation by USACE. The *Wilmington Harbor Navigation Improvements Section 905b Analysis* and related studies provided valuable baseline information regarding dredging volumes, disposal, shoaling rates, and costs. Reports describing improvement plans at regional ports were reviewed to establish available and future terminal capacity available to North Carolina shippers.

Several highway and rail studies were reviewed, and the subject projects incorporated to address maritime needs where appropriate. The *Track Relocation Study Havelock to Morehead City* and *Request for Letters of Interest – Development of Radio Island* provided useful information on rail and highway alternatives to access the Morehead City port and Radio Island. Recommended road and rail infrastructure to support the Defense Logistics Initiative were evaluated to identify complementary benefits of proposed projects to movement of other goods. The *Statewide Logistics Plan* and *Seven Portals Study* supported the identification of candidate road, rail, and inland improvements for consideration for maritime investment. In its examination of highway infrastructure, existing and planned, the team relied most heavily on the State Transportation Improvement Program (STIP) for North Carolina and for surrounding states.

Numerous GIS datasets were compiled to evaluate highway needs and forecasted truck flows, to examine the meteorological and oceanographic (met-ocean) settings of potential port developments, and to identify potential environmental constraints.

3 INDUSTRY AND STAKEHOLDER INVOLVEMENT

3.1 Scope and Approach to Industry and Stakeholder Involvement

Broad-based stakeholder outreach was a key element to the development of the *North Carolina Maritime Strategy*. A comprehensive public involvement program was developed and implemented to engage the public, agencies and others through a series of informational meetings, public workshops and focused discussions with industry, as well as environmental and community groups.

3.2 Advisory Council Input and Review

The Advisory Council is comprised of state officials and staff along with industry representatives from ocean shipping, trucking, rail and manufacturing interests, and community-at-large representatives. The Advisory Council has taken ownership for the strategy development and implementation as public and private partners.

The Advisory Council met five times at key project milestones of strategy development and served as a thoroughly engaged, hands-on advisory body. The Advisory Council has provided leadership and expertise during specific industry workshops. A complete roster of Maritime Advisory Council members is provided in the appendix.

3.3 Industry Workshops

In order to obtain input from targeted industry groups with specialized expertise and interest in maritime development or goods movement within the state of North Carolina, development of the *Maritime Strategy* included a series of industry workshops.

Workshops were conducted with each of the following industry groups:

Agricultural Producers – August 16, 2011

Conversation included topics such as: weight limitations, infrastructure constraints, railroad usage, bulk facilities and cold storage.

Bulk and Breakbulk Shippers – October 21, 2011

Discussion focused on the costs associated with trucking and rail, barging, port hours of operation and port costs.

Containership Lines – August 30, 2011

Dialogue concerning Panama Canal expansion, strategies for increasing vessel utilization, NC Port usage and container operations.

Logistics Centers and Foreign Trade Zone Operators – October 5, 2011

Discussed opportunities and challenges, military, FTZs, individual models and movement of goods to market.

Non-Agriculture Shippers – August 10, 2011

Conversation regarding factors which influence route and port selection and the impact of military influence.

Railroads, Trucking and Distribution – July 21, 2011

Dialogue included subjects such as market share, current market conditions, infrastructure investments/competiveness, commodity handling and storage, military influence, challenges and opportunities.

US Military – October 5, 2011

Detailed discussion regarding military bases, TRANSCOM, access to NC Ports, requirements for usage and opportunities.

3.4 Focused Stakeholder Meetings

The *Maritime Strategy* team invited and encouraged input from stakeholders with specific interests or singular issues related to North Carolina's port development. Toward this end, focused discussions were conducted with the following entities:

Clean Carteret County Coalition – September 28, 2011

Discussion included economic impacts, public concerns, infrastructure, communication and suggestions for NC Port use.

Morehead City Port Committee – September 28, 2011

Conversation regarding tourism, current NC Port conditions and operations, opportunities and challenges for the Port.

No Port Southport – June 13, 2011

Discussion regarding economics, safety and security, aquifer, environment, health and infrastructure.

North Carolina Division of Coastal Management – August 19, 2011

North Carolina Division of Coastal Management (NC DCM) was contacted to identify GIS data and other relevant information available from the Beach, Inlet, and Management Plan (BIMP) under development by NC DCM. Specific GIS layers of inshore and offshore geology, environmental coverages such as hard bottom, and submerged aquatic vegetation layers were identified and provided to the study team for use in the *Maritime Strategy* analysis.

Progress Energy – October 26, 2011

Identified areas of potential concerns related to the potential port site at Southport, discussed vertical clearance issues along the Cape Fear River, and solicited input associated with the *North Carolina Maritime Strategy*.

Save the Cape – June 13, 2011

Discussion regarding coastal engineering and dredging, cost benefit analysis, market area, environmental concerns, safety and security.

Southport/Oak Island Chamber of Commerce – July 21, 2011

Clarified information regarding the study, discussed the need for job creation and incentives for businesses to relocate, housing markets in port areas and the need for railroad expansion.

US Army Corps of Engineers – July 1, 2011

Conversation included dredging challenges, costs associated and alternatives; maintenance plans; current and future dredge material disposal sites; environmental impacts and navigation channel.

US Nuclear Regulatory Commission – January 26, 2012

Discussed potential issues concerns of the Nuclear Regulatory Commission related to potential port development at the Southport site, including environmental impacts, security, and evacuation needs.

YesPort NC – July 21, 2011

Discussion included support for a feasibility study, preparation in the event of a west coast disaster, infrastructure, USACE and military access.

3.5 Agency Outreach

The *Maritime Strategy* team contacted representatives from ten Metropolitan Planning Organizations (MPOs) located throughout North Carolina to obtain information regarding primary freight transportation nodes and modes for freight movement, primary import and export products, transportation needs, and economic development conditions in each MPO region. The MPOs interviewed included Burlington-Graham, Cabarrus-Rowan, Fayetteville, Gaston Urban Area, Greater Hickory, Greenville, High Point Urban Area, Jacksonville Urban Area, Rocky Mount, and Wilmington. All fourteen NCDOT Division Engineers and representatives from NCOT Rail and Operations Divisions were also interviewed to obtain similar information.

The *Maritime Strategy* team also contacted the North Carolina Regional Economic Development Commissions to solicit their input on the maritime industry in North Carolina. Interviews were conducted with AdvantageWest, North Carolina's Eastern Region, Research Triangle Regional Partnership, and North Carolina's Southeast Region. Discussions sought input on regional

obstacles to economic development, objectives to the movement of waterborne freight, top industries and export commodities, and infrastructure challenges and constraints.

The study team coordinated closely with the North Carolina State Ports Authority throughout the Maritime Strategy development. This included review of port facilities, operations and throughput. NCSPA provided detailed data on cargo handled by the port, including commodity type, origin, and destination. NC Ports marketing programs and analysis were reviewed with NCSPA business development staff. The study team communicated study goals and presented draft findings to the NCSPA Ports Advisory Council at June PAC meetings held June 13, 2011 and January 30, 2012.

3.6 Public Involvement

The *North Carolina Maritime Strategy* promoted an open, proactive and comprehensive public involvement program to engage industry stakeholders and the public and offered multiple opportunities for participation during the study process. The goals of the *NC Maritime Strategy* public involvement program included:

- To foster a public involvement process that will engage stakeholders and the public to assist in the *North Carolina Maritime Strategy* development process and recommendations.
- To produce a comprehensive and cohesive public involvement process that engages various levels of stakeholders through the utilization of a broad array of public involvement tools and techniques.
- To create opportunities to interact with project stakeholders and the public in order to garner input on the future vision for North Carolina Ports.
- To create opportunities to collect feedback and comments and respond to these accordingly.

These goals were achieved through engaging stakeholders and the public by educating and informing them on project-related issues, providing multiple formats and opportunities for public input, and integrating feedback into the decision-making process.

Public Meetings

The purpose of the public meetings for the *NC Maritime Strategy* was to engage the general public and project stakeholders and provide an opportunity for the attendees to obtain information, make comments and speak directly with project team members.

The *Maritime Strategy* process included three rounds of public involvement workshops, held near existing port sites as well as sites being subjected to comparative evaluation as additional container port locations. The workshops were designed to employ a combination of tools used in public open houses and formal public hearings to best combine education and feedback opportunities for participants. Meetings were well attended with significant information exchanged.

Dates and Locations of Public Meetings:

September 27, 2011 in Morehead City, NC – 123 attendees

October 4, 2011 in Wilmington, NC – 92 attendees

December 13, 2011 in Southport, NC – 320 attendees

December 14, 2011 in Wilmington, NC – 91 attendees

December 15, 2011 in Morehead City, NC – 65 attendees

March 6, 2012 in Brunswick County, NC – 155 attendees

March 7, 2012 in Wilmington, NC - 68 attendees

March 8, 2012 in Morehead City, NC - 77 attendees

Stakeholder Database

A project stakeholder database was developed to provide a comprehensive category-specific resource database, from which industry participants in focused meetings or workshops could be drawn. This database includes elected officials and agencies on the federal, county, state and municipal and regional levels; discrete stakeholder groups, including but not limited to, environmental, tourism, commerce, neighborhood and business; and any individual listings captured by phone or mail campaigns or sign-in sheets. The stakeholder database comprised approximately 1,200 individuals.

Stakeholder Issues and Comment Log

A stakeholder issues log was created and maintained to store all public comments – submitted via comment sheets – in a central location and maintained in electronic format. All information has the ability to be queried by issue, place of origin, date received and submitted. 242 comments have been submitted, as well as 315 signatures for ‘Support the Port’, and 13 signatures for the ‘Future Development Port of Morehead City’ resolution, and 733 signatures for the petition to oppose port development in Southport.

Mailing List

An email list was developed and maintained to include the agencies, community groups, businesses, organizations, residents and the public to be targeted for outreach. The stakeholder database was the primary repository for the widest listing of all project stakeholders and interested parties. This list was utilized to disseminate public meeting notices and any additional significant information. Approximately 4,500 addresses were included; 3,300 were received from the North Carolina State Ports Authority.

Toll-Free Hotline

A project toll-free hotline was developed to supplement the website as an option for those without internet access or for those who prefer audio information. A Spanish language option was included on the hotline. Administrative and technical staff monitored the hotline, answered

inquiries received through the hotline and maintain a log of all incoming calls. As of June 26, 2012, four calls were received requesting information.

Website

The project website - www.ncmaritimestudy.com - served as a key element of the public involvement program, serving as both an educational and feedback tool. The project website included project information, a calendar of events, study data, project contacts, a library of study documents and materials, news releases, photos, and a link to a web-based comment form. Information was consistently updated to reflect progress on the *Maritime Strategy*. To date, 109 comments have been received through the website.

Brochure

A full-color project brochure was developed to support the public information campaign and broaden audience exposure to educational opportunities on the project. The content of the brochure mirrors that of the information posted on the website ensuring equal access to information for those who may have limited access to the internet. The brochure was designed to be an informative, graphically engaging educational tool. The piece was distributed at public meetings, stakeholder meetings and also by request.

Fact Sheet

Based on input gathered from the public, it was determined that a fact sheet would contribute to a better understanding of the *Maritime Strategy* as well as to address specific questions. The fact sheet was designed to be an informative and graphically engaging educational tool which has been disseminated at public meetings, stakeholder meetings, by request was made available on the website.

3.7 Summary of Industry and Stakeholder Input

Jobs and Economic Growth

Throughout the course of the industry and stakeholder input process, including public involvement activities, the team gathered input about jobs and economic growth related to current and future port activities. The most common themes were:

- Port workers did not feel that the general public was aware of the importance of the jobs and activities occurring at the ports.
- Some members of the public felt that port jobs were low-skilled, low-paying jobs that did not contribute to the area's economy and that further effort should not be expended to attract/create more of these jobs. Conversely, community members with economic ties to the port identified port-related jobs as higher skilled and higher-paying than other jobs in the area.
- Input was gathered with regard to the higher unemployment rates in the areas surrounding the ports – specifically Brunswick County – and the need for additional port and port-related jobs. It was communicated that these jobs would enable residents to be able to afford to stay in their communities, raise families and create jobs for future generations.

- Economic development, specifically attracting new employers, was deemed critical in improving the job and standard-of-living outlook for those communities near current and future port activities. Inland port-related activities, such as shipping hubs, distribution centers and additional suppliers/manufacturers, would likewise help to improve the local economies, as well as that of the entire state of North Carolina.
- Of those local economic development organizations interviewed, there was a strong consensus that additional port-related jobs would provide a favorable impact on the local economies.
- Other than direct port-related jobs, additional positive economic could be gained through attracting cruise liners and pleasure craft, tourism, fishing, and retirement activities.
- Increased port capacity and capabilities could attract more military operations, including civilian jobs.
- Many stakeholders expressed concern that economic benefits of port activities were not always realized by the local community.

Environmental and Community Concerns

Throughout the course of the industry and stakeholder input process, including public involvement activities, the team gathered input about environmental and community impacts related to current and future port activities:

- There was concern expressed about the impacts of dredging required to create a deepwater port facility. These included impacts to the Castle-Hayne Aquifer, fish and wildlife habitats, natural channel islands/barrier structures, beach re-nourishment and the ongoing costs of maintenance dredging.
- Additional environmental concerns expressed for both Morehead City and the NCIT development previously proposed by NCSA included: air and water quality impacts of port operations, impacts to wildlife habitats, view shed impacts, and secondary inland environmental impacts resulting from the addition of the infrastructure required to support port activities.
- Other community members noted, however, that the health of a number of area beaches was due to re-nourishment provided by high-quality sand dredged from the current shipping channel leading into the Port of Wilmington and Port of Morehead City.
- Some stakeholders were concerned about impacts of port activities on commercial and recreational fishing operations, as well as on tourism.
- Others were concerned that future port activities would have a detrimental effect on existing and future residential and recreational communities. There was a perception that an increase in crime and illicit activities may result from increased port activities.
- Local residents also expressed concern about safety, especially that of a proposed Brunswick County location in relation to its proximity to the Public Service Company Nuclear Power Facility and the adjacent munitions facility.
- Some feared overall negative impacts of proposed port activities on the quality-of-life of the communities adjacent to the port sites.
- Increased traffic, noise, light, and pollution were expected as a result of proposed activity at port locations.

- Concern was expressed regarding the impacts of traffic congestion resulting from additional traffic on inadequate roadways and railroads.

Integration of Port, Community, and State Interests

- Stakeholder outreach conducted for the *Maritime Strategy* identified the need for public education regarding port activities and impacts on surrounding communities and the State.
- Many stakeholders identified their desire for overarching and transparent plan for NC Ports with regards to industry, community and public.

Needs for Infrastructure Investment

- Overall, enhanced road and rail access to NC Ports was sought.
- Many recognized that better access to port facilities could also support tourism.
- Shippers identified the need for deeper water access to support containerships.

Proposed Port Uses

Community stakeholders have provided an array of alternative uses for the North Carolina Ports with the primary focus on tourism, education, water recreation and fishing.

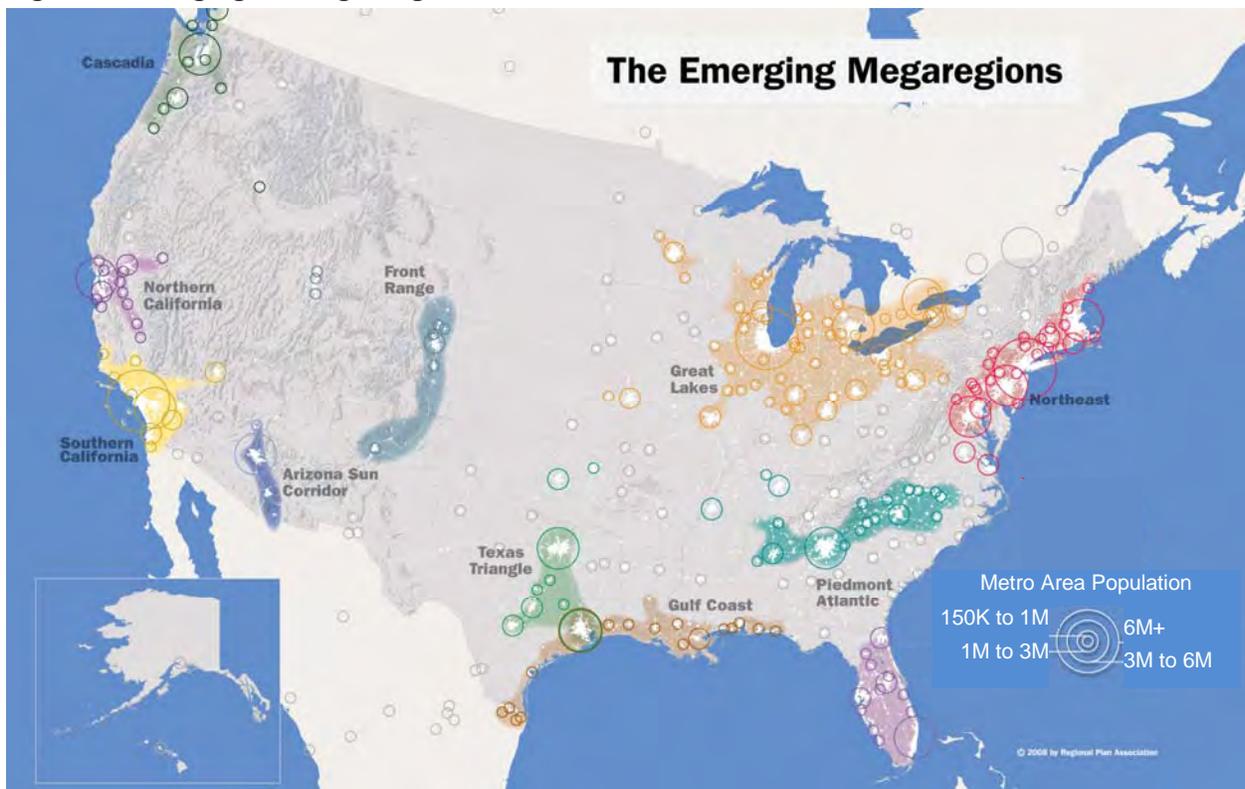
- Morehead City recommendations include: a co-op fish house on Radio Island as well as museum, cruise ships and hotels, farmers market, wind development, public entertainment center, ship repair/boat building facility, fisheries, eco tourism, adding Disaster Relief shipments, and adding a fueling area for private boat traffic.
- Wilmington proposals include: expanding the airport to land 'jumbos', adding new track to Fayetteville, adding rail from Raleigh to Wilmington and increasing cruise lines.
- Brunswick County suggestions include: a state park, theme park, campground, amphitheatre, museum, monuments, walking trails, cultural attractions, a marina, a cruise ship port and an energy park (to demonstrate renewable/alternative energy production and storage technologies). A research facility in association with universities was suggested to include environmental, oceanographic education as well as a cancer research and treatment center.

4 MARITIME MARKET CONDITIONS

4.1 Market Overview for the North Carolina and the Southeastern US

With a low cost of living and high quality of life, the southeastern US is projected to realize significant growth in the coming years. In particular, the Piedmont Atlantic Megaregion,¹ anchored by the metropolitan areas of Atlanta, Birmingham, Raleigh-Durham, and Charlotte, is projected to see its 2010 population of 17 million realize 78 percent growth by 2050.

Figure 1: Emerging US Mega-Regions



Source: Regional Plan Association www.america2050.org/maps/

¹ The Regional Plan Association has written extensively on the trend of individual urban economies to grow into larger more complex urban agglomerations and coined the term “megaregion.” This is an update of an earlier concept known as a “megalopolis” as identified by Jean Gottman in 1961, writing about the Northeast economy anchored by New York. Using population and employment projections from Woods and Poole, they have defined the most distinct megaregions that are developing in the US. There has been substantial research on megaregions in the past decade; the RPA definition and projections are cited here—other definitions differ slightly in the details but all project that a megaregion will develop in the Piedmont Atlantic region.

Looking ahead over the next 40 years, demographers and economists anticipate that the majority of the nation's population growth and economic expansion is expected to occur in ten or more emerging megaregions. Megaregions are characterized by a group of metropolitan economies that share 1) environmental systems and topography, 2) infrastructure systems, 3) economic linkages, 4) settlement patterns and land use, and 5) shared culture and history.

Two of North Carolina's largest metropolitan areas anchor the northern end of this sprawling megaregion, expected to become one of the nation's largest consumer and labor markets. The evolution of an urban network dominated by 360+ metropolitan areas into a more consolidated one dominated by ten large megaregions is an important change in considering how to move freight in the future.

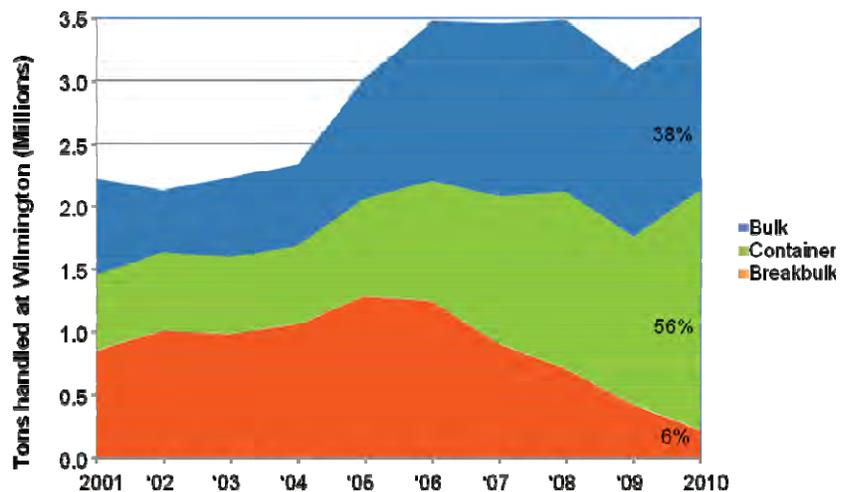
4.2 North Carolina's Maritime Assets

North Carolina's main maritime assets are the Port of Wilmington and the Port of Morehead City. Both ports are designated as strategic seaports, capable of simultaneously handling commercial and military requirements. There are only 15 such ports nationwide. The state's maritime assets extend beyond the port properties, however. The North Carolina State Ports Authority (NCSPA) also operates inland terminals in Charlotte and in the Piedmont Triad region in Greensboro. These port facilities are profiled briefly below. NCSPA also owns a small boat harbor in Southport.

4.2.1 Port of Wilmington

NCSPA handles containers, dry bulk², and breakbulk³ goods at the Port of Wilmington (POW) on the Cape Fear River. POW handled 250,048 twenty-foot equivalent units (TEU) in FY 2010, growing to 290,666 TEU in FY 2011. Across all classes of freight (container, bulk, and breakbulk), the port handled a total of 3.5 million tons in that same year. Containerized goods accounted for about 56 percent of the total; bulk

Figure 2: Bulk, Breakbulk, and Container Volumes Handled at Port of Wilmington (2001-2010)



Source: AECOM from NCSPA data

² Bulk cargo is loose cargo (dry or liquid) that is shoveled, scooped, forked, mechanically conveyed or pumped in volume directly into a ship's hold. Examples handled by North Carolina ports include woodchips, phosphates, sulfur, cement, and aggregate.

³ Breakbulk cargo is non-containerized general cargo stored in boxes, bales, pallets or other units to be loaded onto or discharged from ships or other forms of transportation. Examples handled by North Carolina ports include wood pulp (in rolls), raw rubber, steel, and lumber.

freight accounted for about 38 percent of the total. Grains and various wood products represent 79 percent of non-containerized tonnage handled in 2010. The recent global economic crisis and US housing crisis has negatively affected the volumes of construction-related commodities, including breakbulk exports and imports handled by the ports. Across all commodities, the Port of Wilmington generated \$22.8 million in operating revenues in fiscal year (FY) 2010 and \$25.2 million in FY 2011.

Authorized channel depth along the Cape Fear River is 42 feet, while the depth of the ocean channel and inlet is authorized to 44 feet. The channel, however, has not been consistently maintained to this depth by USACE.⁴ In addition to depth limitations, the “S” curve shape of the Cape Fear River at the port entrance restricts the length of the ship entering the port to 965 feet. POW also has an air draft restriction of 170.5 feet, which is the maximum height of the vessel permitted in order to clear electrical lines that crisscross the port, and a 1,200-foot turning basin in the Cape Fear River, which can accommodate vessels no more than 1,000 feet long.

Improvements to Interstate I-40, the Wilmington Bypass, have improved connectivity from POW to the Raleigh-Durham region and the construction of Interstate I-73 has increased connectivity from the port to Greensboro. POW is approximately 75 miles from Interstate I-95 and 200 miles from Interstate I-85. These two large interstates serve as the primary transportation corridors for both passengers and freight in a north-south direction through North Carolina. They connect the largest population centers within the state (Charlotte, Greensboro and Raleigh/Durham). Upgrading of an existing road to interstate standards to create Interstate I-74 has added vehicle capacity between the port and I-85 connecting to Charlotte; however there are many gaps in the highway connection between the port and this major population center.

The majority of freight arrives and leaves the port by truck. A challenge for the port is that trucks must pass through residential areas to connect to the interstates from POW. They must traverse Burnett Boulevard (two-lane road) to reach I-74, or Shipyard Boulevard and College Road (four-lane bi-directional roads) with a series of stop lights to reach I-40.

CSX provides daily service to the port. The speed of rail services to the port is impacted by the route through the City of Wilmington. Most crossings within the city are at-grade crossing and the rail follows a route that crosses many of the city’s major thoroughfares.⁵

4.2.2 Port of Morehead City

NCSPA handles only bulk and breakbulk goods at the Port of Morehead City. The port generated \$9.5 million in operating revenues and handled a total volume of nearly 1.8 million tons during FY 2010. The Morehead City port’s operating revenues grew to \$10.4 million in FY 2011, handling 1.9 million tons.

Phosphate and sulfur products represent 86 percent of total tonnage handled by Morehead City in 2010. Breakbulk commodities handled include natural rubber, for which NCSPA provides value-added inventory management and warehousing services on the wharf. Like at POW, the

⁴ NC Maritime Strategy stakeholder input from USACE, July 1, 2011

⁵ Moffatt and Nichol (2006). North Carolina State Ports Authority Equipment Analysis: Wilmington Terminal, pg. 3. (In Appendix E of their Port of Wilmington Container Yard Improvements Report, 2006)

slowdown in construction industry has affected the volumes of import lumber, aggregate, and other construction materials handled at the facility.

The port has a channel depth of 45 feet at Radio Island, an adjacent facility, and the ocean channel has a 47-foot depth in the approach to the port. The ocean channel is relatively short compared to competing ports at only four miles. There is no air draft restriction at Morehead City. Three Morehead City berths have depths of 45 feet, but the six remaining berths offer only 35 feet to 41 feet depths⁶.

Road accessibility to Morehead City is concern because trucks must pass through the middle of

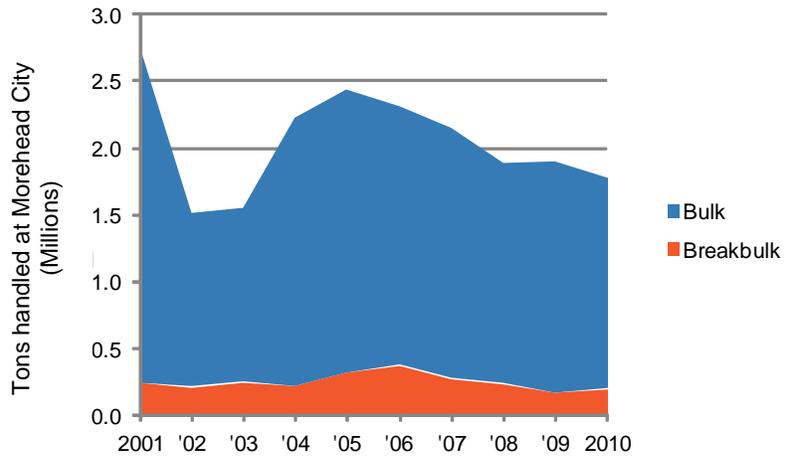
Morehead City to reach the port. This route during the summer months, with the tourism associated with the Outer Banks coastal regions, makes the more than six-miles from the port to beyond the intersection of NC 24, which is the only way out of Morehead City to access US 70, difficult. NCDOT has a number of initiatives underway to mitigate this conflict. The Gallants Channel Bridge project that is now underway will provide an alternative route to US 70. Until the Northern Carteret Bypass and Havelock Bypass are completed, this link would not be a viable alternative route to and from Morehead City. Interstate 95 (I-95) is approximately 120 miles from Morehead City via US 70 and I-795. After construction of the Gallants Channel Bridge, there would be an opportunity to follow NC 101 but this roadway is a rural two-lane road and would not effectively reduce travel time. In the meantime, all traffic would have to continue through Morehead City.

The port is served by Norfolk Southern (NS), which runs three trains per week into the port. Rail freight passes through the center of Morehead City with numerous at-grade crossings that slow train speeds and create numerous traffic bottlenecks throughout the day. Carolina Coastal Railroad Company provides switching service within the port limits.

4.2.3 Charlotte Inland Terminal

Managed by NCSPA, I Charlotte Inland Terminal (CIT) is a 16-acre site that is C-TPAT certified and bonded by US Customs and Border Protection. The facility provides storage space for approximately 400 stacked containers and 300 containers on chassis. NCSPA offers “Sprint” container service via truck to and from the Port of Wilmington, Charlotte, and beyond. CIT has access to I-77 and I-85 for trucking. CIT is not directly accessible by rail. The CSX Charlotte

Figure 3: Bulk and Breakbulk Volumes Handled at Port of Morehead City (2001-2010)



Source: AECOM, from NCSPA data

⁶ Figure 1.2 Summary Overview of MHC Facilities in the “Port Business Case Study”

intermodal terminal is approximately one mile away and the new NS intermodal facility is approximately eight miles from CIT.

4.2.4 Piedmont Triad Inland Terminal

The Piedmont Triad Inland Terminal (PTIT) is located in Greensboro NC. It is an existing site that is currently dormant. The PTIT property is currently being leased to a private company for its use. CSX and NS have terminals approximately six miles from PTIT; however, there are rail spurs within one mile.

4.3 Private Marine Terminals

While NCSPA operates most of the terminals on its property, there are two privately-leased terminals at Morehead City and at Wilmington. PCS Phosphate operates the bulk terminal north of US 70 at the Morehead City port, sulfur and phosphate products are exported, primarily for fertilizer use. PCS also operates private barges to transport goods from its extraction facilities to the port terminal. Vopak leases property to the north of the POW general cargo terminal. The Vopak North Wilmington Terminal has been privately developed to include twenty storage tanks and two berths. The terminal is served by ocean carriers, barge, rail and truck. Vopak handles bulk commodities from this facility, including petroleum products, chemicals, vegoils, and biofuels.

Separate from the NCSPA-leased terminals, there are additional privately owned marine terminals along the Cape Fear River, including:

- Vopak South Wilmington Terminal includes five bulk storage tanks and two berths to accommodate vessel and barge service. Bulk petroleum products, chemicals, and biofuels are imported and exported from this facility.
- Carolina Marine Terminal (CMT) handles chromium, salt, and urea from its 60-acre terminal. Its dock handles vessels with up to a 40-foot draft. CMT also maintains a layberth facility at Eagle Island for ship dockage.
- ChemServe Terminal, recently purchased by Kinder Morgan, has 40 tanks and 1.1 million-plus barrels of capacity to move liquid bulk products such as agricultural and chemical products, caustic soda solution, urea-ammonium nitrate solutions, asphalt, and methanol via barge and ship. The site is served by both truck and rail.
- Colonial Terminals offers storage and distribution (ocean service and barge) of petroleum and liquid chemicals as well as kaolin clays, mulcoa, fertilizer, and other dry bulk commodities.
- Amerada Hess Corp. owns and operates a petroleum terminal capable of loading/unloading liquid bulk vessels via four pipelines that extend from the wharf to 14 steel tanks with total 580,000-barrel storage capacity.
- Apex Oil Co. operates a terminal on the Wilmington Wharf that specializes in the receipt and shipment of petroleum products and petrochemicals. Multiple pipelines for vessel loading/unloading extend from wharf to 17 steel storage tanks with total capacity of 902,000 barrels.
- Flint Hills Resources operates a liquid terminal handling paraxylene.

- Gold Bond Building Products (National Gypsum) receives gypsum from self-unloading vessels at its terminal on the west bank of the Cape Fear Channel. The terminal's open storage area has capacity for approximately 100,000 tons of gypsum.
- Archer Daniels Midland handles locally-produced food additive products over its docks.

4.4 Share of North Carolina Freight that is Maritime Eligible

4.4.1 US and NC Maritime Economy

The US economy has been steadily evolving from a goods-based economy to one that is based on information and services. Between 1997 and 2010, the value of goods and services produced in the US grew by 33 percent, adjusting for inflation⁷. The combined value of agricultural and forestry production, mining and manufacturing—the types of goods most likely to travel by water—grew by 27 percent over the same period, adjusting for inflation. As a consequence, the goods-producing portion of the national economy shrank modestly from 16 to 15 percent. What this means is that if all maritime-eligible production were exported through the nation's ports, this would account for at most 15 percent of the nation's annual production. In reality, this share is much smaller as 1) not all goods production is exported and 2) many exports leave the US by air, rail and truck.

North Carolina's economy is following a similar trend but the pace of restructuring is more pronounced. The value of all state production expanded by 41 percent over the 1997 to 2010 period, outpacing the US economy by a healthy eight percentage point margin. By contrast, the goods producing or maritime-eligible economy expanded by roughly half that pace (19 percent), adjusted for inflation. Although both the total economy and the combined goods-producing industries posted outright gains, because of the difference in their long-term economic performance, goods producing industries (the maritime eligible economy) account for a smaller share of North Carolina's economy now than in 1997. This restructuring of the state's economy has occurred at a more rapid rate than for the nation as a whole; the percentage point drop in overall share of goods-producing industries was four points in North Carolina, much more pronounced than the nation's one percentage point change over the same period. That said, North Carolina's economy still has a larger share of its economic activity concentrated in goods-producing industries than the US as a whole.

⁷ Because the underlying data are measured in dollars not tons, they are reported in real terms—that is they are adjusted for price effects. By holding prices constant over time, the growth in value shown in the table reflects changes in volumes only.

Table 1: Trends in US and NC Maritime-Eligible Economy, real GDP (millions of chained 2005 \$)

Industry	1997	1998	2000	2002	2004	2006	2008	2010	1997-2010 CAGR
United States									
All Industry	9,847,068	10,275,885	11,223,130	11,560,341	12,212,854	12,895,854	13,100,045	13,099,722	2.2%
Ag, Forestry, Mining, Mfg.	1,542,722	1,620,433	1,732,696	1,735,526	1,869,863	1,972,291	1,944,613	1,962,921	1.9%
Share (%)	15.7%	15.8%	15.4%	15.0%	15.3%	15.3%	14.8%	15.0%	
North Carolina									
All Industry	269,885	281,520	316,351	324,155	335,997	370,313	375,559	380,631	2.7%
Ag, Forestry, Mining, Mfg.	64,315	63,547	72,955	68,917	69,601	84,228	78,302	76,654	1.4%
Share (%)	23.8%	22.6%	23.1%	21.3%	20.7%	22.7%	20.8%	20.1%	

Source: Bureau of Economic Analysis, Gross Domestic Product, September 2011

As noted above, while 15 percent of the nation's economy and 20 percent of North Carolina's economy are concentrated in maritime-eligible productions, a much smaller part of this production is actually exported from the state by water. Truck freight is the dominant mode by a substantial margin for freight traveling within the state, from the state and to the state. Waterborne freight, by contrast, accounts for a fraction of the state's overall freight. Of note, it is likely that a portion of the "multiple modes" category includes waterborne freight as well. Even so, combining and both categories still leads to the same conclusion—that waterborne freight is a small portion of the state's overall freight mix.

Table 2: Shipments Within, From and To North Carolina by Mode (2007)

Mode	Within NC		From NC		To NC	
	Weight	Percent	Weight	Percent	Weight	Percent
Truck	284,419	96.2%	83,087	87.4%	77,433	51.9%
Rail	8,530	2.9%	6,264	6.6%	58,535	39.2%
Water*	NA	NA	2	< 0.1%	47	< 0.1%
Air (includes truck-air)	43	< 0.1%	23	< 0.1%	39	< 0.1%
Multiple modes & mail	1,813	0.6%	4,484	4.7%	7,514	5.0%
Pipeline		0.0%		0.0%	4,929	3.3%
Other or unknown	1,003	0.3%	1,215	1.3%	728	0.5%

Source: Freight Analysis Framework Version 3.1.2, <http://faf.ornl.gov/fafweb/FUT.aspx>

Unit of measure is thousands of tons.

* Note: FAF data does not capture in-state barging. Both NUCOR and PCS Phosphate move freight by barge to and from the Port of Morehead City (see Table 21).

The dominance of truck freight for North Carolina is expected to persist through 2040. Even so, waterborne freight capacity can be particularly important for selected state industries. For example, for that portion of North Carolina’s agricultural production that is exported from the US, waterborne freight (any port) accounts for 85 percent of all shipments⁸.

Table 3: Shipments Within, From and To North Carolina by Mode (thousands of tons, 2040)

Mode	Within NC		From NC		To NC	
	Weight	Percent	Weight	Percent	Weight	Percent
Truck	379,961	95.4%	183,460	89.3%	115,836	64.8%
Rail	13,624	3.4%	10,203	5.0%	57,154	2.3%
Water		0.0%	5	< 0.1%	9	< 0.1%
Air (includes truck-air)	150	< 0.1%	224	< 0.1%	58	< 0.1%
Multiple modes & mail	2,787	0.7%	8,477	4.7%	15,214	30.2%
Pipeline		0.0%		0.0%	3,472	0.2%
Other or unknown	1,662	0.4%	3,108	1.5%	2,033	0.8%

Source: Freight Analysis Framework Version 3.1.2, <http://faf.ornl.gov/fafweb/FUT.aspx>

4.4.2 North Carolina Industries that Rely on Waterborne Imports and Exports

Although the US and North Carolina economies are much less dependent on goods production than they once were, waterborne trade remains vital for certain industries. Maritime freight to and from North Carolina is dominated by agricultural, manufacturing, mining/aggregates, and forest products. The dominant shipper locations are 1) sites where the commodity is grown, logged or mined, 2) where it is processed or manufactured, and 3) distribution sites/centers where products and commodities are aggregated for more efficient shipment.

Agriculture and Forestry

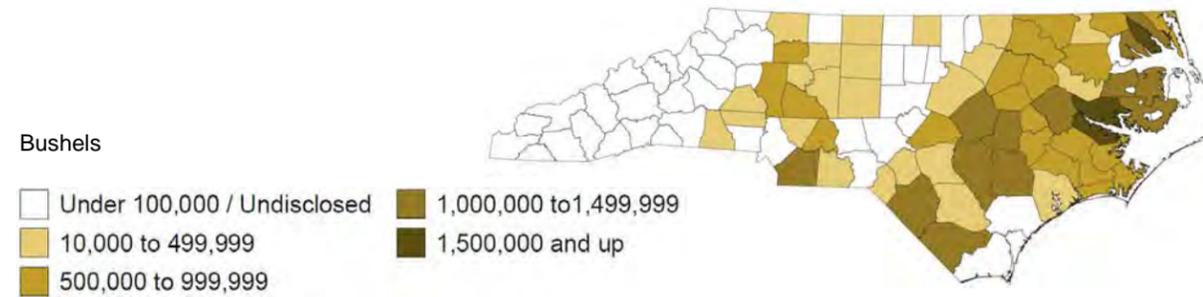
North Carolina is a particularly diverse agricultural state; nearly every county is active in some type of production. The state exported \$2.7 billion of agricultural goods in 2010; this represents about 25 percent of the state’s total agricultural production in that same year.⁹ The maps illustrate regions for the state’s dominant agricultural commodities and for wood products. These locations are large rural areas not concentrated as with urban economies. While there may be year-to-year variation in the amount of acreage planted with a particular crop, it is unlikely that the major growing areas will move over time. Thus, current growing patterns are a good indication of the location of future agriculture and forestry production. North Carolina’s highest value agricultural exports (in descending order) are tobacco (\$1 billion), cotton, meat, wood, soybeans, and sweet potatoes, and consumer-ready foods. The highest volume agricultural exports (in descending order) are wood, cotton, meat, soybeans, and tobacco. Wood accounts for about half of total agricultural exports by volume.

⁸ Agricultural here is defined as live animals/fish, cereal grains, other agricultural products, animal feed, meat/seafood and tobacco products. Share derived from FAF3 data.

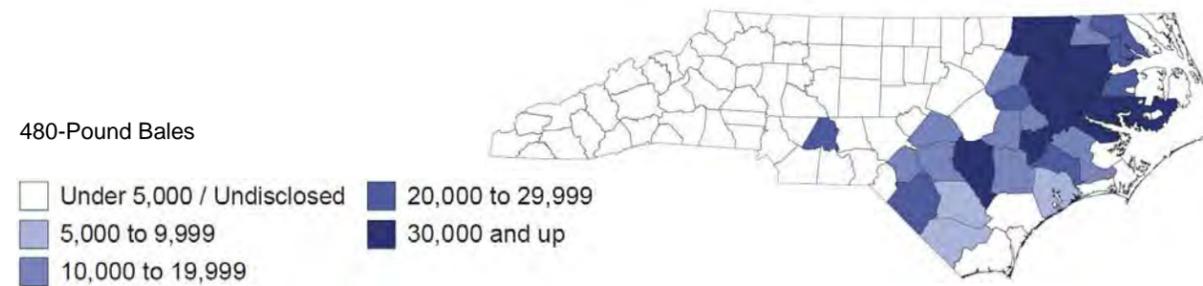
⁹ North Carolina Agricultural Statistics, 2011, page 35.

Figure 4: North Carolina Agricultural and Forest Production (2010)

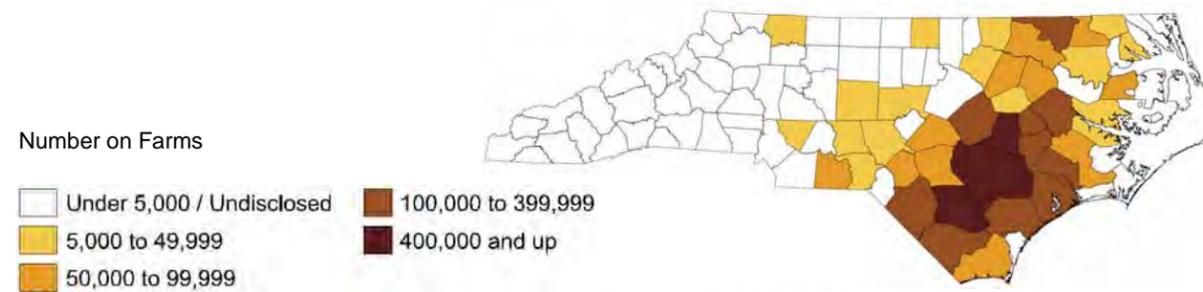
Soybeans



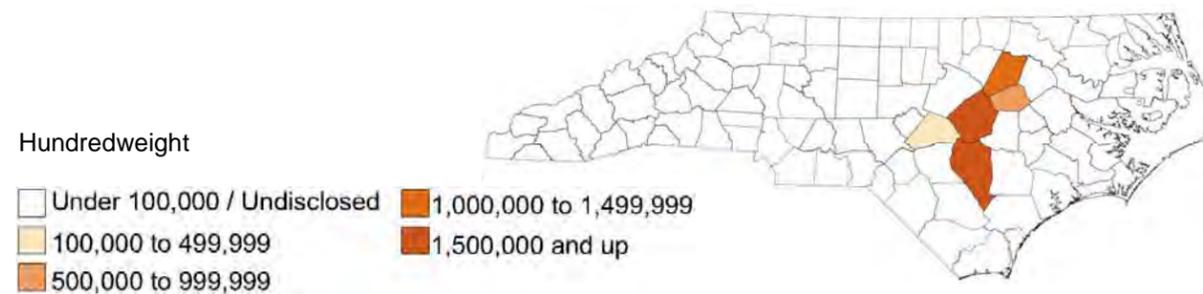
Cotton



Hogs



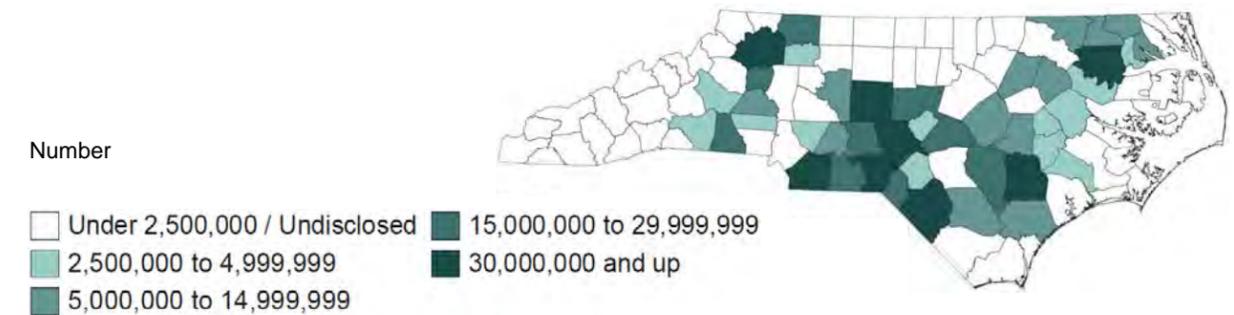
Sweet Potatoes



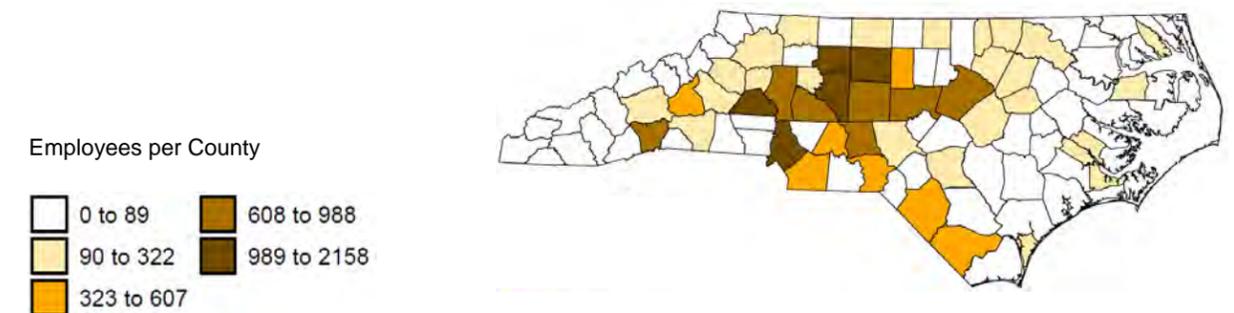
Tobacco (flue-cured)



Poultry (broilers)



Forest Products



Christmas Trees (2007)



Counties reporting more than five (5) Christmas Tree Farms.

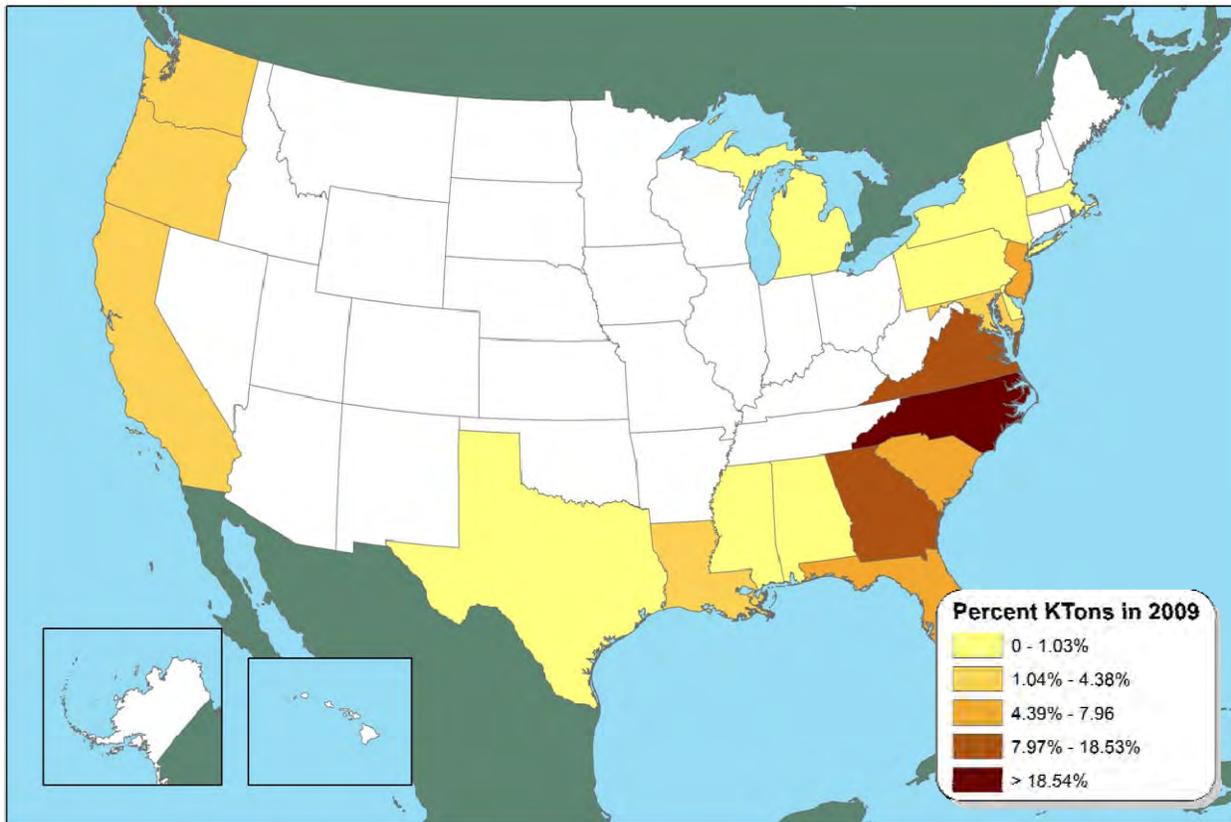
Source: USDA National Agricultural Statistics Service

June 26, 2012

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Roughly one-third of North Carolina’s agricultural and forestry production in 2009 was exported by water, according to national freight statistics. Although North Carolina’s agricultural producers use ports in a variety of states, their own in-state facilities are the most highly utilized.

Figure 5: Waterborne Agricultural Exports from North Carolina by State of Departure

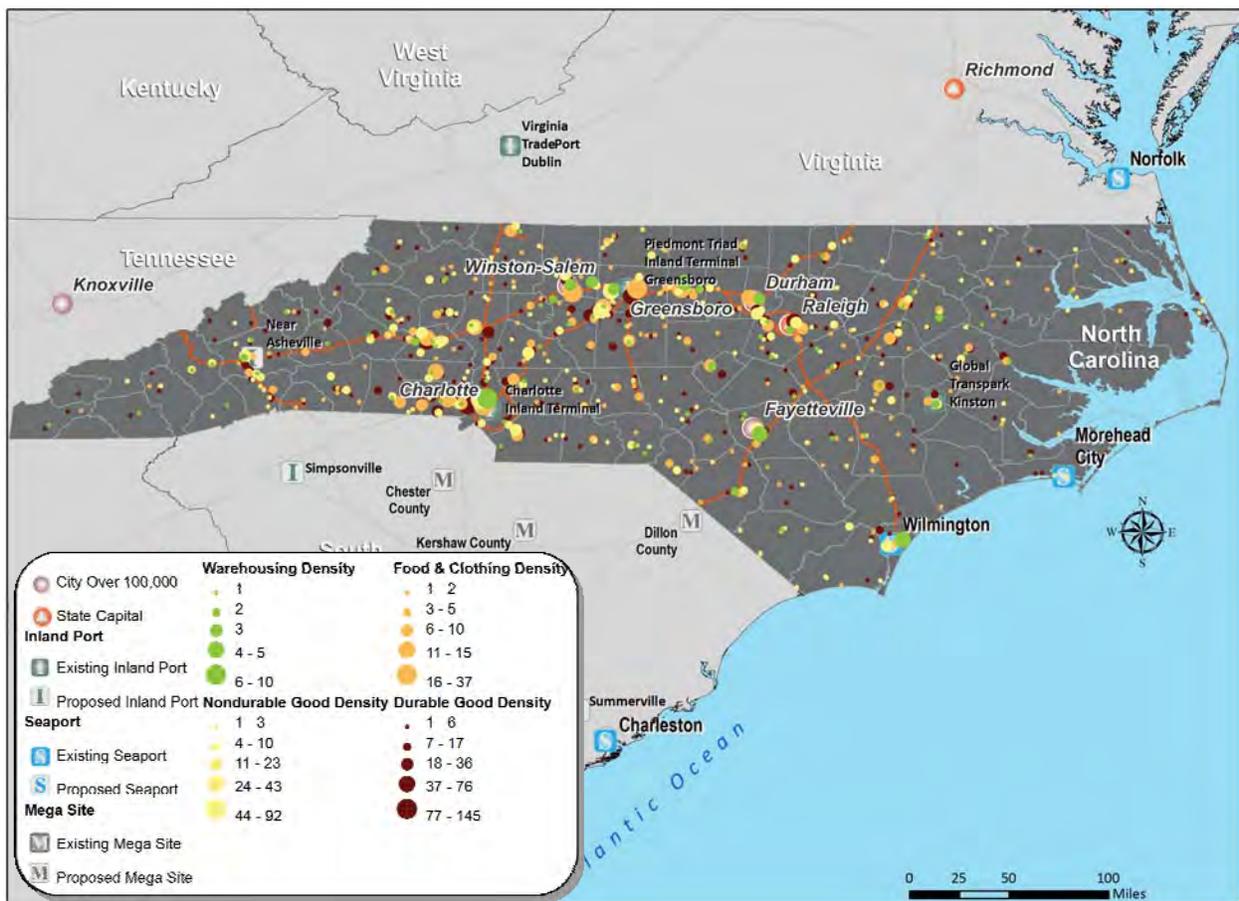


Source: AECOM /URS, assembled from FAF 3.1 and USGS ThematicMapping
 Shading in chart reflects exports by volume.

Manufacturing and Distribution

Manufacturing location patterns in the state reflect a tradeoff between proximity to urban labor markets, with higher-cost land and proximity to the source of inputs or final markets, with lower transportation costs for inputs or the final delivered product. Figure 6 identifies locations of the state’s largest manufacturers and distribution centers—any firm or public establishment with 25 or more employees. While not every firm is an exporter, the map illustrates location and intensity of the major non-agricultural and forestry firms in the state that are in industries that are the most likely to export or import by ocean trade.

Figure 6: Locations of North Carolina Manufacturing and Distribution

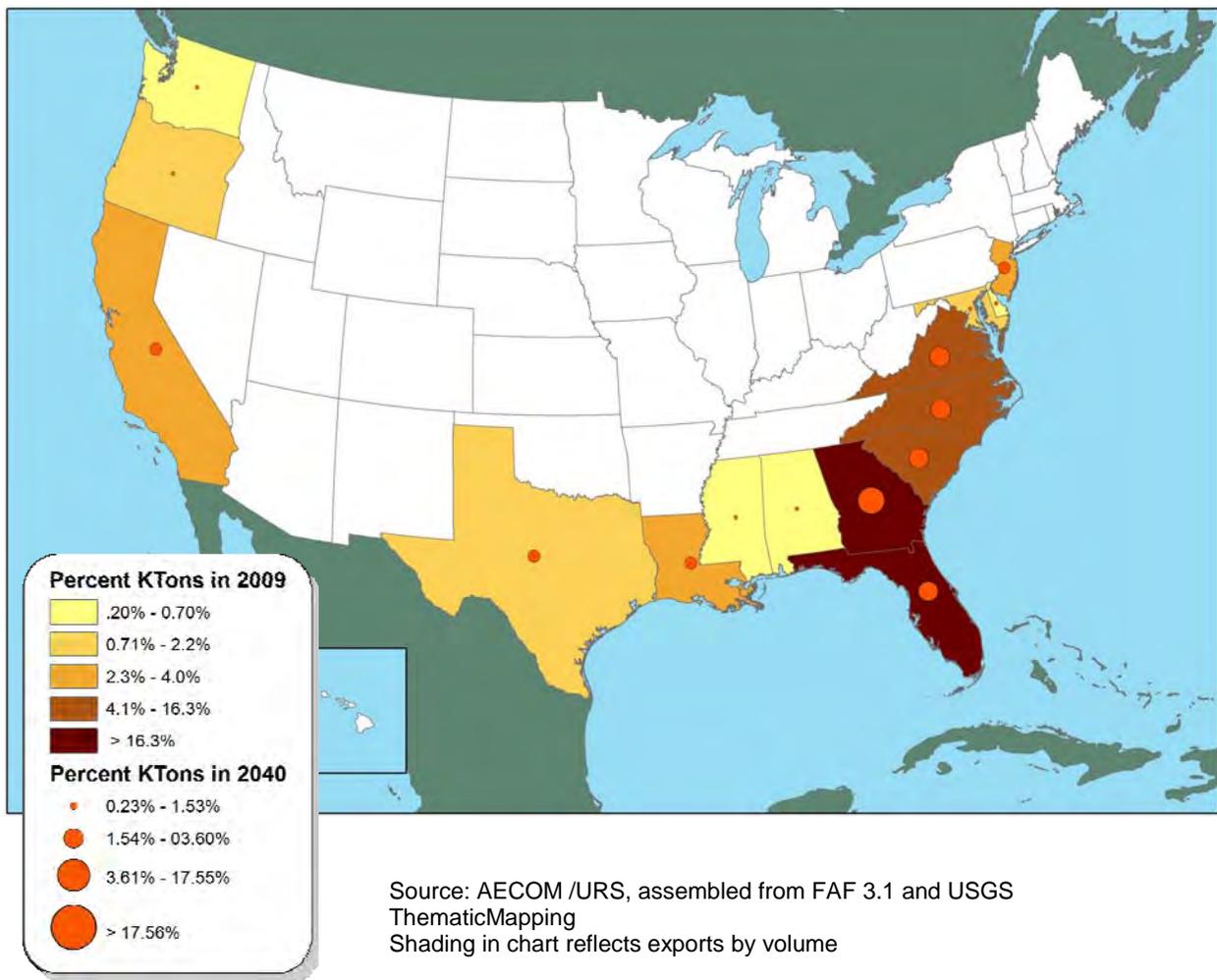


Source: AECOM/URS from ESRI, NCDOT, FAF 3.1

4.4.3 Ports Used for Import and Export of North Carolina Goods

Shippers beyond North Carolina’s border also use the state’s port facilities. When exports are measured by volume, landlocked Tennessee actually uses North Carolina’s port facilities more than in-state shippers do, according to data from FHWA’s Freight Analysis Framework. When exports are measured by value, Illinois shippers use North Carolina port facilities more than in-state shippers. And despite the health of their own state facilities, shippers in California, Virginia and South Carolina still rank among the top ten state customer bases for North Carolina’s ports. While freight data coding issues could change individual rankings, the overall trend that North Carolina shippers are not the overwhelming leaders in exports from the state’s own ports suggests that there is a market impediment. Port selection is influenced by factors beyond proximity, including total delivered cost, frequency of carrier service, variety of origins and destinations and other business advantages offered by ports in other states.

Figure 7: Waterborne Exports From North Carolina by State of Departure, 2009 and 2040

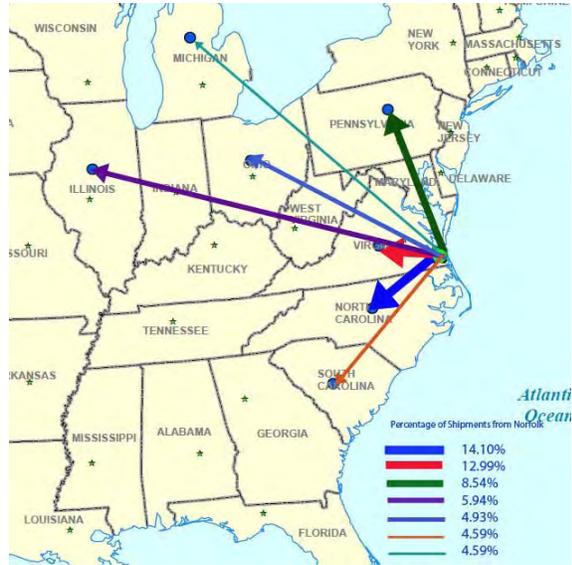


On the import side, more than 60 percent of all foreign imports destined for North Carolina traveled by water, though primarily through ports in other states. Six states account for 90 percent of North Carolina's waterborne imports: Virginia, South Carolina, California, Georgia, Florida, and North Carolina. As shown in Figure 8, North Carolina is the top destination for imports handled by the Port of Norfolk.

Among those shipments that enter the US through North Carolina's ports, the majority are destined for consumption in North Carolina. Illinois, Texas and Florida are other important import customers for the state's port facilities.

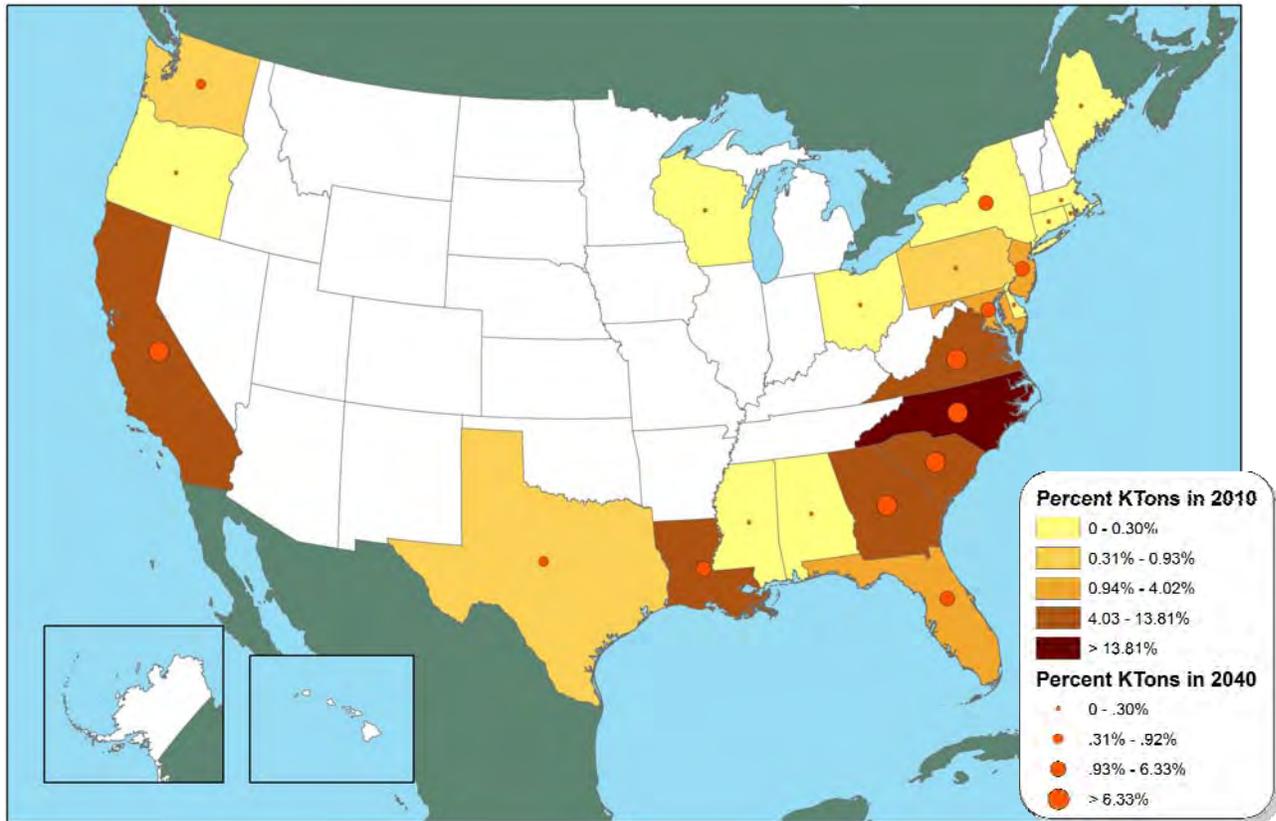
North Carolina is projected to continue to be a strong destination market for imports as part of the emerging Piedmont Atlantic Megaregion.

Figure 8: Top Destinations of Imports Arriving through Port of Norfolk



Source: Delcan, *Private Data for Public Purposes*, AASHTO Special Committee on Intermodal Transportation & Economic Expansion, Richard Mudge PhD, Delcan (October 14, 2011)

Figure 9: States of Entry for North Carolina Waterborne Imports, 2009 & 2040



Source: AECOM/URS from FAF version 3.1, 2010, USGS and ThematicMapping world borders data set
Shading in chart reflects imports by volume

4.4.4 North Carolina's Global Trading Partners

North Carolina's trading partners are geographically diverse. Major export partners include China, NAFTA partners, and a variety of European, Asian and Latin American destinations. The mix is similarly diverse on the import side, led again by China and the NAFTA partners, followed by mostly European and Latin American partners. This diversity is favorable as it shields the state from an economic downturn in a particular region of the world economy.

The listing below compares the state's leading (defined as Top 10) import and export partners overall (that is using any port of entry to the US with an ultimate origin/destination in North Carolina) against the leading origin and destination for trade traversing through the state's own ports. On the import side, only three import partners are common between the two lists. One the export side, only four export destinations are common. This suggests that North Carolina shippers choose to use an out-of-state port to reach the majority of their leading trade partners due to availability of ship calls, storage/equipment availability, or another factor.

Table 4: Top Ten Origins of Waterborne Imports Destined for North Carolina (2010, by volume)

Imported to NC through all ports	Imported through NC Ports
China	China
Mexico	Brazil
Canada	Mexico
Germany	Korea
Japan	Colombia
United Kingdom	Venezuela
Ireland	Belgium
France	Indonesia
Singapore	United Kingdom
Italy	Taiwan

Source: US Census, NCSPA

Table 5: Top Ten Destinations of Waterborne Exports Produced or Manufactured in North Carolina (2010, by volume)

Exported from NC through all ports	Exported through NC Ports
1. Canada	1. China
2. China	2. India
3. Mexico	3. Brazil
4. Japan	4. Korea
5. France	5. Belgium
6. United Kingdom	6. Taiwan
7. Germany	7. Turkey
8. Honduras	8. United Kingdom
9. Brazil	9. Argentina
10. Hong Kong	10. Honduras

Source: US Census, NCSPA

4.5 Regional Ports Serving the North Carolina Market

North Carolina imports and exports are handled primarily through ports in Virginia, South Carolina, Georgia, and North Carolina. The Port of Wilmington competes for container market with peer ports on the US east coast, including Norfolk VA, Charleston SC, Savannah GA, and to a lesser extent, Jacksonville FL. For non-container market, the extent of competition varies based on the type of cargo handled and proximity of importer/exporter to the port location.

Regional ports identified as peers to NC Ports include Norfolk VA, Charleston SC, and Savannah GA. These peers were selected for evaluation and comparison based on the following factors:

- Similar location in the southeastern US: all of the ports selected are likely to directly serve North Carolina shippers and the emerging Piedmont Atlantic Megaregion (PAM) is

composed of core metropolitan areas, including Birmingham, Atlanta, and two in North Carolina – Charlotte and Raleigh-Durham

- All have interstate landside access to major North Carolina market areas without passing one of the other peer ports
- All are designated as strategic military ports
- They are leading ports for North Carolina waterborne exports
- They handle the same freight types as the North Carolina facilities, facilitating comparison

4.5.1 Port Characteristics

North Carolina’s ports rank the best and worst among the regional peers in terms of distance to ocean. Morehead City has a highly advantageous location that is closest to the ocean and nearly the best water depth—only Norfolk is currently deeper. Wilmington, by contrast, is the most distant from the ocean. In terms of water depth, it ranks at the bottom among the peers, tied with Savannah. Despite the variation in water depth, none of the regional peers with the possible exception of Norfolk can currently accommodate the post-Panamax ships. Thus, the differences in water depth are less critical in determining current competitive advantage than in positioning the ports for future post-Panamax opportunities.

The surrounding business base (measured by employment) in close proximity to the ports (within 300 miles) is the smallest for the North Carolina ports; each of the regional peers has a greater density of economic activity to generate trade. The ranking changes, however, at a broader 500-mile radius. Both Morehead City and Wilmington have larger markets compared to Savannah and Charleston. Only Norfolk’s market density exceeds that of North Carolina at a 500 mile radius.

Table 6: USACE Expenditures on Regional Harbor Projects, FY1999 to FY2008

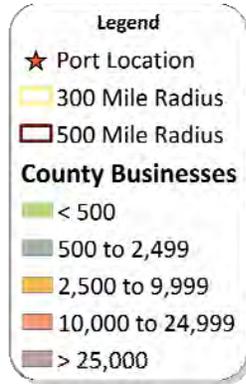
Harbor	10-Year Harbor Maintenance Trust Fund Expenditures
Savannah	\$123,447,085
Norfolk	\$96,059,577
Charleston	\$75,709,695
Wilmington	\$69,060,101

Source: Congressional Research Service, Harbor Maintenance Trust Fund Expenditures, January 10, 2011

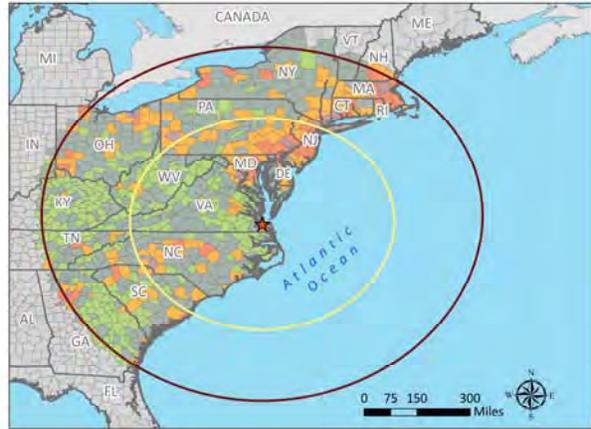
The handling facilities at North Carolina’s ports are more limited than the peers in terms of the variety of freight types that can be handled. Although both refrigerated cargo and Ro/Ro can be shipped via North Carolina, the facilities are more limited than those at other ports and North Carolina port facilities lack specialized equipment to make such operations more efficient. The range of bulk commodities that can be handled is similarly limited.

North Carolina’s ports have the most limited hours of operation among the regional peers. While this has the benefit of containing operating costs, it also limits shippers’ ability to access the port and deliver multiple truckloads in a day—ultimately constraining volumes and making other ports more attractive in terms of trucking costs and ability to move containers.

Figure 10: Employment Densities around Regional Ports



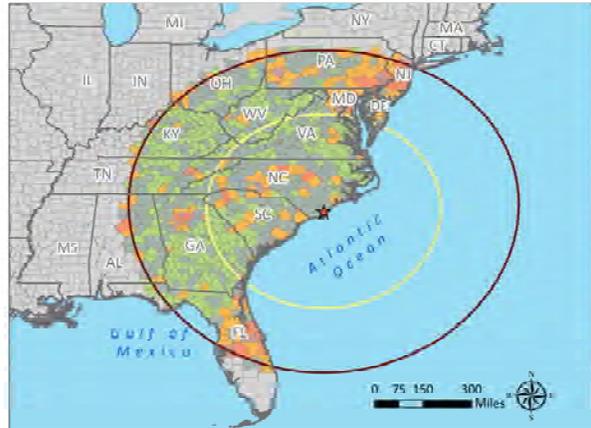
Norfolk



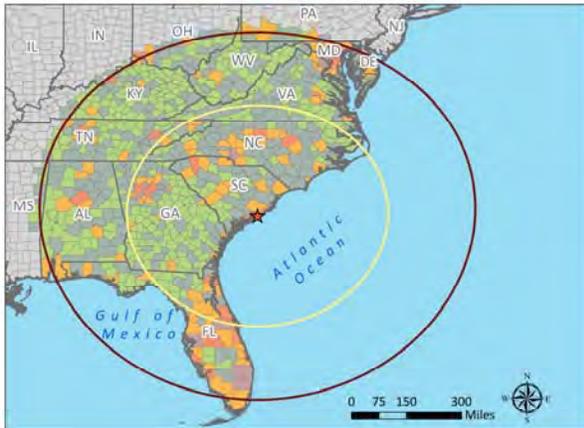
Morehead City



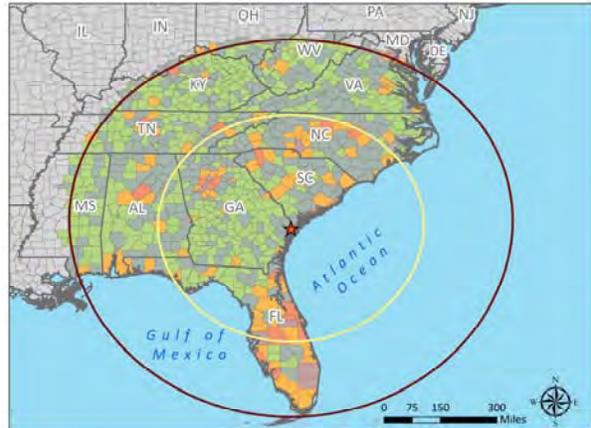
Wilmington



Charleston



Savannah



Source: AECOM/URS, ESRI, United States Census Bureau

Table 7: Summary of Regional Peer Port Characteristics

Characteristic	Wilmington	Morehead City	Norfolk	Charleston	Savannah
Landside Characteristics					
Employment (300 miles)	9,835,746	11,299,091	25,709,948	13,763,843	15,884,074
Employment (500 miles)	41,704,522	41,900,520	50,527,138	33,299,436	29,043,452
Distance to interstate from gate	7.8 miles to I-140 and US 17	111 miles to I- 795	5.8 miles to I-264	2.5 miles to US 17 and I-26	5.6 miles to I-95 from Garden City Terminal 1.2 miles to I-16; 10 miles to I-95; 1.5 miles to I-516 from Ocean Terminal
Rail access	CSX service; In-port switching by Wilmington Terminal Railroad; Substantial rail car storage	NS service; In-port switching by Carolina Coastal Railway; Railroad scale; Substantial car storage	CSX and NS service to Hampton Roads; NS and CSX service to Norfolk via Suffolk and the Commonwealth Railway	CSX and NS service to Union Pier, Columbus Street, North Charleston and Veterans; On-terminal rail yards at Columbus St. and North Charleston	CSX and NS service to Garden City and Ocean Terminal; On-terminal ICTF at Garden City
Port Characteristics					
Distance to sea buoy (miles)	26	4	18	16	20
Depth (maximum ft)	42	45	NIT: 50 (with authorization to dredge to 55) APMT: 55	45 (harbor channel and dockside)	Garden City Terminal: 42
Type of facilities	Container Limited Ro/Ro Breakbulk Limited refrigerated cargo Selected Bulk	Ro/Ro Breakbulk Selected Bulk	Bulk Grain Container Ro/Ro Breakbulk	Container Ro/Ro Breakbulk Bulk Refrigerated cargo Cruise	Container Ro/Ro Breakbulk Bulk Refrigerated cargo Cruise

Characteristic	Wilmington	Morehead City	Norfolk	Charleston	Savannah
Operational Characteristics					
Military Use	Yes--Strategic Seaport	Yes--Strategic Seaport	Yes-- Strategic Seaport (Hampton Roads)	Yes--Strategic Seaport	Yes--Strategic Seaport
Hours of operation	Container Terminal: M-F 8am -12pm ; 1pm - 4:30pm General cargo: M-F 7:30am to 3:30pm	General Terminal: M-F 8am - 4pm	NIT: M-F 6am - 6pm APMT: M-F 6am - 6pm NMMT: M-F 8am - 12pm; 1pm – 5pm	Container gates: 7am - 6pm Breakbulk gates: 8am - 12pm; 1pm - 5pm	GCT Gate 3: M-Th 7am - 6pm; F 7am– 5pm GCT Gate 4: M-F 7am - 6pm Saturday 8am – 12pm; 1pm – 5pm

Source: AECOM/URS team analysis, FAF 3.1 data, NCDOT rail maps, individual port web sites

4.5.2 Capacities and Commodity Volumes Handled by Regional Ports

As compared to ports in Virginia, South Carolina and Georgia, North Carolina’s ports handle the lowest total tonnage across all cargo modes (containerized, bulk, and breakbulk). In aggregate, the disparity is overwhelming; however, more detailed review identifies commodity-specific information that is important to understand each port’s strengths and capabilities. While Virginia ports handle a very large volume of bulk cargo, this figure is dominated by coal exports. Excluding coal, North Carolina demonstrates an overall strength in the handling of bulk cargos as compared to neighboring states. North Carolina’s handling of breakbulk cargo is also a relative strength among the regional ports. Across containerized cargo, North Carolina ports handle only a small share of containers destined for the region.

An in-depth review of the existing and planned facilities at regional ports was conducted to determine the extent of potential capacity available in the North Carolina maritime market area for handling various types of containerized and non-containerized cargo.

Although Wilmington’s container capacity utilization is lower than at peer ports, the overall size of its capacity is much smaller than its regional peers. The unused container capacity at Norfolk, Charleston, and Savannah exceeds the total capacity at Wilmington.

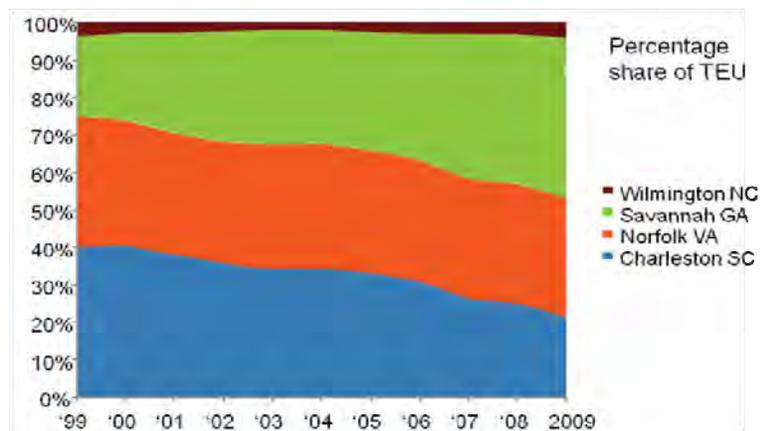
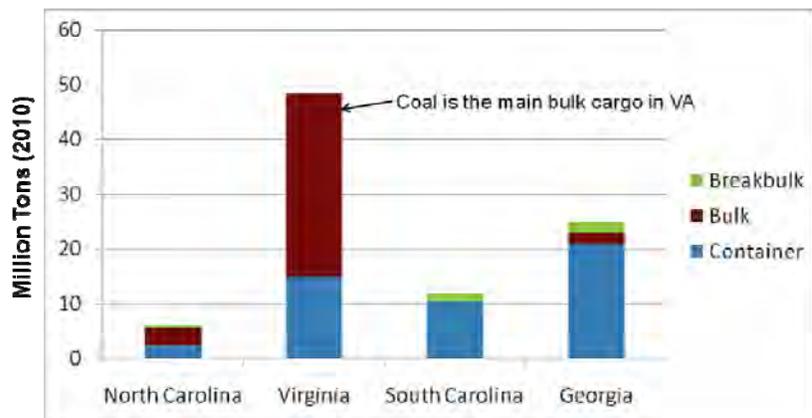
At 70 percent, breakbulk capacity utilization at Wilmington is much higher than at Morehead City and the regional peers. Each of the other peer ports has significant unused breakbulk capacity.

Among the peers, the North Carolina ports have the greatest bulk handling capacity, with less than half of it used. This measure, however, omits that bulk facilities can be specialized (chemicals and aggregates in this case) and that the capacity at North Carolina’s ports does not directly address the needs over to handle key bulk commodities within the state. The capacity utilization masks the mismatch between facilities and key markets that could use the port.

Finally, in terms of dedicated Ro/Ro facilities, North Carolina has not entered this market although it can accommodate certain types of Ro/Ro ships. The other peers have at least some capability in this market, with the greatest regional capacity in Savannah.

Table 8 summarizes peer ports capacity utilization based on the independent evaluation of terminal capacity for each cargo type vs. actual amount of cargo handled in 2010.

Figure 11: Commodity Volumes at Regional Ports



Source: AECOM, from NCSPA data and port websites

Table 8: Regional Ports Capacity and Utilization

	Containers (TEU)	Breakbulk (Tons)	Bulk (Tons)	Ro/Ro (Units)
Wilmington NC				
Terminal Capacity	530,000	1,470,000	2,220,000	
2010 throughput	250,048	1,033,426	606,556	
% Utilization	47%	70%	27%	
Morehead City NC				
Terminal Capacity		1,080,000	2,730,000	
2010 throughput		199,603	1,260,402	
% Utilization		18%	46%	
Virginia				
Terminal Capacity	3,630,000	6,820,000		320,000
2010 throughput	1,895,018	230,246		
% Utilization	52%	3%		0%
South Carolina				
Terminal Capacity	3,230,000	4,030,000	100,000	200,000
2010 throughput	1,280,000	991,705	0	106,498
% Utilization	40%	25%	0%	53%
Georgia				
Terminal Capacity	4,500,000	7,440,000	2,110,000	1,070,000
2010 throughput	2,825,178	1,239,091	1,772,897	477,851
% Utilization	63%	17%	84%	45%
Jacksonville, Florida				
Terminal Capacity	1,800,000	3,550,000	2,400,000	950,000
2010 throughput	826,580	580,326	1,515,161	795,773
% Utilization	46%	16%	63%	84%

Source: AECOM, from port data

4.5.3 Landside Access and Distribution

Measured in terms of distance to the nearest interstate, both North Carolina ports are at a disadvantage relative to their peers, although in the case of Wilmington, the margin of difference is small. Morehead City, however, is at a significant disadvantage to its peers in terms of landside highway access.

North Carolina's ports are served by a single rail provider while each of its peers is served by two Class I providers. This reduces the potential for competition and is perceived in the market as a disadvantage for shippers needing rail service. It also imposes a "directional bias" on rail shipments from the Port of Morehead City. Norfolk Southern serves Morehead City; its main routes from the port run east-west; it would require a transfer (adding cost and a time penalty) to another line in order to move North-South upon leaving the port.

As compared to other regional ports, North Carolina ports are more reliant on truck freight than their peers. The two tables provided below summarize the mode of travel to North Carolina's ports and its peers for exports and imports. As truck freight is more readily divertible than rail freight, this supports efforts to retain North Carolina shipments and attract freight from other ports. Reducing costs for North Carolina shippers translates directly into productivity gains and competitiveness for the North Carolina economy. Attraction of the freight from out-of-state shippers to volumes at North Carolina's ports may yield scale efficiencies that benefit all port users and the state's costs of operation, but the productivity gains for out-of-state shippers remain out of state.

Table 9: Mode of Travel by Weight, 2010

Port	NC Exports Leaving from Port (A)			Goods Imported to NC Arriving at Port (B)		
	% Trucks Only	% Rail Only	% Other Modes including Multiple Modes	% Trucks Only	% Rail Only	% Other Modes including Multiple Modes
North Carolina	97.3	0.3	2.5	94.8	4.6	0.7
Norfolk	83.8	3.2	13.0	90.8	0.0	9.2
Charleston	83.2	3.3	13.5	70.8	14.2	15.0
Savannah	55.9	2.8	41.3	91.9	1.7	6.4

Source: FAF, 3.1

Note: Because of their spatial proximity, the North Carolina ports cannot be isolated in the FAF, 3.1 commodity data. (A) North Carolina exports shipped to the port by the mode indicated. (B) North Carolina imports shipped inland from the port by the mode indicated.

Table 10: Mode of Travel by Value, 2010

Port	NC Exports Leaving from Port (A)			Goods Imported to NC Arriving at Port (B)		
	% Trucks Only	% Rail Only	% Other Modes including Multiple Modes	% Trucks Only	% Rail Only	% Other Modes including Multiple Modes
North Carolina	77.0	0.0	23.0	94.7	2.4	2.9
Norfolk	70.2	1.4	28.4	81.6	0.0	18.4
Charleston	86.3	1.1	12.7	76.0	8.4	15.6
Savannah	84.1	0.5	15.4	90.2	2.0	7.8

Source: FAF 3.1

Note: Because of their spatial proximity, the North Carolina ports cannot be isolated in the FAF 3.1 commodity data. (A) North Carolina exports shipped to the port by the mode indicated. (B) North Carolina imports shipped inland from the port by the mode indicated.

4.5.4 Port Revenues

Table 11 summarizes the operating revenues, in millions, and associated revenue per ton for the peer port authorities in the Southern Atlantic Region.

Table 11: Peer Ports Revenues

2010	Revenue (in millions)	Revenue per ton
North Carolina State Ports Authority	\$33.32	\$6.41
Virginia Port Authority	\$193.79	\$12.44
South Carolina State Port Authority	\$111.74	\$10.80
Georgia State Port Authority	\$238.32	\$11.11
Port of Jacksonville	\$50.60	\$6.25

Source: NCSPA Independent Audit Report, peer port websites

4.5.5 Port Governance and Funding

NCSPA and four of the regional peer port state operate as statewide port authorities; however, there still are differences among each in terms of governance structure.

US seaports operate under various structures for governance and funding. Most port authorities are financially self-supporting. In addition to owning land, setting fees, and sometimes issuing bonds and levying taxes, port districts can also operate shipping terminals, airports, railroads and even such things as irrigation facilities. As a general rule, port authorities operate as businesses, sustaining themselves on their revenue streams, and, as significant economic engines, in some cases contribute funds to state (or other governmental) coffers.

The North Carolina State Ports Authority (NCSPA), founded in 1945, has an 11-member Board of Directors comprising: six members appointed to four-year terms by the Governor, a chair with a six-year term also appointed by the Governor, and an additional two members appointed by each of the Speaker of the House of Representatives and President Pro Tempore of the Senate for two-year terms. Per NC General Statute 136-260, NCSPA and its board falls under the jurisdiction of NCDOT and reports to the NC Secretary of Transportation.

In addition, organized in 1989, the North Carolina Ports Advisory Council, inclusive of members who represent business and industries involved in international trade and transportation across North Carolina, offers support and assistance to the NCSPA in the areas of business planning, finance, government relations, marketing and operations. Council membership (which presently stands at 33) is open to anyone involved or interested in international trade.

NCSPA owns and operates its terminals and facilities. The primary source of revenues to NCSPA is from these operating activities; however, NCSPA has received grants and aid from the State of North Carolina to support its capital program. State capital grants and capital aid totaled approximately \$423,000 in fiscal year 2010-11. The fiscal year 2011-12 budget includes approximately \$1.7 million in state capital aid and capital grants to support specific projects that include port-wide berth structure repairs and fire sprinkler replacement at Morehead City.

NCSPA has also been the recipient of federal grants to support capital investments, primarily security-related. No state or local funds or tax revenues are used to support operations.

The Virginia Port Authority (VPA) is an autonomous agency (political subdivision) of the Commonwealth of Virginia that owns the Port of Virginia. As an agency of the Commonwealth, the VPA reports to the Virginia Secretary of Transportation. The Governor appoints 11 citizens to form the Virginia Port Authority Board of Commissioners; the state Treasurer is an ex-officio member of the Board. Commissioners serve staggered five-year terms at the pleasure of the Governor, and no commissioner may serve more than two consecutive terms. Law dictates that there must be one, but no more than one, commissioner from Norfolk or Virginia Beach; one, but no more than one, commissioner from Portsmouth or Chesapeake; and one, but no more than one, commissioner from Hampton or Newport News. Traditionally, an active or retired senior executive from Norfolk Southern Railway and an individual with ties to the coal industry have served as members of the Board. The Board elects a chairman and vice chairman from within its membership. The Board of Commissioners appoints the executive director of the Virginia Port Authority, who is responsible for overseeing the daily execution of the agency's policies, as well as serving as an ex-officio member of the Board of Directors of Virginia International Terminals, Inc. (VIT), which is the VPA's non-stock, non-profit affiliate responsible for operating the Port of Virginia. The VPA receives 4.2 percent of the Commonwealth Transportation Trust Fund (from vehicle and fuel taxes), equating to about \$35 million a year for capital projects, and, similar to several other states, the Commonwealth contributes to payment of outstanding bond debt service.

The South Carolina Ports Authority (SCPA) is governed by a nine-member Board of Directors, each appointed by the Governor and confirmed by the Senate, along with two non-voting, ex-officio members – the state Secretary of Commerce and Secretary of Transportation. Despite its status as a public agency dedicated to the economic development of the State of South Carolina, the Authority does not receive direct appropriations from the state for capital or operations expenses. Instead, the Authority operates like a private business, and funds its operations and investment efforts through its own revenue stream and ability to issue bonds. The Authority has no taxing authority. Founded in 1942, the Authority owns and operates public marine terminals at two port facilities: The Port of Charleston and the Port of Georgetown. These facilities are owner-operated terminals, meaning the Authority owns the terminals, operates all container cranes, manages and operates all container storage yards and leads all customer service functions in both the yard and the channel. Similar to the case in other states, the State of South Carolina does provide funding for access roads and other outside-the-gate projects and has been a co-share sponsor for harbor deepening projects that serve both Authority public terminals and also private terminals along the ship channel.

The Georgia Ports Authority is a quasi-state agency whose activities are governed by a 13-member Board of Directors, appointed by the Governor from the state at large to serve staggered four-year terms. Policy directives, administrative duties and managerial controls are implemented by a chief executive officer. The GPA owns and operates most of its facilities, but it leases some (such as the inland Port Columbus) to private terminal operators. The GPA does not receive a regular state funding allocation but has on occasion received legislative appropriations as needed.

Florida's northernmost major port, the Port of Jacksonville is a local port overseen by the Jacksonville Port Authority (JAXPORT). JAXPORT is governed by a seven-member Board of

Directors. The Mayor of Jacksonville appoints four members, and the Governor appoints three members, with each member serving a four-year, unpaid term and eligible for appointment to one additional term. JAXPORT is an independent government agency created by the Florida Legislature, operating primarily as a landlord, managing the upkeep, improvement and expansion of Authority facilities and coordinating their use by private companies. The physical facilities owned by JAXPORT include docks and wharfs, cranes, a passenger cruise terminal, warehouses, paved open storage areas and road connections to the public highway system. The Port Authority provides and maintains the terminals and their equipment and manages the overall use of the facilities. JAXPORT receives multiple revenue streams on a monthly basis (the monthly basis better facilitating bonding capability) as follows: \$250,000 from the Jacksonville Electric Authority; an \$800,000 allocation from the City of Jacksonville; and a split share with the City from a communications service charge (on phone, cellular and cable bills), less payments related to prior debt service.

4.5.6 NCSPA Market Positioning and Strategies

A port's marketing efforts offer a means to increase the likelihood of shipper demand for port services and regular calls by ocean carriers to match that demand -- reducing the risk that new and existing capital investment is underutilized.

Port facilities, specialized services, and changes to operating policies to make the NCSPA's facilities more accommodating may be underutilized by the market if carriers and shippers do not recognize their availability. The following summarizes some of the key points.

Domestic and International Port Offices

NCSPA maintains three foreign offices: Korea, Hong Kong, and Germany; these are collocated with the State's international offices maintained by the Department of Commerce. The collocation of offices is a good strategy as it reduces the state's cost of foreign representation and allows the port's marketing budget to go further. The Department of Commerce also maintains offices in Brazil, Canada, Mexico, and mainland China (Shanghai), though no affiliation with the NCSPA is listed. The fast-emerging India market is missing; North Carolina is not developing ties to this important trading partner, making the investment to establish links now while the economy is emerging as an important world market, even as its competitors are already in those markets.

There are no domestic NCSPA offices outside of North Carolina. By comparison, the South Carolina Ports Authority lists sales offices in Charlotte NC, Atlanta GA, New York, Tokyo, Japan, Mumbai, India, and Shanghai China. Domestic shippers who participated in stakeholder workshops reported successful working relationships with NCSPA port representatives, but indicated that they received information and visits from other ports in the region more than NCSPA.

Port Website

The port has recently renovated and enhanced its web site to provide much more information with a marketing focus. NCSPA received several awards for the redesign. One of the chief changes is a transition from just describing the port to a greater focus on describing how to effectively use the port. For example, the redesigned website contains extensive site selection

information and links to development partners. This change emphasizes the port's role as the prime gateway to the North Carolina and broader southeastern economies.

Information-Based Marketing to Carriers

Recognizing that carrier staff do not have extensive research departments and many demands on their attention, the NCSPA port staff have developed an approach that develops customized information packets tailored to the interests of the specific carrier. The ports use PIERS data and other sources to identify local shippers and volume potential. The packages include both general information on the port's recent growth and available services and facilities, but also tailored information on cost savings achievable by using a North Carolina gateway as opposed to another regional alternative. These include: proximity to growing population, highway connections, recent and proposed channel and port infrastructure investments, port productivity (crane moves/hr, truck turn time), and container move cost. Port representatives travel extensively; providing carrier representatives with these information summaries at their meetings. Follow up for those carriers that express an interest in NCSPA facilities entails addressing specific follow on questions as well as working to secure domestic partners for the carrier service.

NCSPA's strategy focuses on trans-Pacific container trade, Central American bulk and breakbulk trade, trans-Atlantic and South American trade.

4.6 Global and Regional Trends affecting Waterborne Goods

4.6.1 Regional Goods Movement Initiatives

Goods movement patterns in the US have emerged to optimize the supply chain based on sources of goods and consumer market locations. A fully functioning system of ports of entry, transportation links, and distribution nodes is needed to bring goods to market. This has led to a transportation strategy to identify "gateways" that facilitate the entry of goods and "corridors" that provide reliable capacity to transport goods to local distribution centers and ultimate marketplace.

Reliability of transit time is critical for delivery of containerized goods. By affording "time-certain" delivery, the container supply chain – including ship, train, and truck – serves as a virtual warehouse, thereby reducing warehousing requirements. To avoid congestion-related transportation related costs and delays, shippers and shipping lines are drawn to ports of call that provide access to transportation networks (highway and rail facilities) and distribution centers with adequate capacity and a record of time-certain delivery.

Increasingly, transportation providers – including air and seaports, departments of transportation, railroads and facility

Figure 12: I-95 Corridor



Source: I-95 Corridor Coalition

operators – are collaborating to implement multi-state or multi-party strategies for gateway and corridor development.

I-95 Corridor Coalition

Interstate 95 comprises nearly 2000 miles of interstate highway from Maine to Florida. The I-95 Corridor Coalition brings together key entities and agencies such as state and local transportation departments, transportation authorities, transit and rail agencies, port authorities and railroads who have established a collaborative vision plan. NCDOT is an active member of the I-95 Coalition, which plans and advocates for projects that will advance multi-state passenger and freight mobility needs of this primary highway backbone along the Atlantic seaboard.

National Gateway

The National Gateway is a partnership between CSX, USDOT, and various state departments of transportation to better connect mid-Atlantic seaports to Midwest population centers. Key freight rail corridors included in the program include the I-95/I-81 corridor between North Carolina and Baltimore MD, the I-70/I-76 corridor between Washington DC and northwest Ohio, and the I-40/Carolina Corridor between Wilmington NC and Charlotte NC. Among the National Gateway projects identified in North Carolina is proposed expansion of the existing CSX Charlotte intermodal terminal; advancement of this project requires that rail-related traffic impacts within Charlotte be satisfactorily addressed.

Figure 13: National Gateway Corridor



Source: CSX, from Phase 1 National Gateway Clearance Initiative Environmental Assessment, 2010.

Figure 14: Crescent Corridor



Source:
<http://www.thefutureneedsus.com/crescent-corridor/>

Crescent Corridor

The Crescent Corridor¹⁰ is a 2,500-mile Norfolk Southern (NS) rail corridor supporting the supply chain from Memphis and New Orleans to New Jersey. The corridor includes NS' two primary rail lines paralleling I-85 through North Carolina and other Atlantic states and paralleling I-40/I-81 in eastern Tennessee. NS is planning and implementing a series of focused improvements to move more freight -- and faster. Program components include new intermodal facilities in Memphis TN, Birmingham AL, and Greencastle PA. Some projects have been advanced in partnership with USDOT as well as state, and local governments.

¹⁰ The Crescent Corridor website, <http://www.thefutureneedsus.com/crescent-corridor/>

Heartland Corridor

Norfolk Southern's Heartland Corridor¹¹ provides access for intermodal trains carrying double-stacked containers along the high-speed, high-capacity Norfolk Southern line from VPA terminals in Norfolk VA to population centers and inland intermodal facilities in the US Midwest. The program, which was completed in September 2010, included total investment of \$191 million shared between NS and federal and state government, included a new intermodal terminal at Columbus OH and clearance improvements to allow for movement of double-stack containers along its full length. The improvements are estimated to have cut 250 miles and one day of transit time between VPA terminals and the Midwest destinations in Ohio and Chicago.

Figure 15: Heartland Corridor



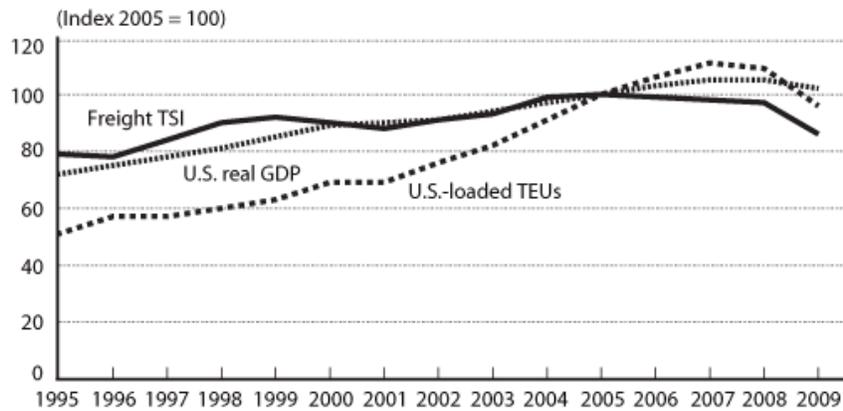
Source:
<http://www.thefutureneedsus.com/project-updates/heartland-corridor/>

4.6.2 Containerization

The use of shipping containers was initiated in the late 1950's. With modest but growing container use in the 1960's and 1970's, it was really in the 1980's that fully functional container terminals began to take hold. From 1980 onward, the use of containers to import and export goods was a true revolution in freight handling. Containers offered security of transport and logistical efficiencies that had not previously existed. The efficiency of intermodal – ship to rail – container cargo is even more dramatic, cutting dwell times in the port by 50 percent or more.

Due to efficiency of handling, the use of containers has expanded beyond use for consumer goods. Containers can also reduce cargo damage and loss associated with multiple handling of traditional bulk and breakbulk goods. Today's containerized goods include such items as furniture, auto parts, toys, computers, cotton, paper, animal feed, scrap, and soybeans.

Figure 16: Growth in US Waterborne Foreign Containerized Trade, Overall Freight, and Real GDP



Source: US Bureau of Trade Statistics

¹¹ Heartland Corridor website, <http://www.thefutureneedsus.com/project-updates/heartland-corridor/>

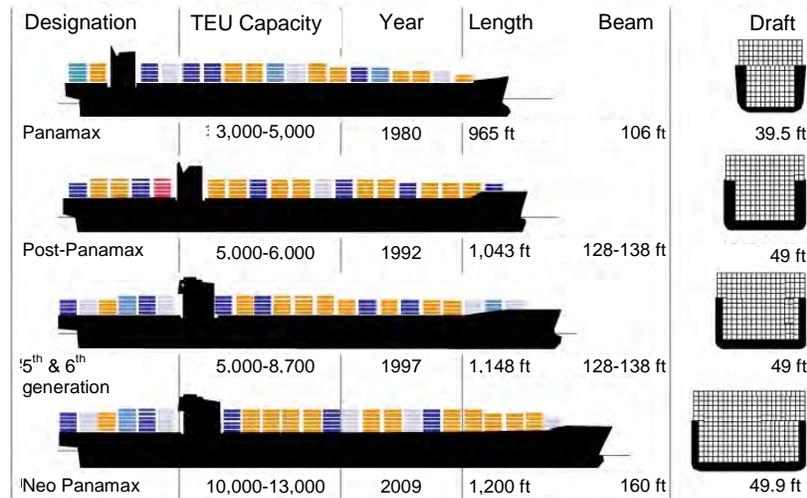
Measured by twenty-foot equivalent unit (TEU), container volumes handled at US ports generally track gross domestic product (GDP). Growth in containerized shipments has outpaced overall freight growth in the US.

4.6.3 Panama Canal Expansion

The ongoing expansion of the Panama Canal will allow more and larger (deeper draft, wider, and of greater capacity) ships to pass through this key trade link between Asia and the US east coast. Scheduled for completion in early 2015, the Panama Canal expansion comprises the addition of a second, larger set of locks that will allow for transit “Neo Panamax” ships that have nearly three times the carrying capacity of current Panamax ships. Perhaps more importantly, the new parallel locks will significantly increase the capacity of the Canal. With high vessel demand, transit through Panama Canal currently requires an average four days of canal water time (including actual canal transit and wait time) and causes vessels to queue for up to ten days during peak shipping seasons. Vessels carrying passengers or high-value goods often pay extra to jump the queue.

With larger locks and greater capacity, the expanded Panama Canal has the potential enhance the competitiveness of the all-water route between Asia and the US gulf coast and east coast; however, there has been much debate regarding the amount of Asia-Pacific cargo that will be diverted from US and Canadian west coast ports through the Canal. Gulf coast and east coast marine ports stand to improve their share of the Asia-Pacific trade volumes if they can provide adequate navigation depth, in-port handling capacity, and fast, reliable rail and highway connections from North American production centers (for exports) to end consumer markets (for imports).

Figure 17: Container Vessels Capable of Transit through the Panama Canal



Today’s Asia-Pacific trade routes have developed over more than two decades to provide a highly-efficient gateway and corridor for containerized imports into the US from China and other north Asian countries. The Ports of Los Angeles and Long Beach are the nation’s first and second largest container ports and, together, the world’s sixth largest port complex. These Southern California ports handle about 80 percent of all container imports into the US. This includes more than ten percent of waterborne imports destined for North Carolina. Combined,

the San Pedro Bay port complex comprise 2300 acres of container terminals, including more than 30 berths and nearly 100 dock cranes capable of servicing Neo Panamax vessels, on-dock and near-dock intermodal facilities, along with dedicated rail connections such as the Alameda Corridor that offer these ports an unmatched capacity to move goods into the nation's Midwest population centers.

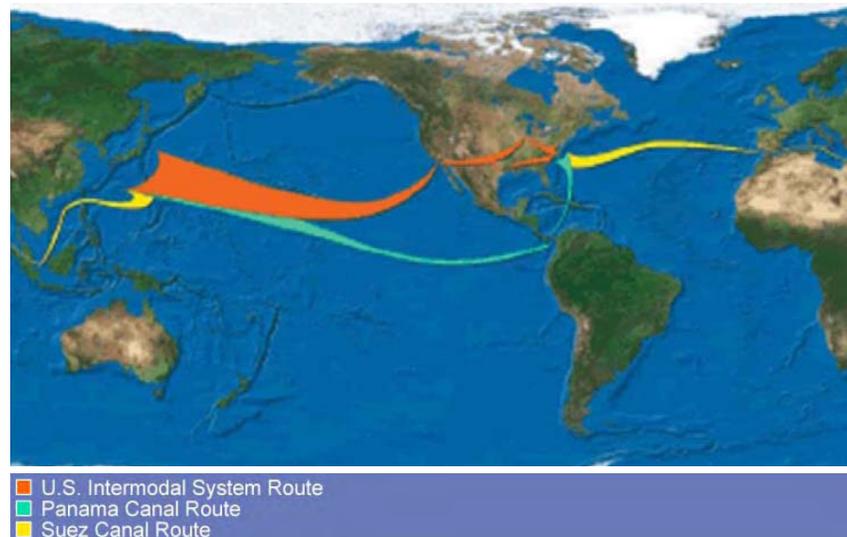
Price competition between the all-water Panama Canal route,

which is today the less expensive alternative, and traditional Asia-Pacific land-bridge route is expected to cause west coast ports and railroads to increase their efficiency and cost-effectiveness to maintain their container import volumes. The Panama Canal Authority is also expected to revise upward their tariff rates, which is based on ship capacity and load, in order to recoup their capital investment for expansion.

In consideration of the potential impacts of the Panama Canal on global shipping practices, the USACE Institute for Water Resources (IWR) conducted an analysis¹² to identify the potential impacts of the Panama Canal expansion on the economics of deep draft navigation projects in the US. The study identified factors affecting projections of volumes through Canal to the US east coast including vessel size, water transit cost, overall transit time, and potential shifting of manufacturing centers from the Far East to India. IWR concluded the size of vessels that may call on US east coast ports will depend not only on the capacity of the canal but also ocean service alternatives that include regional specialization or a hub-and-spoke network. Either of these options would likely utilize smaller vessels (as opposed to Neo Panamax) to serve local markets in the southeastern US. IWR recommended a follow-on study to assess US ports' capacity and ability to handle post-Panamax vessels, to examine the key variables driving port choice and the attraction/diversion of containers to different ports. The results of this analysis could be used to prioritize USACE investments in channel deepening and dredging. Such a study, however, has not yet been undertaken.

Notwithstanding the USACE-proposed analysis, many forecasts indicate that much of the anticipated shift of Asia traffic from west coast to east coast already occurred when ocean

Figure 18: Routes competing with the Panama Canal to the US East Coast



Source: The Panama Canal Authority,
<http://www.panacanal.com/eng/plan/documentos/propuesta/acp-expansion-proposal.pdf>

¹² IWR White Paper: The Implications of Panama Canal Expansion to US Ports and Coastal Navigation Economic Analysis (December 2008)

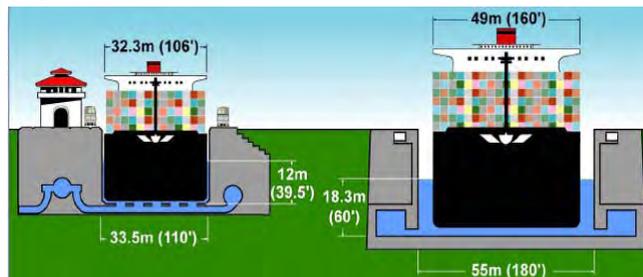
carriers sought to diversify their North American ports of call following Southern California work stoppages in 2002. The latest global forecast commissioned for the *Maritime Strategy* projects that, while there is not expected to be a paradigm shift of Asian goods entering the US via east coast ports, some adjustment of trade routes is expected (refer to Section 4.7). It is important to remember, however, that today’s trade patterns will shift to match changes in global production and demand. Anticipated economic growth in India and Brazil, for example, would deemphasize the importance of the Panama Canal in reaching US markets.

4.6.4 Global Vessel Fleet

Containerships

The trend in the container shipping industry in recent decades has been toward the use of increasingly larger vessels. This trend is driven both by economies of scale and the availability of infrastructure to these larger ships – such as Post Panamax and Neo Panamax vessels (refer to Figure 17).

Figure 19: Cross-Section of Existing (left) and New (right) Locks of the Panama Canal

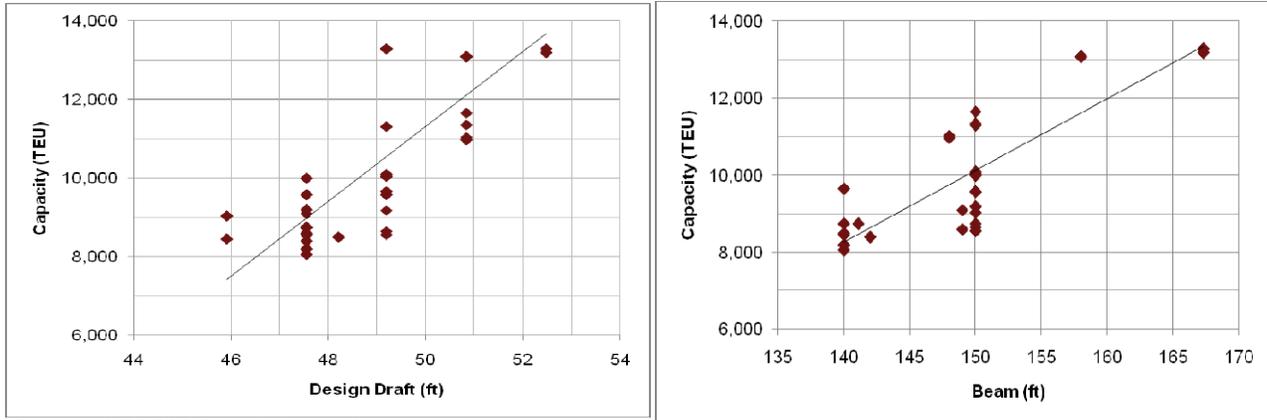


Source: Lloyds Register

It is important to note that the various “Panamax” classifications represent the draft and beam of a “typical” vessel that could navigate the canal. Some containerships manufactured with a 12,500 TEU capacity, for example, have a beam of more than 180 feet, making them incompatible with the expanded canal. The vessels of this size are expected not to call on the US east coast, but to support the Asia-Europe trade.¹³ A review by the study team of more than 100 of the largest container vessels put into service since 2007 (see Figure 20) confirms the trend toward larger vessels – and also indicates that the largest vessels built since 2007 meeting Neo Panamax limitations for draft, beam, and length (not shown), are about 10,000 TEU.

¹³ Lloyd’s Register, Containership Focus, June 2006.

Figure 20: Container Vessel Capacity, Design Draft & Beam of Post Panamax Ships Built Since 2007



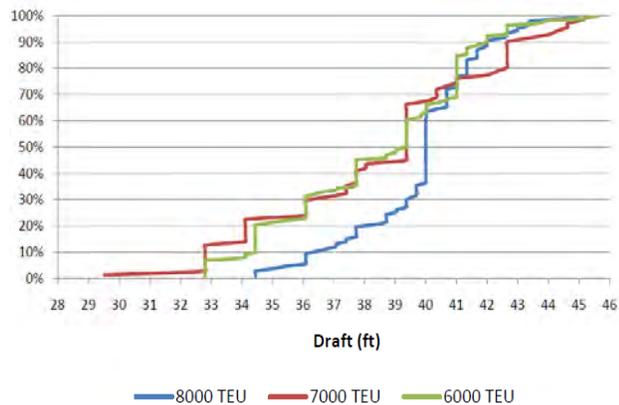
Source: AECOM, from industry data

The focus today on the Panama Canal results from the dominance of Asia in the US container trade. With a potential trade shift to India and other parts of Asia, the Suez Canal may become a more significant consideration in the size of vessels that serve the US east coast. The Suez Canal has no locks, and therefore no vessel length restrictions. Ships with a maximum draft of 68.9 feet and beam of nearly 200 feet can navigate the Suez Canal.

Looking beyond size restrictions imposed by the Canal, operational costs will drive the size of vessel serving the southeastern US. An evaluation of vessel operational costs, including fuel and crew costs as well as canal tolls, indicates that a 12,000 TEU vessel carrying about 55 percent of its total container capacity would have the same per-TEU operating costs as a Panamax 4,000 TEU Panamax vessel that is 80 percent full. Before putting these larger vessels into service, shipping lines will need to be confident that they can achieve at least this level of utilization.

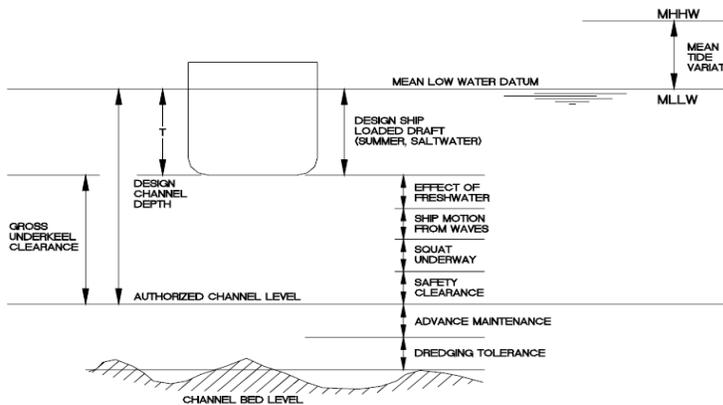
With much focus on design draft of these larger containerships, it is important to remember that vessels typically operate at 80 percent to 90 percent of their design draft, so a vessel with 45-foot design draft may draw significantly less water as loaded. Figure 21 shows, for example, that the actual draft of 90 percent of the 8,000 TEU vessels calling on the Port of Long Beach (which has no depth restriction) had an actual draft of 42 feet or less. Those same vessels would require four feet of gross underkeel clearance, or an operating channel depth of 46 feet.

Figure 21: Cumulative Probability of Actual Containership Draft



Source: Moffatt & Nichol from Port of Long Beach data on actual vessel draft

Figure 22: US Army Corps of Engineers Channel Depth Allowances



Source: USACE, Hydraulic Design of Deep-Draft Navigation Channels, Engineer Manual Figure 6-17

Channel depths are typically described by Mean Low Low Water Depth (MLLW), which establishes the minimum navigational depth at low tide. Operational depths may be greater due to tide variation, advance maintenance dredging and dredging tolerances below the authorized depth.

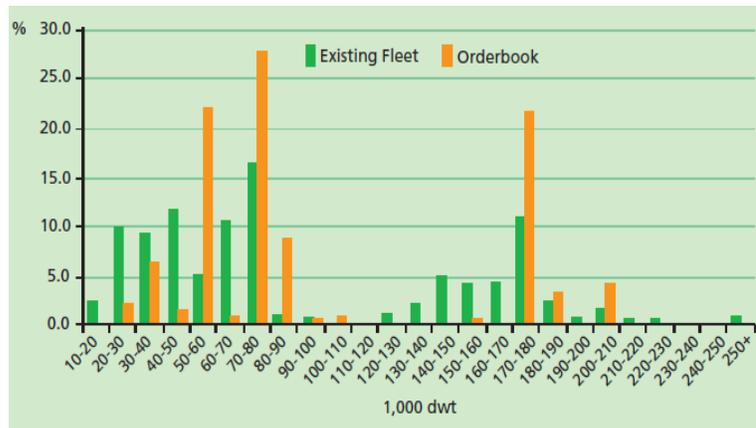
Stakeholder discussions with shipping lines serving North Carolina and surrounding states indicate that 8,000 TEU vessels will become the “workhorse” of US container trade. While these vessels have a design draft of 45 feet to 49

feet and would theoretically require an authorized channel depth of up to 53 feet, ocean carriers concur that an operational depth of 45 feet to 47 feet would meet demand for container vessels likely to call on the US east coast.¹⁴

Bulk and Breakbulk Vessels

Lloyd’s Register projects a global use of three primary vessel sizes for bulk transport: Panamax (60,000 to 80,000 dead weight tonnage [dwt] capacity), Handymax (50,000 to 60,000 dwt), and Capesize (greater than 80,000 dwt) vessels. The larger (170,000 to 180,000 dwt) Capesize vessels are generally liquid bulk or dry bulk vessels used for Asia, Australia and Europe routes. Use of Handymax bulk vessels offers flexibility to serve a variety of bulk markets. Most berths at North Carolina’s ports can accommodate the popular Panamax and smaller Handymax bulk vessels

Figure 23: Global Bulk Vessel Fleet



Source: Fairplay, as reported in Lloyd’s Register Bulk Carrier Focus, January 2005 dwt = dead weight tonnage

¹⁴ NC Maritime Strategy industry workshop with shipping lines – held August 30, 2011.

4.6.5 Distribution Centers, Foreign Trade Zones, and Inland Port Developments

Regional distribution nodes, including logistic centers and inland ports, provide facilities for intermodal transfers, transloading, and warehousing for waterborne goods. At present, the vast majority of maritime-transported goods going through North Carolina logistics facilities moves in or out of seaports of other states, most notably Norfolk VA, Savannah GA, and Charleston SC. Reasons cited for why North Carolina ports are not used to a greater extent include insufficient channel depth for serving larger oceangoing vessels, as well as inland congestion choke points, including in the areas of Charlotte and Greensboro. Thus, in the near term, inland port facilities in North Carolina are likely to largely handle significant cargo volumes that move through seaports of other states; however, growing volumes at North Carolina inland ports could bring about a critical mass that spurs justification of channel deepening and other infrastructure enhancements at North Carolina seaports. Combining inland port development with state export and import tax credits could enhance utilization of both the inland ports and the seaports of North Carolina.

One of the driving purposes of an inland port is to accommodate numerous functions of shipping that do not have to take place at or in close proximity to the water's edge. In addition to consolidation of cargos, inland ports may include warehousing, cross-docking (unloading goods from incoming truck or rail units and loading them directly into outbound units with little or no storage in between), light manufacturing, truck and rail servicing, and storage of chassis and containers. With the US chassis provisioning model changing, as ocean carriers get out of this aspect, involvement in furnishing chassis may also be considered.

The aggregation of transportation assets and logistics services at a single location has the potential to reduce cost-to-market for manufacturers and shippers with similar transport needs. Benefits of logistics infrastructure – from road connections and airport access to industrial zoning and foreign trade zones (FTZ) – must be brought to full awareness of potential users. Availability of value-added services (warehousing, distribution, handling, repackaging and consolidation) may also be seen as essential. Some of the most successful inland ports in other states, such as the Virginia Inland Port at Front Royal VA, serve as US Customs-designated ports of entry and offer a full range of customs functions to customers.

Today, North Carolina's inland logistics centers, and the value-added services available there, are generally underutilized.¹⁵ Discussions with logistics providers indicate that the benefits of North Carolina's six existing FTZs are not well-publicized. They suggest that successful strategies for distribution and logistics centers, including foreign trade zones, should include a coordinated marketing effort with the North Carolina Department of Commerce. Engagement of MPOs, local economic development commissions, and logistics providers is important to identify and target the needs of potential users. In some locations, distribution center infrastructure (for example, local road connections and industrial zoning) is already in place but has not been strongly marketed as part of a larger freight transportation strategy.

¹⁵ NC Maritime Strategy "special zones" industry workshop – held October 5, 2011.

4.6.6 US Military Activities

The military provides both national defense and response to domestic natural disasters; both types of missions rely heavily on national surface transportation infrastructure to fulfill those support requirements. The selection of ports used for military moves, deployments and redeployments is made by the US Transportation Command (TRANSCOM), which typically defaults to the least expensive alternative as long as required timelines can be met.

Following Operation Enduring Freedom (OEF) MARAD undertook an assessment of lessons learned¹⁶ that identified the need for domestic port infrastructure and capabilities to be tested and exercised for readiness to support major military moves. In particular, port-rail capacity and lack of sufficient staging area were cited as concerns at some US ports.

Military stakeholders have also reported¹⁷ that the military has transitioned from relying on its own capabilities to deploy and sustain missions to greater reliance on commercial providers of transportation, logistics and maintenance support where possible. Per its “commercial first policy,” the US Military maintains Voluntary Intermodal Sealift Agreements (VISA) with various ocean carriers to move containerized military cargo that can be mixed with commercial containers. More than 95 percent of the equipment and cargo shipped to support Operation Desert Shield (ODS) moved on commercial carriers¹⁸.

With anticipated reductions in the military budget, there is increasing pressure to find lowest-cost solutions to military logistics needs. The military’s current policy of downsizing while at the same time maintaining its ability to be a rapid and precision response force, will require the US based forces to be able to move swiftly and efficiently without impediment.

4.6.7 Trade Agreements

During the period from January 1, 2001 to October 1, 2011, North Carolina has led the nation in the number of employees negatively affected by foreign trade—because production has shifted overseas or industries were negatively affected by import competition. The ranking is all the more remarkable because the ranking is in terms of absolute numbers (not a share) and North Carolina is leading much larger states such as California, Texas, Florida and New York for example.

¹⁶ Quoted from “Military Deployment Support: Evaluation of the System’s Ability to Support Future Military Deployment Needs,” technical paper prepared for the National Surface Transportation Policy and Revenue Study Commission. US Maritime Administration, Operation Enduring Freedom Lessons Learned Report (September 2003), p.3.

¹⁷ NC Maritime Strategy military workshop – held October 6, 2011.

¹⁸ TRB Millennium Study: “US Military Transportation,” Sarah Brown, Henry M. Bennett, and Robert B. Honea (Washington, D.C.: 2000), referenced in “Military Deployment Support: Evaluation of the System’s Ability to Support Future Military Deployment Needs,” technical paper prepared for the National Surface Transportation Policy and Revenue Study Commission.

Table 12: Estimated Number of Workers Affected Under Certified Trade Adjustment Act, by State (January 1, 2001 through October 1, 2011)

State	Number of workers covered under TAA certifications	Ranking	State	Number of workers covered under TAA certifications	Ranking
Alabama	50,920	14	Minnesota	31,557	22
Alaska	3,960	44	Mississippi	25,745	24
Arizona	20,417	26	Missouri	36,340	19
Arkansas	33,359	21	Montana	3,049	46
California	109,429	3	Nebraska	6,558	41
Colorado	14,202	32	Nevada	1,746	47
Connecticut	17,226	29	New Hampshire	8,725	37
Delaware	3,089	45	New Jersey	29,179	23
DC	56	51	New Mexico	7,564	39
Florida	20,156	27	New York	64,647	10
Georgia	51,841	13	North Carolina	141,579	1
Hawaii	566	49	North Dakota	1,362	48
Idaho	8,985	36	Ohio	108,746	4
Illinois	74,423	7	Oklahoma	21,142	25
Indiana	68,948	9	Oregon	40,504	17
Iowa	15,783	30	Pennsylvania	108,273	5
Kansas	17,280	28	Rhode Island	7,246	40
Kentucky	37,850	18	South Carolina	52,060	12
Louisiana	10,189	35	South Dakota	4,221	43
Maine	14,868	31	Tennessee	73,072	8
Maryland	11,401	33	Texas	83,016	6
Massachusetts	35,630	20	Utah	8,139	38
Michigan	132,862	2	Vermont	4,589	42
			Wyoming	Not Reported	50

Source: US Department of Labor, TAA Program Statistics, October 2011

Table 12 above reports the number of employees whose jobs were affected by foreign trade, by state, based under certified petitions recorded by the US Department of Labor's Trade Adjustment and Assistance (TAA) Program.

The potential impact on North Carolina's economy is not entirely one-sided and negative, however. Not all trade agreements are harmful for North Carolina's economy. North Carolina's leading rank in number of employees affected by foreign trade to date reflects the state's past reliance on manufacturing—particularly textiles and furniture—industries that were particularly affected by major trade agreements of the past because of the types of economies with which we signed the agreement.

In contrast to the state’s losses under NAFTA and CAFTA, North Carolina’s agricultural interests supported the recently-passed (2011) trade agreement with South Korea because North Carolina is expected to be a net beneficiary of the agreements. For example, the US Agricultural Research Service reports that under KORUS, the South Korean agreement, cotton and soybeans will now enter Korea duty-free. Tariffs on chicken and pork will decline in coming years, making key North Carolina commodities more competitive.

4.6.8 Auto Expansion

To date, none of the major auto plant relocations to the Southeast has selected North Carolina for its main assembly location. In addition, the physical location of these plants in neighboring states has not been conducive to the state’s ability to capture a portion of the supplier industry. Auto industry suppliers typically locate within a short radius (two hours) of the main plant in order to supply components reliably and on short turnaround times.

By contrast, the state is having much more success in attracting the aviation industry, with a steadily growing cluster of aviation suppliers moving to or expanding in the state. Manufacturers of construction, mining, and agricultural equipment are also a strong presence in North Carolina.

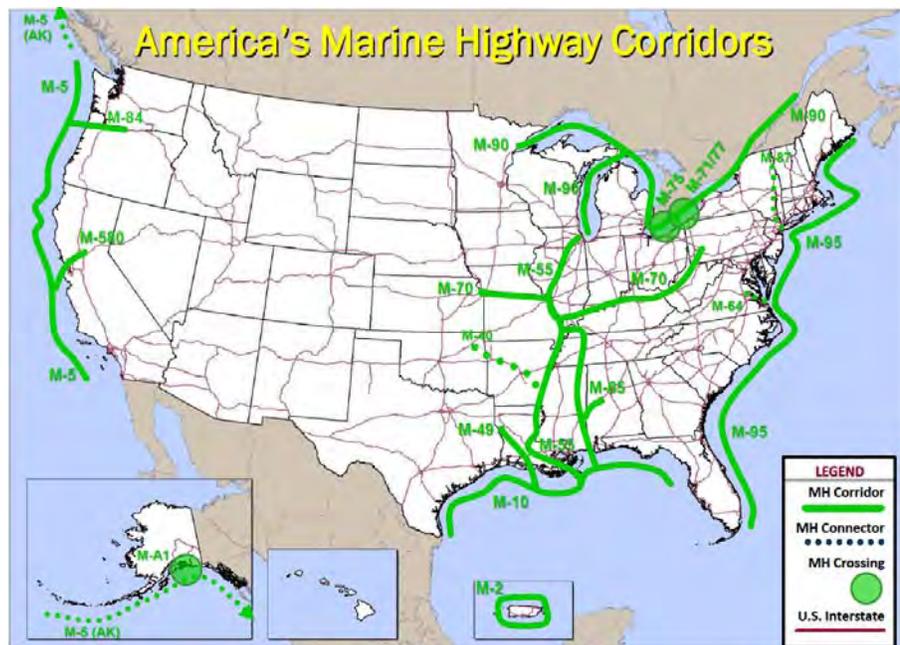
4.6.9 Short Sea Shipping and America’s Marine Highway Program

The concept of short-sea shipping has been implemented for centuries in Europe and other parts of the world as a means for efficient, cost-effective movement of goods along coastal and inland water routes – a means that today is of added benefit in that it typically is a “greener” way of goods movement.

Initially, this concept was formally introduced in the United States under the name of the Short-Sea Shipping Initiative of the USDOT Maritime Administration (MARAD). In the middle of the past decade, a push was made for a name that might not only avoid the tongue-twisting nature of the “short-sea shipping” moniker but that would also reflect the fact that much of this initiative is directed toward use of inland water routes that never touch the “sea.”

USDOT has now identified 18 marine corridors, eight projects and six initiatives for further development as part of “America’s Marine Highway Program” or

Figure 24: Map of Short Sea Shipping Routes in the United States



Source: www.marad.dot.gov/ships_shipping_landing_page/mhi_home/mhi_home.htm

AMH.¹⁹ According to USDOT, the identified AMH corridors are seen as offering routings that can serve as extensions of the surface transportation system, offering potential relief to landside corridors that suffer from traffic congestion, excessive air emissions or other environmental concerns and other challenges.

One of the identified Marine Highway corridors directly relates to North Carolina, that being the M-95 Corridor, which essentially designates an Atlantic coastal route generally paralleling heavily-traveled I-95 from Florida to Maine. The East Coast Marine Highway Initiative Study of the M-95 Corridor seeks to further advance the AMH Program by identifying corridor-specific Marine Highway markets, developing tailored business plans and optimal operational models for those markets along and related to the M-95 Corridor. In support of the development of the M-95 Corridor, a final report on the East Coast Marine Highway Initiative is scheduled for delivery in March 2012.

In addition to its corridor-specific studies, MARAD has supported an assessment of the types of vessels suitable for AMH trade, finding them generally not unique, but similar to ships already in service. Identifying eleven different designs that would adequately address the spectrum of vessel types envisioned, including configurations suitable for existing North Carolina navigation conditions. The designs range in size, type and speed, from Articulated Tug Barge (ATB) roll-on /roll-off (Ro/Ro) vessels to conventional Ro/Ro-type trailer ships, combination Ro/Ro and container carriers, and special high-speed vessels.²⁰

One of the identified potential impediments to advancement of AMH activity is the Jones Act – 46 USC § 55102 – which from 1920 has required all domestic short-sea shipping be conducted on US-built ships owned by US citizens and crewed by US citizens and/or permanent residents. These factors raise the cost of AMH transport to substantially more than would be the case were foreign-built, foreign-flagged, foreign-staffed vessels permitted to be used. Exceptions to this cabotage law are rarely granted. An additional cost-related concern is the federal Harbor Maintenance Tax, or HMT, as created under the Water Resources Development Act of 1986, or WRDA, and as reauthorized under the Water Resources Development Act of 2007. The HMT, while not assessed on truck or rail moves, is assessed upon shippers for cargo moving by vessel between US ports.

It is important to note that short-sea shipping opportunities typically can be cost-competitive with trucking only if the beginning and ending points are 400 miles or more apart. Thus, for example, a route between North Carolina and Virginia is unlikely to prove to be cost-competitive. Some AMH routes being explored have included across the Gulf of Mexico between Brownsville TX and Port Manatee FL where the water route is significantly shorter than routings by land; along the M-95 Corridor between New Bedford MA and Port Canaveral FL, and even a longer route along M-95 and across the Gulf of Mexico between New York/New Jersey and Galveston TX. Short-sea shipping remains significantly underused as a cost-effective alternative for goods movement.

¹⁹ The America's Marine Highway Program was fully implemented in April 2010 through publication of a Final Rule in the Federal Register, which may be found online at <http://edocket.access.gpo.gov/2010/pdf/2010-7899.pdf>.

²⁰ *US Department of Transportation, Maritime Administration in Consultation with the Environmental Protection Agency, America's Marine Highway – Report to Congress, April 2011*

The current industry trend toward deployment of larger vessels along the busiest global trade routes may work to the benefit of expansion of successful short-sea shipping services, as some shippers already are finding themselves squeezed out of major ports due to this focus upon mega-containerships. Also, this emerging deployment pattern is likely to increase the hub-and-spoke concept for maritime shipment, opening the door for greater implementation of feeder services. There are expected to be niche opportunities for ports that find a market in serving smaller and/or specialized shippers.

4.6.10 Port Partnerships

Ports in the southeastern US are best characterized as competitors in the current environment. Looking ahead, a number of factors provide incentives to ports to consider forming alliances and partnerships with other public sector agencies to a greater degree than in the past. These include:

- Tight government budgets—a large federal budget deficit and the expectation of reduced federal spending (including for dredging) and similarly tight budgets at the state and local level limiting resources for investment
- Reduced reliance on federal earmarks and greater emphasis on transparent project justification and identification of projects of regional or national significance
- Identified infrastructure needs (across all modes) that far exceed available resources—transportation program managers are seeking creative ways to do more with less and to demonstrate that new investments are not in redundant facilities
- In prioritizing federal investments, greater federal emphasis on interjurisdictional and regional collaboration as a selection criterion in making investments in state and local economies
- Greater recognition that partnership opportunities can reduce risk relative to a single-owner approach to providing infrastructure

Successful partnerships among public facilities can take a variety of forms, as participants identify opportunities to complement their core competencies. There is no single model for a public partnership. Examples include:

Port MetroVancouver and the Ports of Seattle and Tacoma are collaborating on a clean air strategy. This includes developing common goals for ships, cargo-handling equipment, rail, trucks, harbor craft and port administration through cooperative relationships with customers, tenants, and regulatory agencies. The partnership advances a common regional goal that could not be attained by one port acting alone.

The Port Authority of New York and New Jersey (PANYNJ) is the product of agreement between two neighboring states to jointly pursue their common interests in the Hudson River, thereby establishing the nation's first bi-state agency in 1921. The Port Compact and subsequent supporting legislation define the activities and projects to be undertaken by PANYNJ. Today, the authority's focus has expanded beyond seaport activities to include passenger rail transit operations between the two states. PANYNJ operates under the direction of a twelve-member board that reports to both state governors.

Port of Houston Authority and the Port of Galveston signed a memorandum of understanding (MOU) to explore opportunities for the development and use of property on Pelican Island as a

future container-handling facility to maximize gulf coast opportunities arising from the Panama Canal expansion. The partnership develops additional capacity and shares the risk of that development.

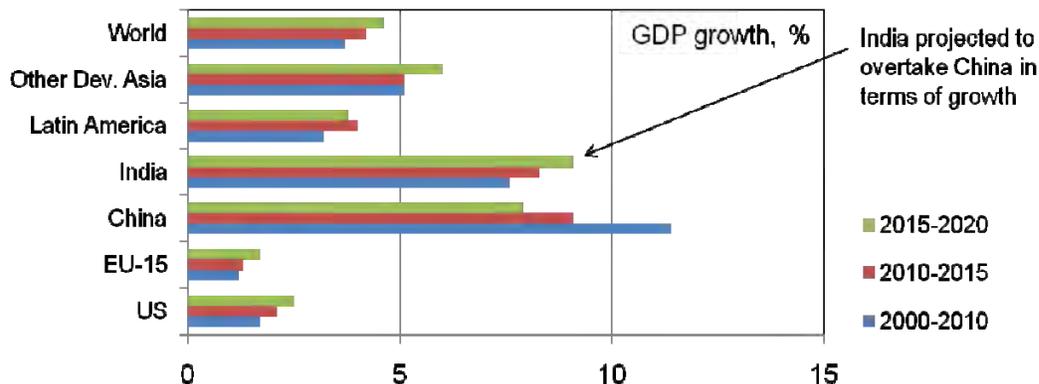
The Ports of Charleston and Savannah are in discussions to develop a new facility in Jasper County SC. Still in the early stages with the partnership still being framed, the new facility would develop additional capacity and share the risk of that development. The future of the agreement and planned port development, however, has been put into question by disagreements and threatened law suits between the two states.

Port Everglades is partnering with Florida East Coast Railway's (FEC) strategy to grow its intermodal business in the coming years. The project is a \$72.8 million objective to build an intermodal container transfer facility (ICTF) at Port Everglades in Fort Lauderdale. Concurrently, the Port of Miami has a \$50 million plan to restore freight-rail service to the Port of Miami — where intermodal service between the port and FEC's Hialeah Yard has been suspended since Hurricane Wilma damaged a connecting rail bridge in 2005.

4.7 Market Growth

Economic projections indicate that the pace of economic expansion and associated demand for goods among North Carolina's key trade partners will strongly outpace the expansion of the domestic economy in coming decades. The ability to connect with these foreign economies and capitalize on this market potential through the exchange of resources, goods and products represents an important economic development opportunity.

Figure 25: Growth in Global Economy Anticipated to Outpace US Growth



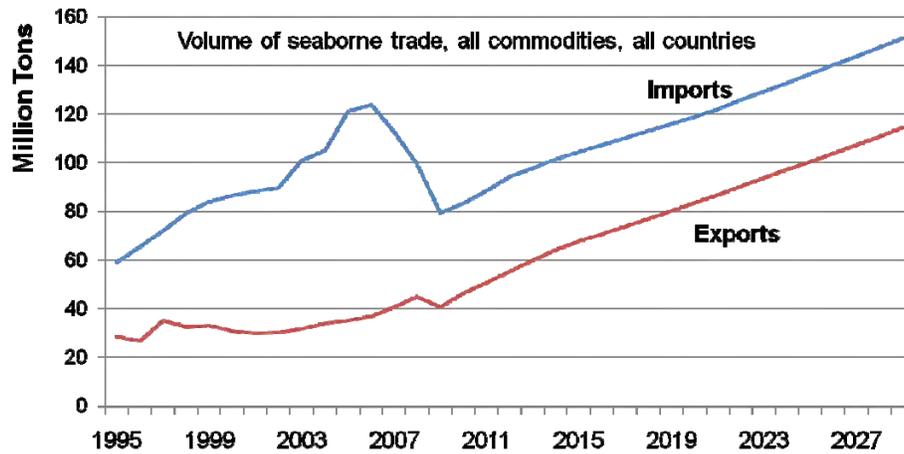
Source: Conference Board Global Economic Outlook, March 2011
Other developing countries in Asia comprise all Asian countries except China and India. EU-15 includes the fifteen nations that are members of the European Union.

Baseline projections of imports and exports by commodity were obtained from IHS Global Insight for the South Atlantic region. The firm is a nationally-recognized forecasting firm with both domestic and international economic capabilities. The projections are trend forecasts, meaning that they do not project a business cycle, but rather project long-term trends based on expectations for US and Southeast regional industrial and population growth, as well as global growth trends. The projections are for waterborne trade only and cover 77 commodities and 54 regions.

Early regional market forecasts (pre-recession) had projected global growth at CAGR of five to six percent (Savannah economic study, 2004). These rates have now been tempered.

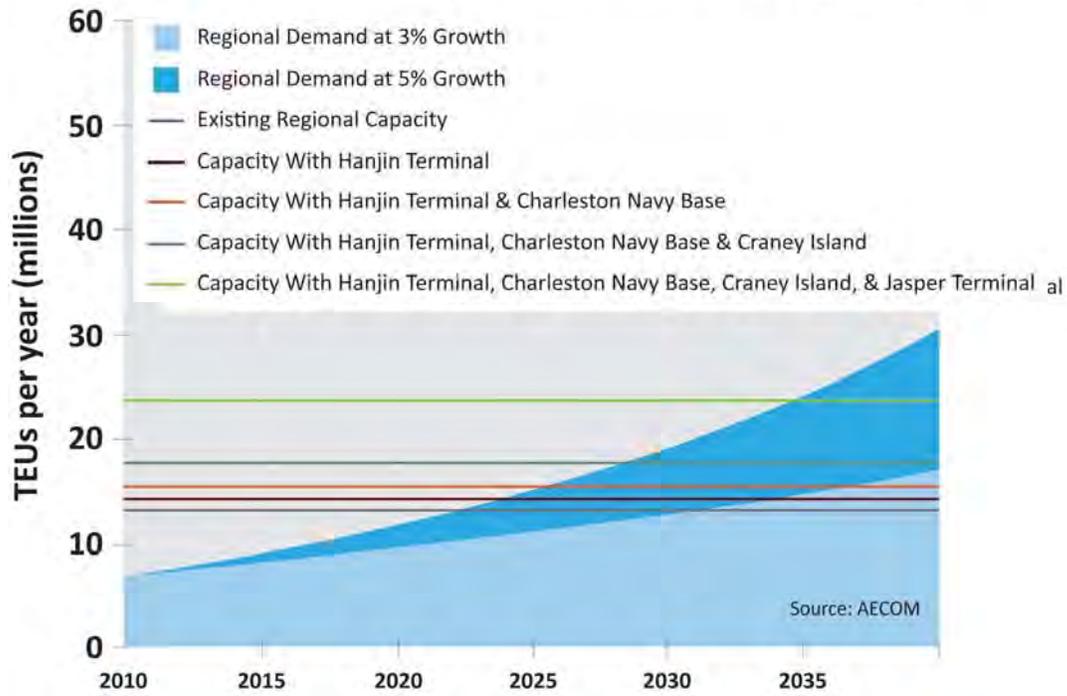
When evaluated by commodity type – containerized, bulk, breakbulk, and Ro/Ro – the forecasted demand for waterborne imports and exports in the southeastern US identifies stronger growth for some commodities than others. Figure 27 compares projected regional demand to available port capacity in North Carolina, Virginia, South Carolina, Georgia, and Jacksonville FL.

Figure 26: Forecasted Growth for Imports and Exports in Southeastern US

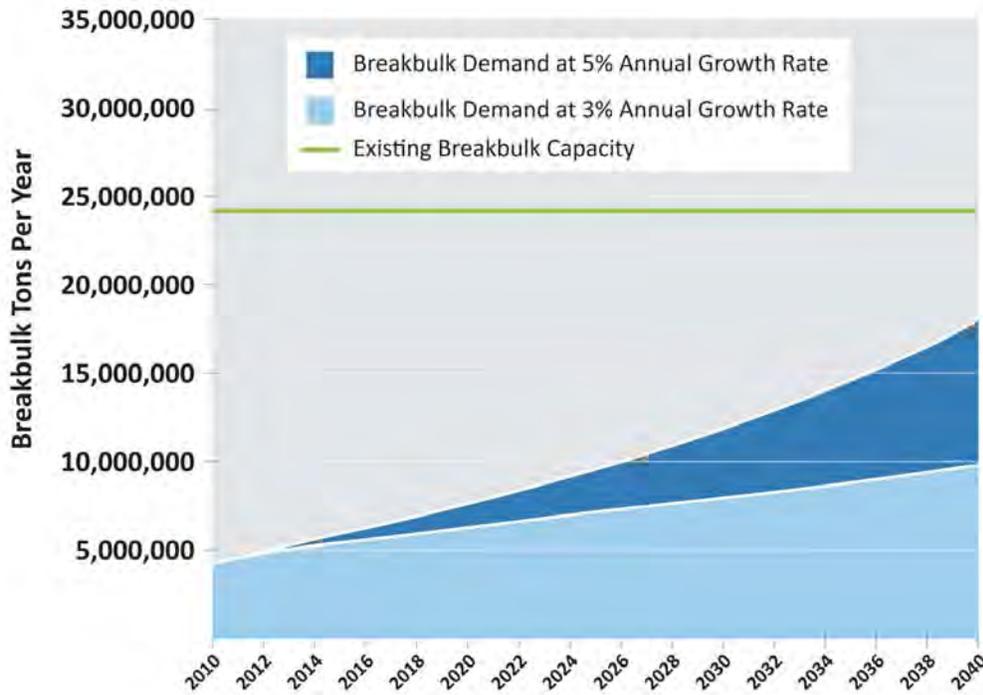


Source: IHS Global Insight, 2011 Forecast

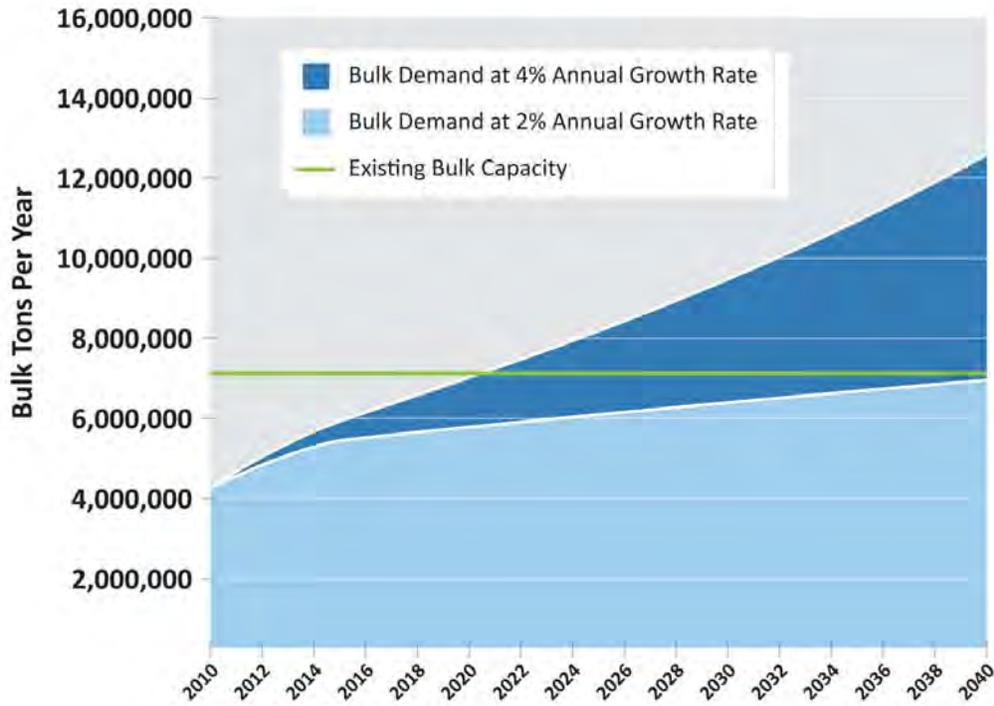
Figure 27: Projected Southeastern US Demand vs. Capacity for Various Types of Goods
Containerized goods



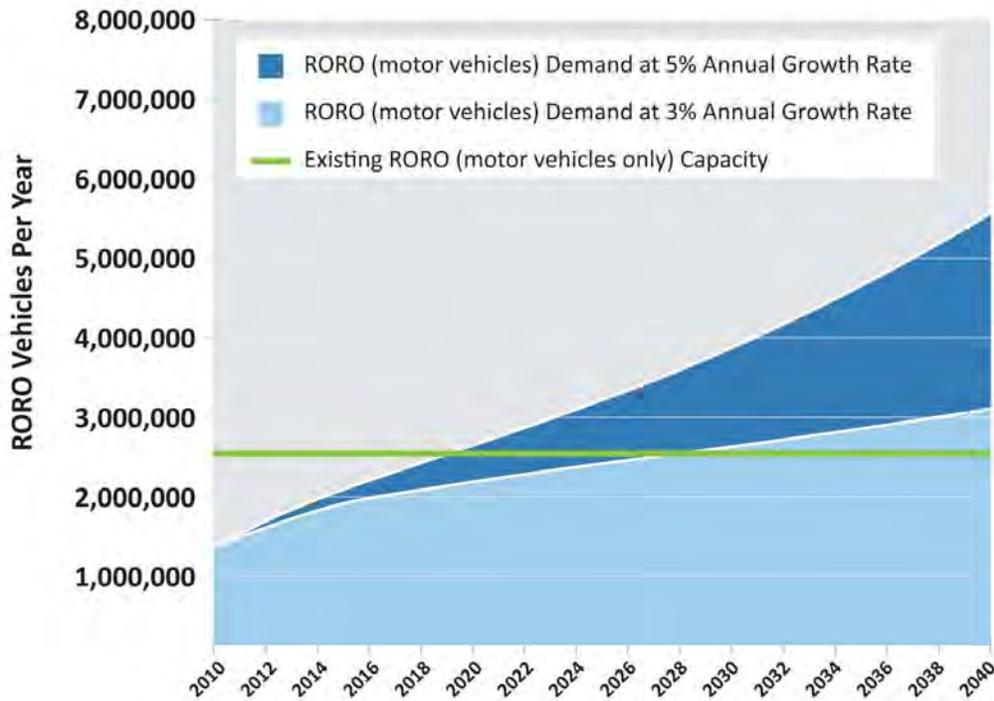
Breakbulk cargo



Bulk cargo



Ro/Ro (vehicles)



Source: AECOM, from PIERS and IHS Global Insight 2011 Forecast
 Bulk cargos exclude coal and petroleum

4.7.1 Containerized Goods

Regional demand for import and export of containerized goods is projected to grow at an annual rate of three percent to five percent through 2040. This growth rate is slightly higher than projected regional GDP growth, which may be attributable to some diversion of containers from west coast ports to be delivered directly to the region's ports via the all-water route through the expanded Panama Canal.

Available container capacity at southeastern US ports is also expected to grow during this period. The Port of Charleston is currently developing the Navy Base container terminal, which will add nearly 1.2 million TEU²¹ to the region's annual capacity. JAXPORT's Hanjin terminal, with an annual capacity of 80,000 TEU²², is scheduled to open in 2016. Other large container terminal projects are in the planning stages. Virginia Port Authority has developed concept designs for its proposed Craney Island terminal, which would add 2.1 million TEU²³ annual capacity to Virginia ports. This project is expected to be advanced only as the APMT container facility, which is now operating at about 50 percent, nears its capacity. The other major project in conceptual planning is the Jasper Ocean Terminal, a joint effort between the SCPA and the GPA. Planning for the Jasper Terminal has been stop-and-start effort; most recently, SCPA voted in December 2011 to suspend its funding for the project, citing that the Jasper Terminal was no longer a feasible alternative to accommodate Post Panamax containerships.²⁴ This decision could well be reversed in the future.

Without the Jasper project, the region's existing and planned container ports are projected to reach capacity sometime between 2028 and 2040, as bracketed by the low and high growth forecasts illustrated in Figure 27. In lieu of immediate additional terminal development, some steps could be taken to increase throughput in this time period. Implementation of demurrage charges—an extra fee for containers stored on the terminal beyond an established time limit, as is charged at many west coast ports—and increased use of intermodal rail to move quickly containers off the port could increase effective capacity by 15 percent to 20 percent.

4.7.2 Bulk Cargo

Growth forecast for regional bulk commodities is between two percent and four percent, excluding coal and petroleum products. Across all bulk cargos, existing regional capacity is estimated to be about seven million tons.²⁵ Under a pessimistic or low growth, existing bulk facilities within the four peer ports could theoretically handle forecasted bulk volumes through 2040, while a more optimistic overall market demand for bulk products require additional capacity to handle regional demand as soon as 2020.

²¹ AECOM's industry standard BERTHA and PRECAP models were used to independently estimate the berth and backland capacity of each proposed terminal.

²² From AECOM BERTHA and PRECAP analysis

²³ From AECOM BERTHA and PRECAP analysis

²⁴ "Ports Authority Suspends Jasper Funding," Charleston Regional Business Journal, Matt Tomsic (December 20, 2011).

²⁵ From AECOM BERTHA and PRECAP analysis

Because bulk facilities are often dedicated to a single commodity type, the imbalance between demand and capacity may be more distinct or severe for specific commodities. Bulk products are also expensive to transport on land over large distances, so ports further from production or extraction sites may not be economically feasible alternatives. Such a mismatch in location or capability and specific shipper needs would be consistent with the perception of North Carolina's agricultural shippers that there is a shortage of regional bulk export terminals to handle their products.²⁶

4.7.3 Breakbulk Cargo

As a generalized commodity type, breakbulk products can be handled across numerous facilities, so estimated overall capacity within the region is high – estimated at nearly 25 million annual tons²⁷ across the regional ports examined. Terminals, equipment, and storage facilities can be readily adapted to handle a variety of goods that do not require special handling or storage. Where specialized equipment or storage facilities are required, however, the demand-to-capacity ratio may be quite different. North Carolina producers of heavy and oversize cargo have identified a need for terminals that can move this cargo.²⁸ Heavy or oversize goods are also expensive to transport on land over large distances, so ports further from manufacturing sites may not be economically feasible alternatives. Warehouse and storage facilities for commodities that require temperature or climate control was also identified as a local need.

4.7.4 Ro/Ro Cargo

The Ro/Ro commodity for which there is the best information is autos. For the purpose of this evaluating available Ro/Ro capacity, the study team used auto Ro/Ro to be representative of the total Ro/Ro market. Because autos are the largest user of Ro/Ro capacity, they are a fairly good proxy for the Ro-Ro market overall. Areas currently used for auto storage could readily be converted to accommodate other roll-on/roll-off commodities.

Total estimated Ro/Ro capacity at regional ports is estimated to be about 2.6 million units per year.²⁹ In the low-growth or pessimistic scenario at three percent average annual growth, this capacity will be exceeded before 2027. For a more optimistic five percent annual growth rate, regional Ro/Ro demand will outstrip capacity by 2019.

The requirements of heavy or oversize Ro/Ro cargo are not reflected in this analysis. This specialized segment of the Ro/Ro market would have more limited available capacity across North Carolina and its peer ports. Heavy or oversize goods are also expensive to transport on land over large distances, so ports further from manufacturing or distribution sites may not be economically feasible alternatives.

²⁶ NC Maritime Strategy agricultural shippers workshop, held August 16, 2011.

²⁷ From AECOM BERTHA and PRECAP analysis

²⁸ NC Maritime bulk and breakbulk shippers workshop, held October 21, 2011.

²⁹ From AECOM BERTHA and PRECAP analysis

5 ALTERNATIVE NORTH CAROLINA MARITIME MARKET POSITIONS

5.1 Opportunities and Outlook for North Carolina Maritime Trade

In an increasingly global and interlinked economy, ports (air and sea) are gateways to the rest of the world. Although communication technology has made employees in many industries footloose, able to work nearly any location, technology has yet to untether goods from the need for efficient access to sea ports, nor the economy's reliance on these commodities. Moreover, in a highly mobile global economy, sensitivity to cost is heightened.

Firms regularly assess their location as part of paring production costs and remaining competitive. Efficient port access for all types of goods—consumer goods as well as commodities—remains an essential element of an integrated logistics strategy. The southeast region of the US is expected to remain attractive to migrants in coming decades and driving population growth rates above the national average. Freight trends will follow. Recent data from the US Bureau of Transportation Statistics reports that shippers are routing more cargo through US South Atlantic and Gulf Coasts in order to more readily access these growing consumer markets³⁰.

Investments in North Carolina port facilities and associated landside infrastructure have the potential to support and strengthen the state's maritime trade by reducing import and export costs of North Carolina-based shippers. The potential to retain North Carolina freight that is currently exported through out-of-state ports is an important factor necessary to determine the potential for greater capture of the state's trade flows and the associated reduction in shipping costs, and ultimate realization of a maritime freight-focused economic development strategy.

For the State of North Carolina, the potential benefits of maritime trade include expanded markets for North Carolina-based producers via exports, which support local jobs and a diverse state economy, and increased quality and choices available for consumers and business via imports, which support local competitiveness and quality of life.

In addition to the value of the exports and imports to North Carolina's economy, the presence of the port facilities attract a variety of value-added services that support employment in industries such as trucking, rail, distribution, marine maintenance and repair services, and services to facilitate the trade transaction. The port activity also attracts industries that utilize heavy imported goods and bulk items such as manufacturing firms that employ the chemicals and forest products imported through the marine terminals in their production process, manufacturers assembling products from parts included in containerized cargo, and firms producing and consuming dry and liquid bulk cargo.

³⁰ Chambers, Matthew. December 2011. "The Changing Tide of U.S.-International Container Trade: Differences Among the U.S. Atlantic, Gulf, and Pacific Coasts," BTS Special Report. SR-032.

5.1.1 Building upon North Carolina's Existing Industrial Strengths

North Carolina's competitive industries are a barometer of the state's resource and technical advantages; these are industries that sources of particular strength for the state's economy and future job creation. One consideration in framing the *Maritime Strategy* is ensuring that port investments support the needs of its most competitive port-using industries. Shift share analysis is applied to identify the state's competitive industries, defined as those that outperform the national average performance for that industry.

Through evaluation of the state's overall industry mix, the national share held by various North Carolina industries (location quotient), and the regional shift of this industry share to or from the state between 2001 and 2009, North Carolina has outperformed the rest of the nation in the following industries:

- Forestry and logging
- Agriculture and forestry support activities
- Primary metal manufacturing
- Food manufacturing
- Paper manufacturing
- Chemical manufacturing
- Plastics and rubbery products manufacturing

Also of interest is wood product manufacturing, which has a high location quotient and has suffered only a small negative regional shift out of North Carolina over the last decade. Additionally, transportation equipment manufacturing and motor vehicle parts manufacturing have positive shift effects though small location quotients. This indicates some competitiveness, but they have not yet gained a foothold in the state's economy.

5.1.2 Taking Advantage of North Carolina's Cost Structure

An important element in identifying industries that might flourish or falter in North Carolina is the cost structure of the state relative to competing regions. Investments in maritime infrastructure will improve access between the state's producers and the global economy, but if the state has a high cost of doing business, businesses will still select other locations and the port investment will not foster the desired economic development. The table below provides a summary of North Carolina's business costs relative to other states in the region, as developed by Moody's Analytics, a nationally-known economics firm. The total business cost is a comprised of three components: unit labor costs, energy costs, and tax burden. Unit labor costs are a measure of labor compensation per dollar of output—wage costs adjusted for productivity. This is an important adjustment as firms are willing to pay higher costs for more productive labor, all else held equal. The energy cost component compares the average commercial and industrial electricity cost to the national average. Tax burden is measured as the total tax revenue as a percent of total income, indexed to the national effective tax rate. An index value of 100 means that the cost is equal to the US average cost. An index value of 105 by comparison means that the state's cost is five percent greater than the US average. An index value of 92 means the

state’s cost is eight percent lower than the US average; that is, a producer in that state saves eight cents for every dollar of production cost relative to other producers in the nation³¹.

As the table below shows, North Carolina has very favorable business costs. It ranks 50 out of 51 (50 states plus the District of Columbia) in terms of overall business costs. Only South Dakota has lower overall business costs. Of particular note, North Carolina has a 10 percentage point cost advantage relative to its coastal peers of Virginia, South Carolina, Georgia and Florida, and a five percent advantage on Tennessee. Looking at the individual components, both labor and energy costs are low relative to North Carolina’s neighbors—these are particularly important costs for manufacturers of capital goods and agricultural processors who are likely port users. What this means for the *Maritime Strategy* is that the cost structure of the state’s landside economy is not an impediment to attracting the economic development that would benefit from candidate port investments.

Table 13: North Carolina’s Business Costs Relative to Nearby States

State	Cost of Doing Business		Unit Labor Cost		Energy Cost		Tax Burden	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank
NC	84	50	83	49	81	34	94	30
VA	97	26	101	17	86	28	85	42
SC	95	28	100	22	86	29	80	47
GA	98	20	101	16	89	27	92	33
TN	89	41	89	46	96	20	78	48
FL	102	13	102	13	116	15	94	27

Source: Moody’s Analytics 2011 Cost of Doing Business Review. Updated April 2011 using the most recent available data as of December 2010. Rankings are out of 51 (50 states plus the District of Columbia). A rank of 51 indicates a location has the lowest cost; a rank of 1 indicates a location has the highest cost.

5.1.3 Industries with Regional Growth Potential

Market opportunities were also identified by considering the projected growth in the overall regional market—driven by a fast-growing urban concentration in the Piedmont-Atlanta Megaregion, rising demand in China and other developing countries for US goods, and changes in shipping patterns.

Although building on North Carolina’s existing strengths is important, it is also necessary to assess what industries represent growing export markets for the region that might find North Carolina attractive and represent diversification or entirely new industries for the state. In this analysis, market opportunities are identified by both the projected volume of the trade flow from the Southeast region and its growth rate based on projections by IHS Global Insight, a nationally recognized provider of freight data. Data are identified by commodity and destination country;

³¹ The full methodological description of the Cost of Doing Business Index is provided in “2011 Cost of Doing Business Review,” Moody’s Analytics, updated annually, last updated April 2011 using the most recent available data as of December 2010. The index has been continuously published for 16 years and is used in Forbes’ annual Best States for Business report, as well as numerous other studies.

they are not identified by container/bulk/breakbulk. The data analysis is supplemented with information coming in from the stakeholder interviews conducted as part of the *Maritime Strategy* study.

Exports

Chemicals, metal products, rubber, machinery parts, wood products and food are among the major commodities for the North Carolina State Ports Authority (NCSPA). Several of NCSPA's current key markets are projected to post strong growth over the next two decades. These are summarized below. Although aircraft is not a large flow, it is included as it is high-valued and a growing industry for North Carolina mentioned specifically in interviews with shippers.

Table 14: Leading Export Prospects from the Southeastern US

	2009	2020	2029	2009 to 2020	2020 to 2029
Total Commodities	40,591,676	83,750,543	114,585,964	106%	37%
Pulp	3,655,484	6,568,343	8,326,847	80%	27%
Paper & Paperboard Products	2,988,494	6,388,683	8,893,315	114%	39%
Cork & Wood	1,692,771	3,872,959	5,077,685	186%	28%
Waste Paper	15,499,483	3,444,864	5,896,618	70%	10%
Meat, Frozen	1,357,983	2,465,851	3,361,668	126%	52%
Animal Feed	1,295,194	1,776,941	1,997,645	129%	31%
Textiles	782,343	1,627,146	2,279,017	122%	71%
Cotton	549,994	829,780	1,030,553	155%	58%
Special Industrial Machinery	277,329	678,746	997,878	82%	36%
Aircraft	5,901	12,576	19,001	113%	51%

Source: IHS Global, August 2011 South Atlantic waterborne trade forecast

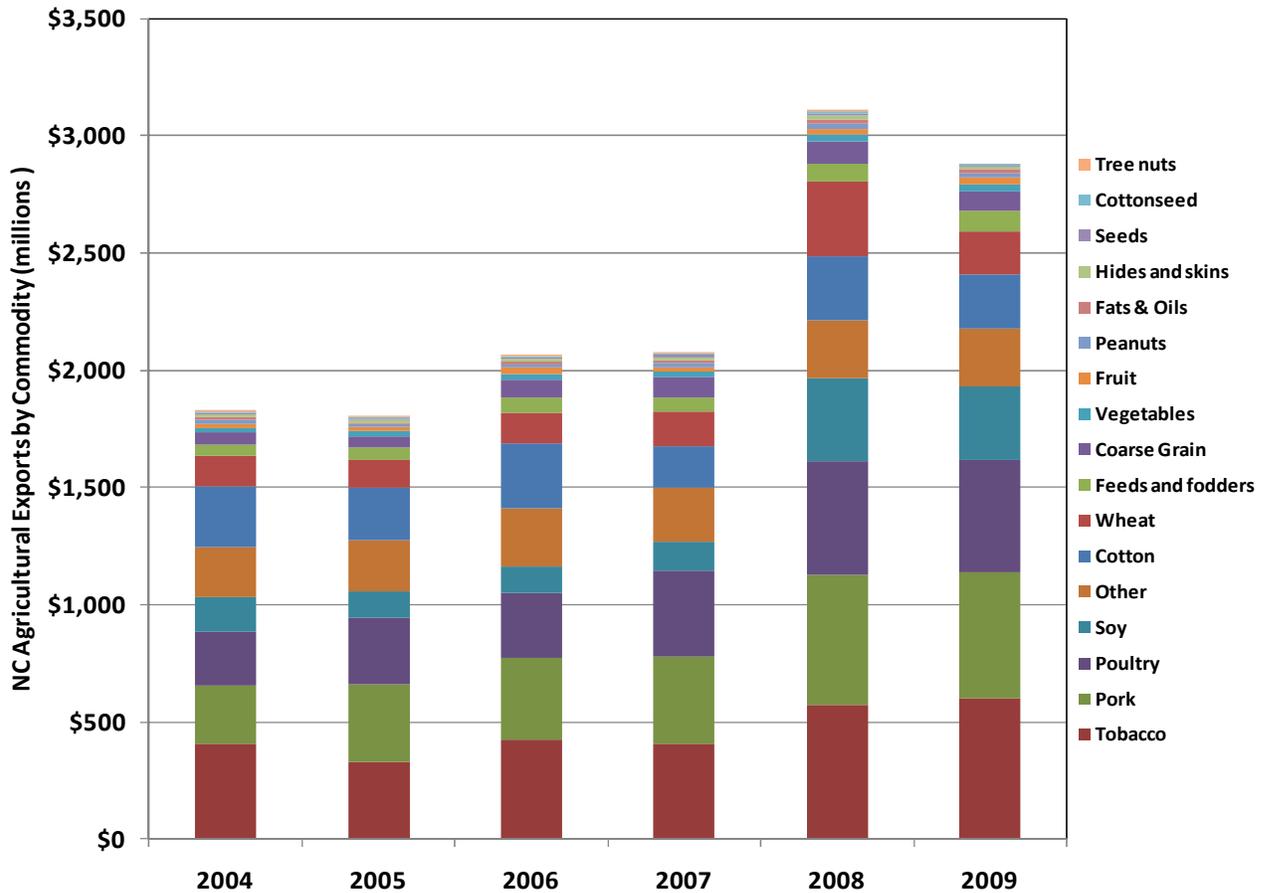
Other traditional North Carolina markets fare less well—either because they post strong growth but have lower overall volumes or have weak growth. Crude fertilizers (phosphate) remains a large market and posts solid growth over the forecast horizon, suggesting that it has the potential to remain an anchor for the port provided the company continues to use Morehead City. Processed fertilizers and pesticides are a much smaller market and post weaker growth. Tobacco is projected to continue growing until 2020 and then is projected to start contracting. North Carolina could still benefit if the US industry consolidated into North Carolina, but it is not a major freight opportunity for the state.

Wood products are projected to post strong growth, but this is a comparatively smaller market in terms of volumes. This projection, however, is based on historical trends and may not be picking up the potential for wood pellets which is an emerging market. The shipper interviews are very positive about the potential for wood products overall for North Carolina, and wood pellets in particular. There is a consortium of wood producers working to develop a wood pellet facility to serve the UK and other places in Europe. A consequence of the Kyoto agreement, the UK and other countries in Europe are converting some of their power plants to be able to use biomass. The consortium would like to develop a facility at the Port of Morehead City. Initial research suggests that European companies are willing to partner with US firms to develop the capability to source wood pellets.

Agriculture is another opportunity, with solid export growth projected for the region. North Carolina agricultural shippers reported that they could ship much more than they currently send,

citing transportation cost as limiting access to international markets. North Carolina's agricultural exports posted solid growth, even during the recent global recession.

Figure 28: North Carolina Agricultural Exports, 2004-2009



Source: North Carolina Department of Agriculture

Table 15: Moderate or Emerging Export Prospects from the Southeastern US

	2009	2020	2029	2009 to 2020	2020 to 2029
Total Commodities	40,591,676	83,750,543	114,585,964	106%	37%
Wood Products	152,950	363,335	458,163	138%	26%
Grain	87,305	132,309	148,052	52%	12%
Meat, Fish & Dairy, Other	85,260	135,281	161,868	59%	20%
Meat, Fresh/Chilled	80,678	155,614	226,007	93%	45%
Other Raw Textile Materials	2,442	3,056	3,280	25%	7%
Other Agriculture	67,566	120,810	153,959	79%	27%
Fertilizers and Pesticides	108,534	135,111	152,194	24%	13%
Rubber Products	189,969	422,630	622,436	122%	47%
Other Food	451,179	734,866	986,991	63%	34%
Crude Fertilizers	6,203,100	10,364,843	12,330,645	67%	19%
Tobacco	44,924	62,309	52,221	39%	-16%

Source: IHS Global Insight, August 2011 South Atlantic waterborne trade forecast

Imports

According to NCSPA data, the following commodities have consistently ranked among the top commodities handled at the facilities in recent years: chemicals, grain, cement, metal products, machinery parts, general merchandise, forest products, and coal. Several of NCSPA's current key markets are projected to post strong growth export growth from the southeastern US over the next two decades. These are summarized below. Where multiple commodity classifications map to a general product group (inorganic, organic and chemical products for example), all are provided even if an individual segment is not large in volume or above average in pace of projected growth.

Table 16: Strongest Southeastern US Import Markets

	2009	2020	2029	2009 to 2020	2020 to 2029
Total Commodities	79,578,018	118,911,098	151,291,294	49%	27%
Inorganic Chemicals	2,505,619	3,772,249	4,484,133	51%	19%
Chemical Products, nec.	1,034,013	1,319,777	2,112,491	28%	60%
Organic Chemicals	1,011,598	2,199,983	3,821,071	117%	74%
Metal Products	684,948	1,515,300	2,265,076	121%	49%
Stone, Clay and Other Crude Materials	6,181,801	8,675,418	9,054,265	40%	4%
Non-Metallic Products, nec.	1,956,082	3,462,126	6,128,983	77%	77%
Machinery and Equipment, nec.	527,108	1,335,959	2,407,142	153%	80%
Special Industrial Machinery	205,265	365,687	462,506	78%	26%
Engines and Turbines	177,614	334,764	559,895	88%	67%
Electrical Industrial Machinery	166,134	345,920	520,851	108%	51%
Agricultural Machinery	71,852	171,920	301,738	139%	76%
Transport Equipment, nec.	48,866	128,949	254,121	164%	97%
Metal and Wood Working Machinery	45,058	71,320	113,293	58%	59%

Source: IHS Global, August 2011 South Atlantic waterborne trade forecast

Other traditionally strong import markets for NCSPA are projected to be less significant in the future—either because they post strong growth but have lower overall volumes or have weaker growth. None of these markets is projected to contract; all can serve as an anchor or economic base of activity for the ports but they are unlikely to drive a significant expansion of activity but could serve as profitable niche markets—especially grains and wood products. The one caveat here is coal, which is projected to be a one of the largest single commodities imported via South Atlantic ports. While posting just average growth, the overall size of the market makes it an important opportunity for the ports—not because of the dynamics of the market itself, but because of the potential to increase market share. Because of the size of the market, even a small increase in market share would translate into a noticeable increase in volume for the port.

Table 17: Strongest Southeastern US Import Markets

	2009	2020	2029	2009 to 2020	2020 to 2029
Total Commodities	79,578,018	118,911,098	151,291,294	49%	27%
Grain	451,832	683,300	853,954	51%	25%
Animal Feed	116,189	142,772	149,032	23%	4%
Goods not classified by kind	172,665	378,983	639,132	119%	69%
Coal	5,171,882	8,175,388	10,839,437	58%	33%
Wood Products	567,013	843,332	1,125,789	49%	33%
Cork and Wood	385,520	479,234	614,886	24%	28%

Source: IHS Global, August 2011 South Atlantic waterborne trade forecast

5.1.4 Export and Import Commodities Requiring Specialized Infrastructure

The most significant driver of the ability for North Carolina maritime infrastructure to meet the goods movement needs of certain industries may be investments in specialized equipment to accommodate some of the state's key exports and market opportunities.

Another way to look at the data, apart from overall volume and pace of growth, is to combine commodities by the type of specialized equipment required for their handling. The following commodities are all potential users of specialized refrigeration equipment. This list omits several specialty products that fall with the larger commodity groups reported. For example, stakeholder interviews have identified that some types of textiles and rubber products must be kept cool. Shippers reported using the Port of New Orleans and other ports specifically for this reason; the requisite facilities to keep the commodity at a proper temperature were not available at the North Carolina port facilities.

In addition, these imports would pair well with the state's existing strengths in exporting agricultural products requiring refrigeration such as sweet potatoes, frozen poultry and meat.

Table 18: Export Outlook for Refrigerated Commodities

	2009	2020	2029	2009 to 2020	2020 to 2029
Total Commodities	79,578,018	118,911,098	151,291,294	49%	27%
Beverages	1,007,407	1,501,440	2,031,706	49%	35%
Fruits & Vegetables, Fresh/ Chilled (Sensitive)	578,265	699,339	936,454	21%	34%
Fruits & Vegetables, Fresh/ Chilled/ Frozen	473,692	680,582	1,134,349	44%	67%
Fish & Seafood, Frozen	176,912	252,814	324,708	43%	28%
Meat, Fish & Dairy, Other	139,150	177,421	216,128	28%	22%
Fruits, Exotics	137,491	223,392	307,535	62%	38%
Meat, Frozen	49,704	47,723	53,439	-4%	12%
Fish & Seafood, Fresh/ Chilled	20,296	26,493	33,236	31%	25%
Dairy	17,248	18,738	22,314	9%	19%
Meat, Fresh/ Chilled	11,146	11,166	12,179	0%	9%
Fresh Cut Flowers, Foliage	2,420	5,224	5,638	116%	8%
Total Commodities Potentially Using Refrigeration	2,613,730	3,644,332	5,077,688	39%	39%

Source: IHS Global, August 2011 South Atlantic waterborne trade forecast

Provided that there is the requisite equipment and capacity to handle freight, relative costs are the next important driver of diversion potential. Particularly for key North Carolina commodities such as forestry and agricultural products, profit margins are thin, making these commodities highly sensitive to differences in shipping costs. Investments to improve the landside travel time and reliability can change the relative costs between shipping locations in North Carolina's favor.

5.2 Potential Market Scenarios

Based on the analysis described above, the following candidate market opportunities were selected for further development: chemicals, containers, refrigerated cargo, grain, wood products (traditional), wood pellets, Ro/Ro, and wind power. Wind power was identified through the stakeholder interviews and is consistent with the state's competitiveness in metals and machinery. Additional information on the market potential for each is provided below. Of note, many of the scenarios outlined here utilize resources from rural areas; as much of the state's growth takes place in its metropolitan areas; maritime investment is a way of supporting continued economic growth in the state's rural areas.

An overview of candidate market scenarios identified and evaluated for North Carolina is presented on Table 19 below.

Table 19: Overview of Candidate Market Scenarios for North Carolina

	Grain		Wood Pellets		Other Wood Products		Container		Refrigerated Cargo		Ro/Ro & Oversize	
Foreign Nodes	Asia via Panama Canal		Asia via Panama Canal, Europe		Africa, Asia via Panama Canal, Asia via Suez Canal, Europe, Mediterranean		Africa, Asia via Panama Canal, Europe, Asia via Suez Canal, west coast of S America via Panama Canal		Africa, Asia via Panama Canal, Caribbean, Europe, east coast of South America		Africa, Asia via Panama Canal, Asia via Suez Canal, Europe, Mediterranean	
Domestic Nodes	Soybean producing counties in North Carolina		Lumberton Western North Carolina		Lumberton Western North Carolina		Intermodal yards in Charlotte and Greensboro; distribution centers in the Triangle Region		Intermodal yards in Charlotte and Greensboro; distribution centers in the Triangle Region; sweet potato producing counties in North Carolina		Manufacturing centers in Kinston, Triangle Region, Greensboro, Winston-Salem, and Charlotte	
Port	Morehead City	Wilmington	Morehead City	Wilmington	Morehead City	Wilmington	Morehead City	Wilmington ³²	Morehead City	Wilmington ³²	Morehead City	Wilmington
Inland Corridors	US 70	US 17 US 74/US 76 US 258/NC 24	I-140 US 17 US 70 US 74/US 76 NC 24	I-140 US 74/ US 76	I-140 US 17 US 70 US 74/US 76 NC 24	I-140 US 74/US 76	I-40 I-95 US 70	I-40 I-74 US 74/US 76	US 70	I-40 US 74/US 76	I-40 US 1 US 70	I-40 US 17 US 74/US 76
Inland Mode (2040)	90% Truck / 10% Rail		50% Truck / 50% Rail		80% Truck / 20% Rail		70% Truck / 30% Rail		90% Truck / 10% Rail		50% Truck / 50% Rail	
2040 Volume												
Container							1.26 million TEU		73,000 TEU			
Bulk	730,000 tons		450,000 tons		990,000 tons							
Break Bulk					320,000 tons						96,000 tons	
Ro/Ro											96,000 tons	
Special Equipment	Dedicated storage silos, on-dock rail unloading facility, covered conveyors to load vessels		Dedicated storage silos, on-dock rail unloading facility, covered conveyors to load vessels		Chippers and conveyors for woodchips, storage sheds for wood pulp and lumber		100 ft-gauge dockside cranes, RTG cranes or ASC for container handling, on-dock intermodal rail		Refrigerated warehouse, reefer plug-ins in the container yard		200-ton mobile harbor cranes	
Potential Partner / Competitor	Portsmouth, VA Colonel's Island Terminal, Savannah, GA (major agri-bulk)		Marine Terminal, Savannah, GA (huge pellet business and expanding)		Veteran's Terminal, SC (2.8 MIL tons storage)		Savannah, GA (capacity) APTMM, VA (efficiency)				Ocean Terminal (largest & expanding) & Colonel's Island Terminal, Savannah, GA	
Regional Growth (2012-2040)	0.96% CAGR		1.95% CAGR		2.03% CAGR		3.29% CAGR		2.95% CAGR		2.15% CAGR	

³² Wilmington includes three alternative sites within the Wilmington Harbor

	Grain	Wood Pellets	Other Wood Products	Container	Refrigerated Cargo	Ro/Ro & Oversize
Link to NC Economy	<p>Agriculture and agribusiness comprise nearly 20 percent of NC jobs and income: 52,400 farms and over 50,000 jobs in food manufacturing. Supports non-metropolitan areas.</p> <p>Supports existing industry by increasing profitability and opening up new markets. Landside improvements have spillover benefits for the general public.</p>	<p>NC timber production supports 2,800 jobs in forestry and logging; 20,000 jobs in wood product manufacturing; supports non-metropolitan areas of the state.</p> <p>Wood pellet market opens up a new market for an important state industry. Maritime market focus on other wood products supports an existing industry by increasing profitability.</p>		<p>Manufacturing and retail account for 24% of state GDP; consumption (products purchased by households including imports) accounts for about two-thirds of the economy.</p> <p>This maritime market reduces the shipment cost for a variety of industries across the state, thereby improving profitability.</p>	<p>NC is leading US producer of sweet potatoes; second in poultry, pork, trout, and Christmas trees; third in processed cucumbers and strawberries.</p> <p>This maritime market offers niche services to support the state's large agriculture industry and specialty manufactured goods.</p>	<p>Durable goods manufacturing is 7% of GDP; about 28,000 jobs in transportation equipment manufacturing; over 30,000 jobs in machinery manufacturing.</p> <p>This maritime market supports the aerospace industry, manufacturing of heavy equipment and capital goods for export as well as the state's military needs and Wind Power initiative.</p>

TEU = twenty-foot equivalent unit RTG = rubber tired gantry ASC = automated stacking cranes Lo/Lo = lift-on/ lift-off Ro/Ro = roll-on/ roll-off CAGR = compound annual growth rate
 * 2040 volumes are volumes generated by NC-based demand.

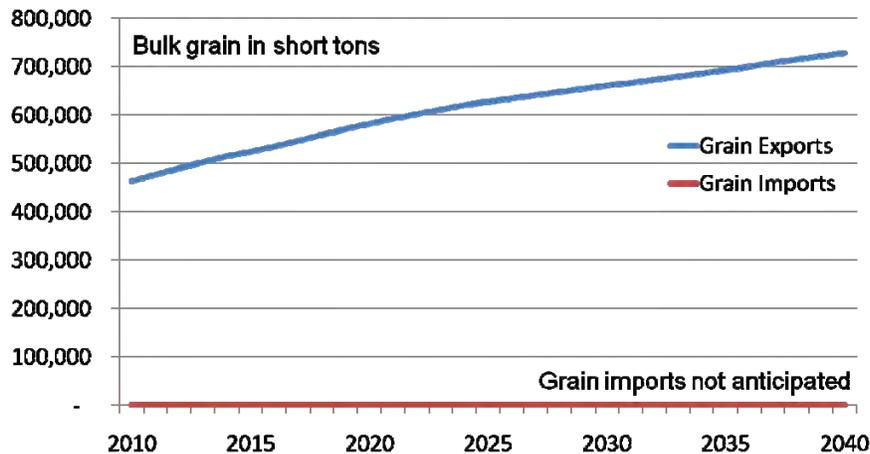
5.2.1 Grain

Soybean exports account for ten percent of North Carolina's agricultural exports; adding in wheat and feed grains and products, and the combined grain total rises to 18 percent of the state's exports and about \$490 million for the state's economy³³. As a result, market options are important for the state. North Carolina's soybeans are attractive to export customers because they tend to have higher protein and oil content than the average bean grown nationally³⁴. The data analysis above finds solid prospects for grain exports and growers reported in interviews that they could produce more than they currently do.

Grain markets are seasonal; soybean producers, for example, market about 65 percent of their beans between October and December³⁵.

As the state's ports do not have a bulk handling facility, the majority of North Carolina's exports go to out of state ports, adding to producers' costs and paring back margins. A small portion travels by container through Wilmington. Even a small savings in transportation cost could yield significant savings for this industry, with multiplier effects for the North Carolina economy.

Figure 29: Grain Market Opportunity for North Carolina



Source: AECOM, from PIERS and IHS Global Insight

³³ Based on 2010 data compiled from the USDA Economic Research Service using data from the US Department of Commerce, the Census Bureau and the US Department of Agriculture, National Agricultural Statistics Service and reported in North Carolina's Agricultural Statistics, page 35.

³⁴ Stakeholder interviews and reported in "Opportunities for Containerized Exports of North Carolina Soybeans," a report to the North Carolina Soybean Producers Association prepared by Market Solutions LLC, September 2008.

³⁵ Ibid.

5.2.2 Wood Products

Heavy commodities such as wood and wood products are particularly sensitive to transportation costs. Potential for improved landside access and handling facilities at North Carolina's ports supports this large industry's ability to capture its maximum share of the world market. The state has an above average concentration in the wood products industry, but its competitiveness is weakening based on the shift share analysis

presented in Section 5.1.1. Support for this industry and opening up opportunities to capture the wood pellets market would bolster this industry.

The wood pellets industry is driven by UK and European initiatives to convert energy sources to renewable ones. For example, in the UK 15 percent of energy consumption must be from forms of renewable energy by 2020 (versus approximately one percent in 2007). Electricity supply must be 35 percent from renewable sources by 2020, in comparison to about five percent in 2007. This is creating a large market for wood biomass that cannot be met domestically.

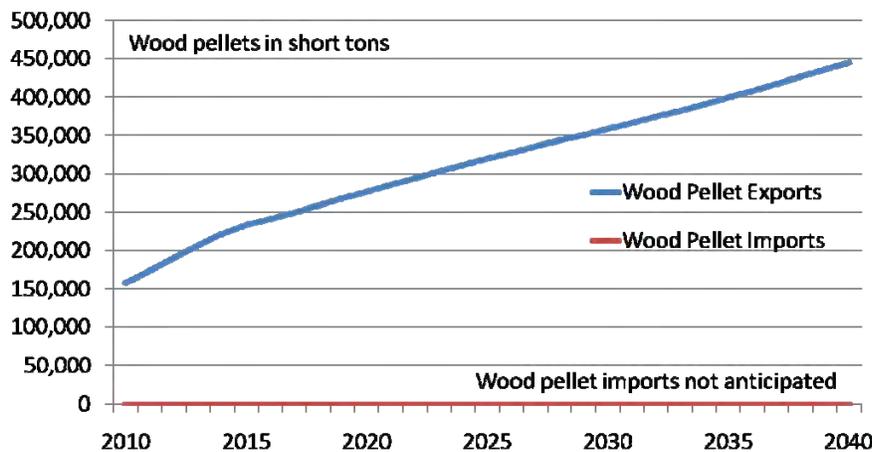
North Carolina is well positioned in terms of resources to serve this market. One pellet facility has already opened in the state; its location near the Virginia state line and the company's purchase of a port terminal in Chesapeake, mean that this first firm will export out of Virginia rather than North Carolina. The example, however, underpins the importance of transportation costs for this industry—favoring locations such as North Carolina with both the wood resource and port access.

Figure 30: Wood Products Market Opportunity for North Carolina



Source: AECOM, from PIERS and IHS Global Insight

Figure 31: Wood Pellet Market Opportunity for North Carolina

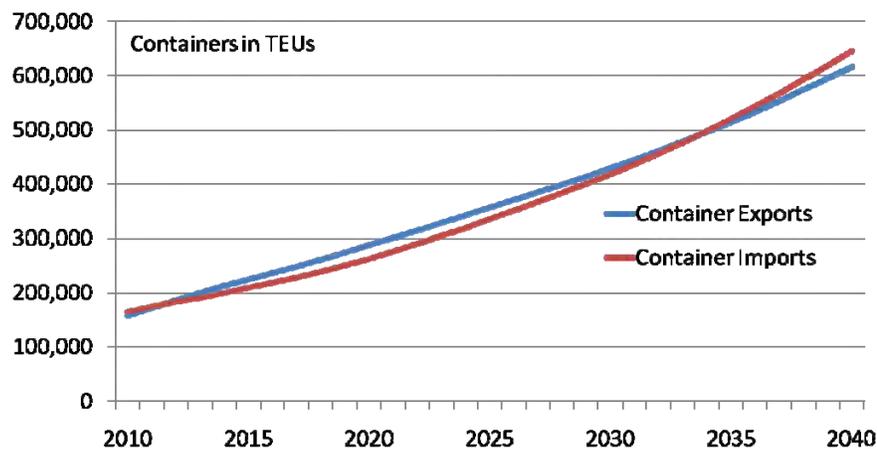


Source: AECOM, from PIERS and IHS Global Insight

5.2.3 Containerized Cargo

North Carolina added 1.5 million people between 2000 and 2010, one of only six states to add more than one million during the decade. To put that in perspective, 12 states have *total* populations less than 1.5 million—the number that North Carolina added in a decade. Moreover, the state’s metropolitan communities frame the northern segment of the emerging Piedmont Atlantic Megaregion. In short, the state is becoming one of the nation’s most populous states and is becoming part of a growing urban economy. This consumer market is attractive to retailers and will generate demand for a full range of consumer goods.

Figure 32: Containerized Cargo Market Opportunity for North Carolina



Source: AECOM, from PIERS and IHS Global Insight

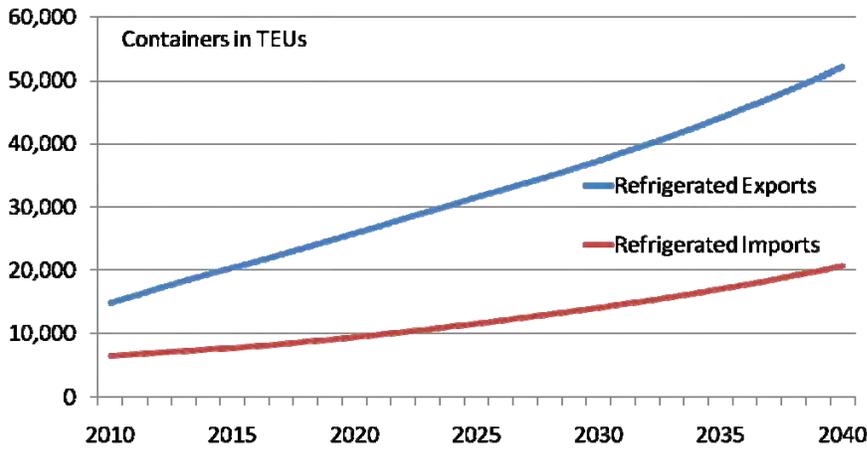
Container handling supports both export and import activity across a large variety of industries--everything from sweet potatoes and frozen chickens to consumer goods destined for local retailers. Growth in container activity at the port would make North Carolina facilities more attractive ports of call for shipping lines, expanding the market reach for NC producers, making it easier to secure containers, and creating scale economies.

Cost-effective delivery of containerized goods to North Carolina users and consumers of foreign products is not the only reason that the waterborne container market is important to the state. North Carolina producers that export their goods by container must transport – primarily by truck – their goods to the nearest port at which empty containers are available and regular overseas service by container shipping lines is provided. Development of the infrastructure and services to support a strong import container market will also support the competitiveness of containerized exports originating from North Carolina.

5.2.4 Refrigerated Cargo

The ability to handle refrigerated cargo supports the export of a variety of the state’s agricultural commodities, to handled specialized manufacturing inputs that require low temperatures, as well as food imports to serve the region’s growing population. Key agricultural commodities served by this investment include the state’s exports of poultry, pork and seafood. Sweet potatoes, too, benefit from temperature control. North Carolina is the nation’s leading producer of sweet potatoes. Refrigeration supports imports, as well. North Carolina-based shippers who participated in the stakeholder workshops noted that they imported specialized textiles and rubber products through out of state ports because the requisite facilities were not available in state. The region’s growing population creates a healthy market for imported fruits and vegetables and other perishables such as flowers.

Figure 33: Refrigerated Cargo Market Opportunity for North Carolina



Source: AECOM, from PIERS and IHS Global Insight

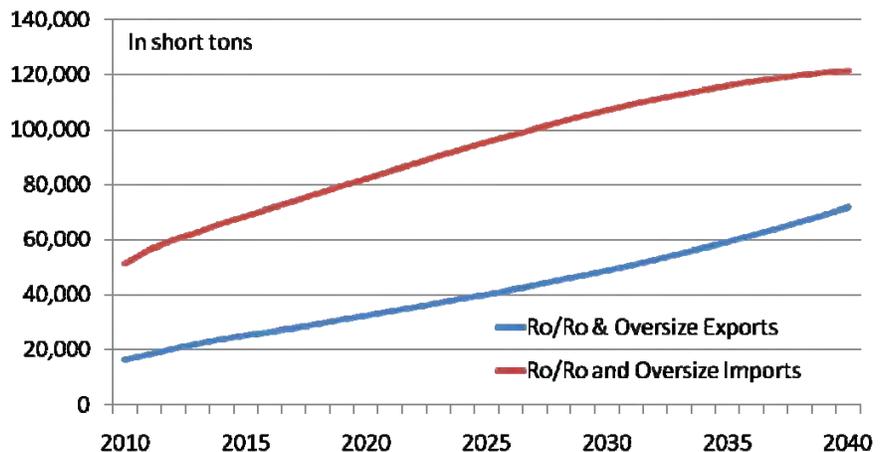
In capitalizing on this opportunity, the port's access to non-traditional food retailers such as Target and Wal-Mart, in addition to chain store grocery store distribution centers, helps in attracting an import perishable foods operator. North Carolina has demonstrated success in attracting grocery distribution centers, with the recent decision of Save-A-Lot to build a distribution center in Lexington. The company operates

24 Save-A-Lot stores in North Carolina, including one in Lexington, and plans to open an additional three stores in by 2012. Save-A-Lot has identified North Carolina and the broader area as a "key region for growth." Food Lion, another grocery chain, expanded its existing Dunn distribution center in 2011. The ability to handle refrigerated cargo thus supports important existing North Carolina industries and manufacturers, but also offers the potential to increase the flow of imports through the ports, offering important truck backhaul opportunities, and potentially expanding the range of carriers that call on North Carolina's ports, providing upside potential to the import projections.

5.2.5 Ro/Ro and Oversize Cargo

The state's low costs of doing business make it an attractive location for producers of capital goods. Moreover, the state's competitiveness in metals and machinery supports the outlook for a growing capital goods industry. Ensuring that the state has the capability to handle large project cargos supports important existing firms and industries such as the local military facilities as well as Spirit and Caterpillar. It also makes

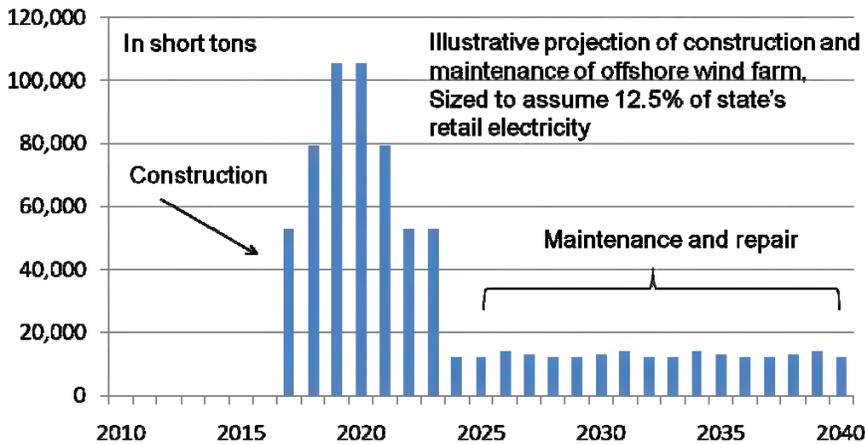
Figure 34: Ro/Ro and Oversize Market Opportunity for North Carolina



Source: AECOM, from PIERS and IHS Global Insight

the state an attractive candidate for the relocation and expansion of other capital goods producers; these are attractive firms because they purchase significant inputs from their host economies, generating larger than average multiplier effects.

Figure 35: Wind Power Equipment and Components Opportunity for North Carolina



Source: AECOM, from wind power equipment specifications

Moreover, the state has a goal of supplying 12.5 percent of its power from renewable sources. This initiative represents an opportunity for the port. During the construction phase, North Carolina's ports would be the focus for imports and exports of equipment and materials for the offshore site. Once built, the freight volumes would fall, but the ports would serve as a service base to maintain and operate the offshore facility. Finally, the presence of the large scale facility and the state's attractive business costs could attract wind power manufacturers to the state, creating upside potential for equipment exports from the state.

5.2.6 Military Cargo

North Carolina has the fourth-largest active duty military population in the US distributed among seven military installations and 14 US Coast Guard facilities, according to research conducted on behalf of North

As a subset of the Ro/Ro and oversize market, North Carolina is actively considering offshore wind power as a new industry. The Governor has convened a task force to evaluate whether and how best to pursue the opportunity. A study by the University of North Carolina concluded that the state could supply 100 percent of its power from offshore turbines.

Figure 36: US Military Depots and Military Bases in the Southeastern US



Source: North Carolina Logistics Initiative, Military Growth Task Force

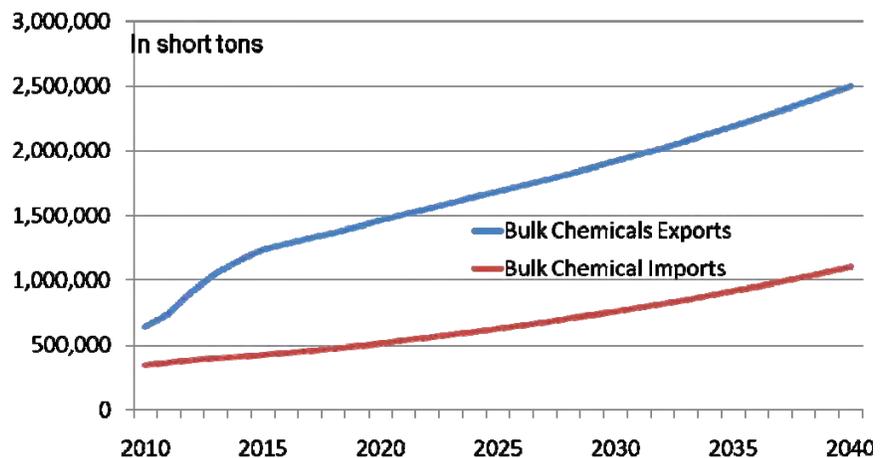
Carolina Department of Commerce³⁶. Military facilities support over 416,000 workers, about eight percent of total state employment, through direct military or Coast Guard employment or jobs supported by military installations in the state such as contractors or support services.

The US Military is investigating changes to its traditional equipment maintenance and reset functions to include an end-to-end Defense Logistics Organization (DLO). Challenges presented by shrinking budgets and mandated consolidation are forcing the examination of the equipment reset process, which includes: redeployment of equipment from overseas; assessment for heavy or light repair; transport to inland depots in Alabama and Georgia for rehabilitation or major overhaul; and, finally return to base – primarily in North Carolina. Through its North Carolina Defense Logistics Initiative, the North Carolina East Region Military Growth Task Force has changes in the marine reset logistics to redirect North Carolina-bound equipment through NC Ports to eliminate several hundreds of miles of equipment transport. The potential economic benefits and impacts of this concurrent effort are not evaluated in this report. Rather, the *Maritime Strategy* seeks to identify port-related infrastructure that would also support military use.

5.2.7 Chemicals and Phosphates

Chemicals are a major existing export for North Carolina’s port facilities, show up as a comparative strength for the state’s economy, and have solid export prospects going forward. The anchor for the state’s industry, PCS, has a long-term lease on a terminal at Morehead City and mines potash in Aurora NC. The company’s phosphate operations “mine phosphate ore and manufacture phosphoric acid, solid and liquid fertilizers, animal feed supplements, purified phosphoric acid which is used in food products and industrial³⁷ The Aurora facility has a capacity of 1.2 million tonnes P2O5 of phosphoric acid per year; the company reports that it is the largest integrated phosphate mine and phosphate processing complex at one site in the world.

Figure 37: Chemicals and Phosphates in North Carolina



Source: AECOM, from PIERS and IHS Global Insight

³⁶ Sara Nienow, Chris Harder, Tim Cole, and Anna Lea. “North Carolina’s Military Footprint: Current Economic Impacts and Projections for 2013” The Policy, Research, and Strategic Planning Division of the North Carolina Department of Commerce with assistance from Adam Cooper (REMI). June 2008.

³⁷ Summary of PCS operations drawn from 2010 10K report and supplemental filings with the US SEC. Report accessed at http://www.potashcorp.com/annual_reports/2010/media/PotashCorp_10-K_110225.pdf.

The company has long-term leases on shipping terminals in Morehead City and Beaufort, North Carolina, through which the company receives and stores Aurora facility raw materials and finished product. Barges and tugboats are used to transport solid products, phosphoric acid and sulfur between the Aurora facility and shipping terminals. Raw materials and products, including sulfur, are also transported to and from the Aurora facility by rail, according to the company's reports.

Existing reserves for the Aurora facility would permit mining for about 33 years. If deposits covered by permits are classified as resources, the mine life extends to about 52 years, confirming that this is a long-term opportunity for North Carolina. State investments in pursuit of new maritime opportunities should be supportive of this existing market.

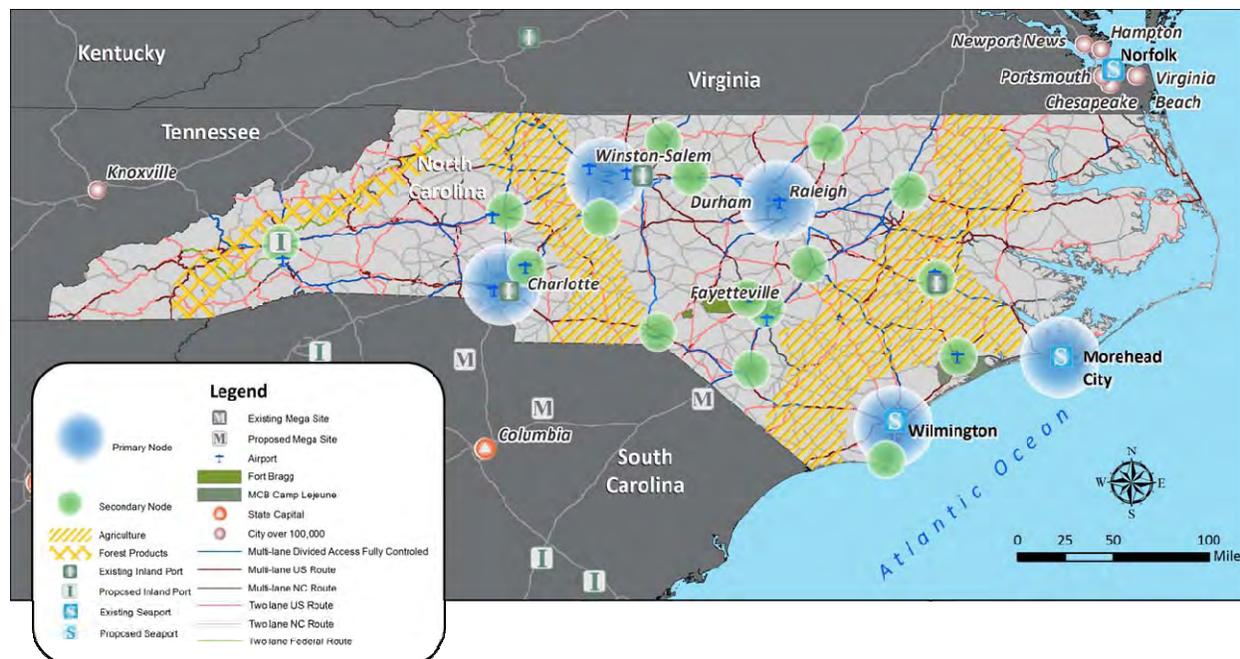


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6 EXISTING INFRASTRUCTURE SUPPORTING MARITIME TRADE

North Carolina’s existing maritime infrastructure comprises more than its marine terminals and extends well beyond the state’s coastal counties. State infrastructure supporting maritime trade includes its ports, waterways, highways, rail network, as well as inland production, logistics and distribution centers.

Figure 38: North Carolina Freight Nodes and Facilities



Source: AECOM/URS from ESRI, NCDOT, NCDA, and USGS ThematicMapping world borders dataset
Agricultural production exists across the state; the areas of dense agricultural production illustrated are intended to be representative

6.1 Port Facilities

6.1.1 Port of Wilmington

The Port of Wilmington is located approximately 26 miles from the open sea on the Cape Fear River. Currently it has a channel depth of 42 feet Mean Low Low Water (MLLW).³⁸ The port has nine berths with approximately 6,800 linear feet of wharf and provides cargo storage space for container, bulk, and breakbulk operations. Figure 39 shows an aerial of the Port of Wilmington.

³⁸ Refer to Figure 22 for MLLW definition.

Figure 39: Port of Wilmington Aerial



Source: Bing Maps

Port of Wilmington Container Terminal

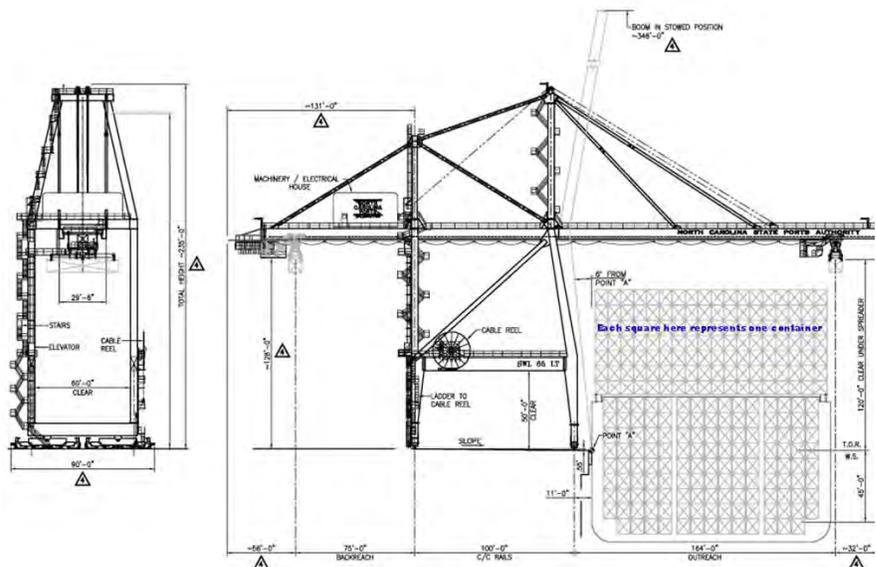
Among the largest facilities at the port of Wilmington is its container terminal, which has a gross area of approximately 85 acres, 6,000 twenty-foot ground slots (TGS) for container storage, and provides area for chassis storage. The container yard is primarily served by a single berth of approximately 1,250 feet at the southern-most end of the container terminal and a 400-foot-long portion of the berth to the north, which has been recently rebuilt to be able to accommodate 100-foot gauge dock cranes.

The existing four 100-foot gauge cranes have an outreach of 18 containers and can load/unload container vessels up to about 8,000 TEU as shown in Figure 40.

The container terminal is supported by a 12-acre chassis storage yard, which lies outside the gate and across the street the port’s south gate container entrance.

The existing gate that provides truck access to the container yard is located in the southeast end of the terminal, but extends inside the middle of the container

Figure 40: Schematic Diagram of 100' gauge dock cranes at Port of Wilmington



Source: http://www.ncports.com/gallery_detail.htm?i=70

storage area. All containers are handled by mobile reach stackers (RS) inside the yard.

During a four-week operating period reviewed by the study team, the Port of Wilmington was receiving regular vessel calls from four global container shipping lines: Yang Ming, Hanjin, ICL, and Maersk. Actual draft of vessels calling at the Wilmington Container Port averaged 32 feet, with maximum draft of 38.5 feet. The average number of containers loaded and unloaded per call was 824, with a maximum of 1,386 loaded and unloaded from a single vessel. Containerships typically remained at dock for less than one day. Average net dock crane productivity was approximately 37 moves per hour, a highly efficient rate³⁹ by industry standards.

Based on water depth, available berths, typical vessel call characteristics, dock crane productivity, container storage area, average container dwell time, and seasonal and weekly peaking factors, the estimated annual capacity of the container terminal is approximately 530,000 TEU per year.

Port of Wilmington General Cargo Terminal

The Port of Wilmington General Cargo Terminal handles various types of import and export breakbulk and bulk commodities. Bulk cargo handled at the Port of Wilmington is summarized in Table 20 below. Estimated annual capacity was calculated based on number of available berths, characteristics of typical vessel call, call frequency, static storage capacity, average dwell times, and weekly peaking factors.

Table 20: Bulk and Breakbulk Cargo Handled at Port of Wilmington

Commodity	Static Storage Capacity	Estimated Annual Capacity	Landside Mode
Grain/Animal Feed (Import)	55,000 tons in five dedicated domes	1,878,000 tons	NA
Cement (Import)	25,000 tons in warehouse	300,000 tons	Truck
Fertilizer (Import)	104,000 tons in 3 warehouses	354,000 tons	75% Truck 25% Rail
Chemicals (Import and Export)	Private Vopak Terminal totaling 23 acres	NA	100% Truck
Metal Products (Import)	30,000 to 50,000 tons in open storage area 25,000 tons in warehouse	1,932,000 tons	Truck and Rail
Wood Products (Import and Export)	43,000 tons in 4 transit sheds	2,043,000 tons	NA
Wood pulp (Export)	99,000 tons in 2 transit sheds	1,070,000 tons	Truck and Rail
Woodchips (Export)	70,000 tons in open storage area	3,137,000 tons	NA

Source: AECOM, from NCSPA operating data

NA = not available

³⁹ As a comparison, west coast ports maintain average dock crane productivity rates of about 30 moves per hour. APMT Virginia averages approximately 35 moves per hour.

Other Property at Port of Wilmington

The Port of Wilmington also includes 100 acres of undeveloped land that lies north of the privately-operated Vopak terminal. The North Property is a brownfield site that, prior to any development, would require remediation or capping of contamination resulting from creosote wood treatment operations by the previous property owner.

The NCSPA-owned Boykin property comprises an additional 90-acre greenfield parcel south of the Wilmington Container Terminal. The Boykin property has rail access but is not on the waterfront.

6.1.2 Port of Morehead City

The Port of Morehead City is located approximately four miles from the Atlantic Ocean and has a 45-foot MLLW deep channel from the sea buoy. It has nine berths with approximately 5,500 feet of wharf and handles both breakbulk and bulk cargo at its existing facilities. Radio Island, which is part of the Port of Morehead City, is located across the Newport River from the port and includes approximately 150 acres of land suitable for port industrial development. Figure 41 shows the location of the Port of Morehead City and Radio Island.

Figure 41: Port of Morehead City Aerial



Source: Bing Maps

Port of Morehead City General Cargo Terminal

The Port of Morehead City specializes in the handling of bulk and breakbulk cargos. Bulk and breakbulk cargo handled at the Port of Morehead City is summarized in Table 21 below. Estimated annual capacity was calculated based on number of available berths, characteristics of typical vessel call, call frequency, static storage capacity, average dwell times, and weekly peaking factors.

Table 21: Bulk and Breakbulk Cargo Handled at Port of Morehead City

Commodity	Static Storage Capacity	Annual Capacity	Landside Mode
Sulfur (Export)	30,000 tons in dedicated tanks on Radio Island	485,000 tons	NA
Aggregates (Import)	60,000 tons in 4.5-acre open storage area	485,000 tons	NA
Phosphates (Export)	180,000 tons in dedicated warehouse and domes	1,747,000 tons	Barge
Natural Rubber (Import)	66,000 tons in warehouse and 3 transit sheds; NCSPA provides warehousing and inventory management services	644,000 tons	NA
Scrap Metal	NA	NA	Barge
Ore, Mica and Schist	20,000 tons in warehouse	162,000 tons	Rail
Wood Products (Export)	21,000 in transit shed Plus additional open storage area for wood chips	170,000 tons	Truck
Metal Products	14,000 tons in open storage area	113,000 tons	NA

Source: AECOM, from NCSPA operating data
NA = not available

In addition to the above described cargo, the US Military also makes 10 to 15 calls through the port each year. The port's roll-on/roll-off (Ro/Ro) ramp is used for loading/unloading of vehicles and equipment and small barracks to property used by military personnel when they are working with cargo.

Other Property at Port of Morehead City

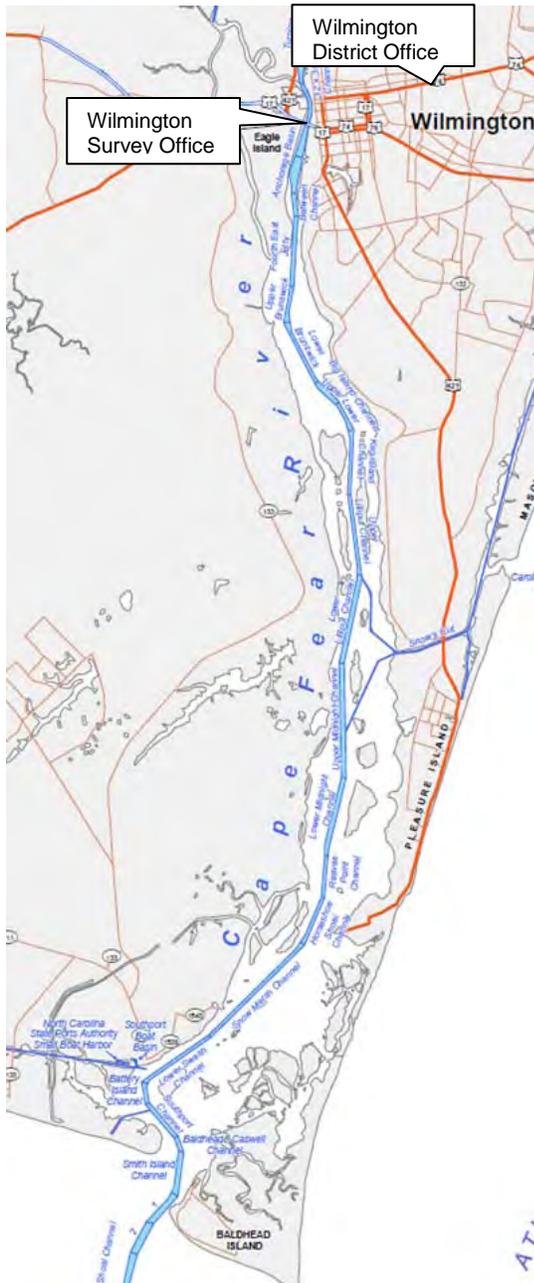
NCSPA also owns an undeveloped parcel approximately six miles from the Morehead City terminal. This Edgewater Tract comprises 43 acres of land off US 70. The property is zoned for port industrial use and borders the NCCR/NS rail line to the south.

6.2 Waterways

6.2.1 The Wilmington Harbor on the Cape Fear River

The Port of Wilmington is served by a 26-mile-long navigation channel along the Cape Fear River. Authorized water depth is 44 feet at the entrance and 42 feet to the turning basin north of the port. The turning basin (or anchorage basin) has a radius of 1,200 feet and can accommodate Panamax vessels (up to 965 feet long).

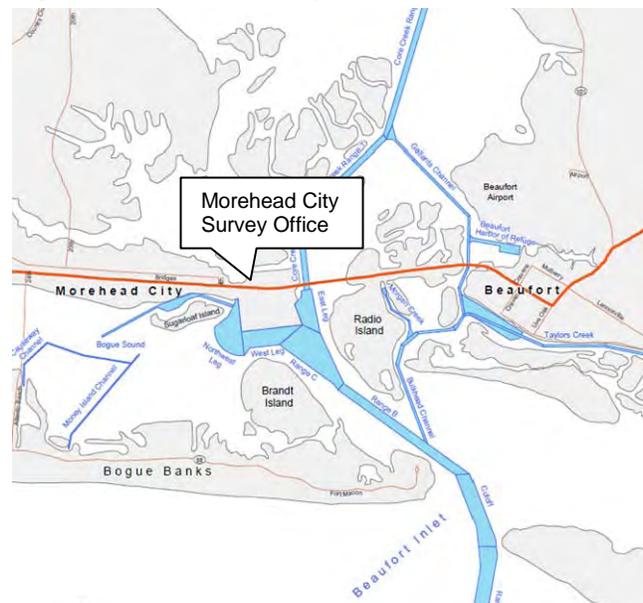
Figure 42: Wilmington Harbor



6.2.2 Morehead City Harbor

The navigation channel at the Port of Morehead City is 45 feet deep. The Morehead City entrance channel is approximately 47 feet in depth and extends into natural deep waters suitable to accommodate larger vessels with dredging needed only to deepen the existing footprint versus extend it as in the case at the POW. There are two turning basins at Morehead City. One turning basin is located within the Northwest leg of the harbor channel and has a water depth of approximately 35 feet and radius of 1,100 feet. The other turning basin, located at the 'Y' of the navigation channel and the Newport River, has a water depth of 45 feet and radius of 1,350 feet.

Figure 43: Morehead City Harbor



Source: USACE

6.3 Highways

Goods originating from or destined for use in North Carolina are transported primarily by truck. The state and regional network of interstate, state and local highways is therefore an important component of maritime infrastructure.

Truck routes within North Carolina comprise Interstate Highways, United States Highways and State Highways, as well as four-lane divided roadways. North Carolina's Strategic Highway network, Statewide Logistics Plan and Seven Portals Study each recognize important corridors within the state's highway network. Review of the state highway network serving in-state port facilities and providing access to ports in the neighboring states of Virginia, South Carolina, and Georgia identifies the following primary highway routes for waterborne truck freight within North Carolina:

- I-40 serving Port of Wilmington, the Triangle Region, and Greensboro from east and west
- I-85 serving Charlotte, Greensboro, and the Triangle Region from north and south
- I-95 serving Lumberton, Fayetteville, and Benson from north and south
- I-26 providing access from Western North Carolina to Port of Savannah and to Port of Charleston
- I-73/1-74 providing access from Greensboro to Port of Charleston
- I-77 providing access from Charlotte and Western North Carolina to Port of Savannah and to Port of Charleston
- US 17 providing access along Eastern North Carolina to Port of Wilmington, Camp Lejeune, Morehead City, as well as Port of Charleston to the south and Port of Norfolk to the north
- US 70 serving Morehead City, Kinston, and the southern Triangle Region
- US 74/US 76 serving Lumberton and Port of Wilmington
- NC 24 serving Fayetteville and Morehead City

North Carolina's STIP includes funded projects totaling \$11.5 billion (highway construction plus right of way acquisition) to be implemented over the next seven years. Key projects currently funded in the STIP that will improve overall freight mobility within the freight corridors identified above include:

- Widening of I-40 in Davie, Forsyth, Orange, Durham, Wake and Johnston Counties [I-4744 (under construction), I-5111A, I-5111BA, I-3306A]
- Widening of I-85 in Mecklenburg, Cabarrus, Rowan, and Davidson Counties, including the ongoing replacement of the Yadkin River Bridge [I-3802A, I-3802B, I-3803B]
- Construction of the final link in the I-485 Charlotte Outer Loop and widening of I-485 on the south side of Charlotte [R-2248E (under construction), R-4902 (2014)]
- Widening and upgrade of interchanges on I-95 from I-95 Business to I-40 in Cumberland, Harnett, and Johnston Counties [I-4745A]
- Construction of US 70 Gallants Channel Bridge [R-3307]
- Widening of US 258 in Onslow, Jones and Lenoir Counties [R-2235]
- Widening of I-26 from US 25 to I-40 in Henderson and Buncombe Counties [I-4400, I-4700]

- Construction of the US 74 Rockingham-Hamlet Bypass in Richmond County [R-3421]
- Additional upgrades to bring portions of I-73 / 74 to interstate standards between Rockingham and Greensboro [R-2606, I-5110]
- Widening of I-77 between Charlotte and Statesville, Mecklenburg and Iredell Counties [I-3311E, I-4750A]
- Construction of the US 17 Hampstead Bypass in New Hanover and Pender Counties [R-3300]
- Widening and bridge replacements on US 17 / US 74 / US 76 and replace bridges in Brunswick and New Hanover Counties [R-3601]
- Widening and upgrade of US 17 between Jacksonville and New Bern in Onslow and Craven Counties [R-2514B]
- Construction of the US 70 Bypass of Havelock, Craven County [R-1015]
- Construction of the US 70 Bypass of Goldsboro, Wayne County [R-2554]
- Construction of the Monroe Connector and Bypass in Mecklenburg and Union Counties [R-2559, R-3329]
- Additional capacity and safety enhancements on US 74 in Mecklenburg County [U-2509A]
- Construction of the Cape Fear Skyway and Wilmington Bypass Project [U-4738]
- Widening of NC 24 in Cumberland, Sampson, and Duplin Counties [R-2303A, R-2303B, R-2303C, R-2303D]

Figure 44 illustrates North Carolina's statewide highway network, highlighting funded STIP projects on major freight routes. Implementation or acceleration these projects would benefit the movement of North Carolina's waterborne goods.

Table 22: Freight Railroads in North Carolina

Railroad	Approximate Trackage	Overview
CSX	Multi-state	Class I railroad serving the eastern US, including service to Port of Wilmington
Norfolk Southern Railway	Multi-state	Class I railroad serving the eastern US, including service to Port of Morehead City over NCRR-owned right of way
North Carolina Railroad	317	Owner and manager of state-owned railroad rights of way including Charlotte-to-Greensboro, Greensboro-to-Raleigh, and Raleigh-to-Morehead City
US Military	35	The US Army and US Marine Corps own tracks that provide rail connections to MOTSU and to Camp Lejeune
Aberdeen Carolina & Western Railway (ACWR)	160	Connects to both NS and CSX, serving Charlotte, Greensboro, Winston-Salem, Raleigh and Fayetteville.
Aberdeen & Rockfish Railroad (AR)	46	Interchange railroad connecting CSX to Fayetteville
Alexander Railroad (ARC)	18	Runs daily weekday service between Statesville and Taylorsville in the western Piedmont area.
Atlantic & Western Railway (ATW)	11	Interchanges with CSX and NS at Cumnock and Sanford. Owned by the Genesee & Wyoming.
Beaufort & Morehead Railway (BMH)	1	Terminal railroad right of way at the Morehead City Port. Owned by NCSPA and operated by the Carolina Coastal Railway.
Caldwell County Railroad (CWCY)	17	Provides connection between Hickory and Lenoir
Cape Fear Railways (CFR)	10	Provides rail service to Fort Bragg and Clifbragg, connecting to CSX. Owned by Seaboard Corp.
Carolina Coastal Railway (CLNA)	159	Operates on a 142-mile NS line from Raleigh to Plymouth and a 17-mile line from Pinetown to a barge facility at Belhaven on the Pamlico Sound. Connects to NS at Raleigh and Chocowinity. Connects to CSX at Wilson and Greenville. Also provides switching services at the Port of Morehead City.
Carolina Rail Service, LLC (CRIJ)	1	Rail line from Port of Morehead City to the Gallants Channel Bridge.
Carolina Southern Railroad (CALA)	37	Provides connections from Whiteville NC to Mullins SC and from Chadbourn NC to Conway SC. Connects to CSX in Mullins.

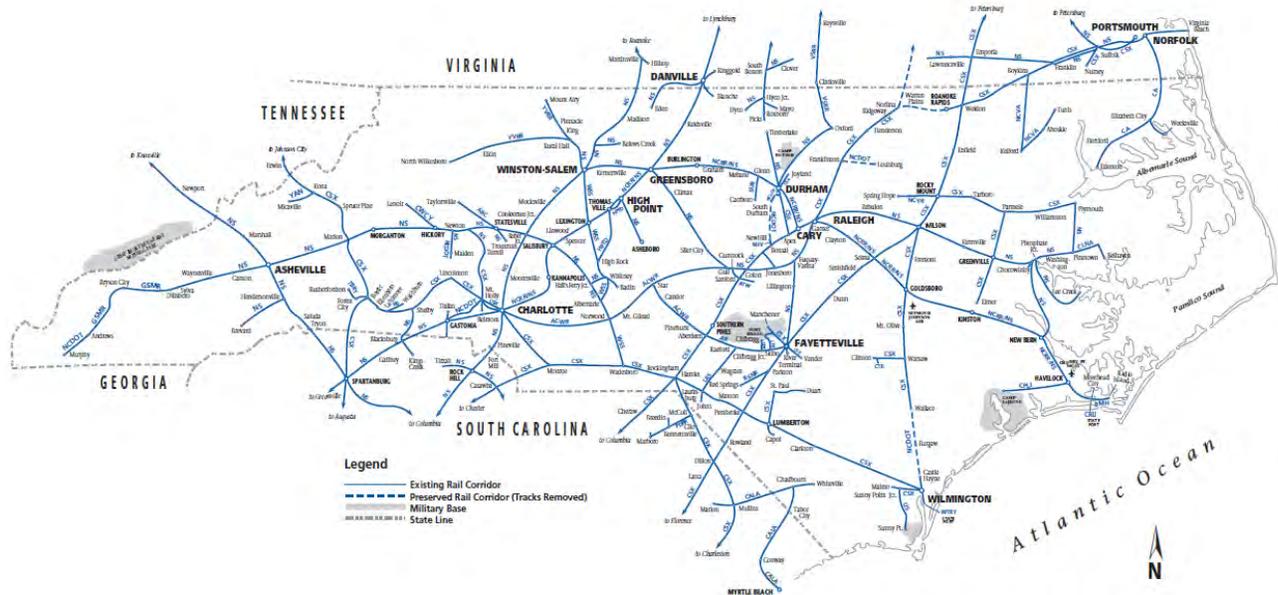
Railroad	Approximate Trackage	Overview
Chesapeake & Albemarle Railroad (CA)	44	Operates between Norfolk VA and Edenton, on the Albemarle Sound in northeastern North Carolina. Moves primarily stone and chemicals. Interchanges with CSX in Edenton NC. Owned by RailAmerica Inc.
Clinton Terminal Railroad (CTR)	3	Operates three and a half miles of switching track at Clinton and connects with CSX.
High Point, Thomasville & Denton Railroad (HPTD)	20	Operates from High Point through Thomasville and Denton to a junction with NS and the Winston-Salem Southbound Railway in High Rock. Jointly owned and operated by NS and CSX.
Laurinburg & Southern Railway (LRS)	28	Operates in south central North Carolina from the CSX line in Laurinburg to Raeford. Owned by Gulf & Ohio.
Nash County Railroad (NCYR)	15	Interchanges with CSX in Rocky Mount and provides service to Nashville NC. Owned by Gulf & Ohio.
North Carolina & Virginia Railroad (NCVA)	135	Operates in northeastern North Carolina and interchanges with CSX in Boykins VA. Owned by RailAmerica Inc.
Thermal Belt Railway (TBRY)	9	Operates in Rutherford County in western North Carolina, with connection to CSX in Bastic.
Virginia Southern Railroad (VSRR)	15	Operates between Oxford and Clarksville VA and points north. Interchanges with CSX at Oxford. Owned by RailAmerica, Inc.
Winston-Salem Southbound Railway (WSS)	87	Operates from Winston-Salem to serve the Piedmont Triad area. Owned jointly by CSX and NS.
Wilmington Terminal Railroad (WTRY)	17	Provides switching service within the Port of Wilmington and interchanges with CSX. Owned by Genesee & Wyoming.
Yadkin Valley Railroad (YVRR)	93	Provides service on NS line from Winston-Salem to Mount Airy and to North Wilkesboro. Owned by Gulf & Ohio.

North Carolina once had more than 5,200 miles of railroad corridors that connected every village, town and city in the State. Over the last 60 years, under greater competition from the trucking industries along with deregulation of the railroad industry, however, railroads have rationalized their rail networks to focus the large network into more densely-served routes that can provide economic rail service to key locations.

Efficient freight rail service is an important component of inland distribution for market opportunities that include large or heavy loads, containerized goods, or transport of goods

beyond a cost-efficient trucking distance. For the most part, North Carolina’s rail network offers sufficient capacity to accommodate additional rail trips across most of the state. The completion of several projects under development such as the Pembroke Turn and the Fayetteville Connector will improve the operational efficiency of the rail network.

Figure 45: North Carolina Rail Network



Source: NCDOT Rail Division

6.4.1 Class I Railroads Serving North Carolina

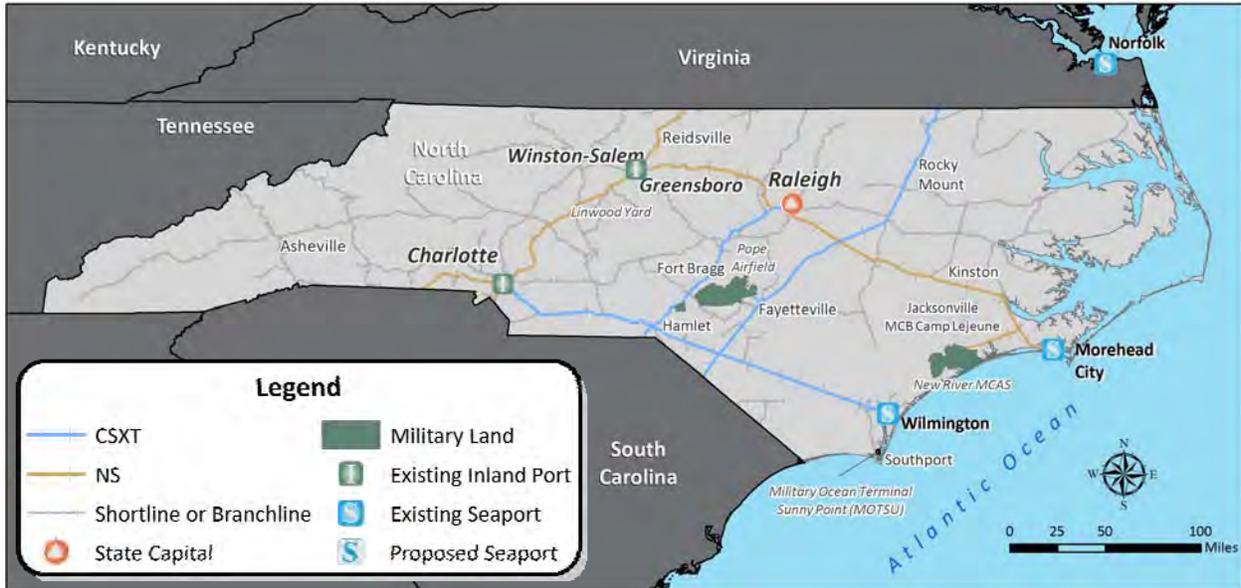
Primary rail service providers in North Carolina are its two Class I railroads: CSX and NS. CSX operates in both an east-west and north-south direction within North Carolina. CSX serves the Port of Wilmington and has a direct east-west rail route to Charlotte from the Port of Wilmington that passes through Pembroke and Hamlet. CSX operates major rail hubs at Hamlet on the east-west route and at Rocky Mount on the north-south, I-95 corridor route. CSX has an intermodal terminal at Charlotte and bulk transfer terminals at Charlotte, Raleigh, Wilmington and Winston-Salem.

Norfolk Southern (NS) operates in both an east-west direction (serving the Port of Morehead City) and north-south direction (roughly paralleling the I-81 corridor). NS has intermodal container facilities at Greensboro and Charlotte, a major classification yard in Linwood at Spencer Yard, and two bulk transfer terminals located just south of Charlotte and east of Winston-Salem. In addition, NS maintains an auto distribution terminal west of Winston-Salem.

As contrasted to CSX, which primarily operates over its own rights of way, the greatest density of NS operation in North Carolina is within rights of way owned by the North Carolina Railroad. NS leases NCRR trackage within three state-owned segments, including the highly-utilized Charlotte-to-Greensboro segment that provides connection between Norfolk VA and NS intermodal facilities in Charlotte and Greensboro. Daily rail traffic on this segment comprises 50 to 60 freight trains and ten passenger trains. The second segment, Greensboro-to-Raleigh, supports limited freight operation as well as daily passenger service. The third NS-leased

segment between Raleigh and Morehead City sees significantly less use, with just three weekly freight trains in and out of the port. The current agreement granting exclusive trackage rights over these State-owned corridors expires on December 31, 2014.

Figure 46: Class I Railroads Serving North Carolina



6.4.2 North Carolina Railroad

The North Carolina Railroad Company is a private corporation whose shares are fully-owned by the State of North Carolina. The NCRR mission is “to maximize the value of the North Carolina Railroad’s properties for the people of North Carolina through partnerships that drive economic growth, enhance freight and passenger service, improve safety and respect the natural environment.” Toward this end, NCRR has partnered with NS, the NCDOT Rail Division, the federal government, and others to advance various capital improvements on the NCRR rights of way. Capital improvements on the state-owned rail right of way completed or underway since 2004 have totaled nearly \$380 million⁴². These investments have largely been focused on the heavily-traveled north-south segments, including various capacity, speed and safety improvements to benefit both passenger and freight rail operations between Charlotte and Raleigh. Recent investments on the Raleigh-to-Morehead City segment comprise mostly capital maintenance and safety projects to replace or rehabilitate rail, at-grade crossings, bridges, and culverts. A new team track (for transload) has also been provided at Kinston.

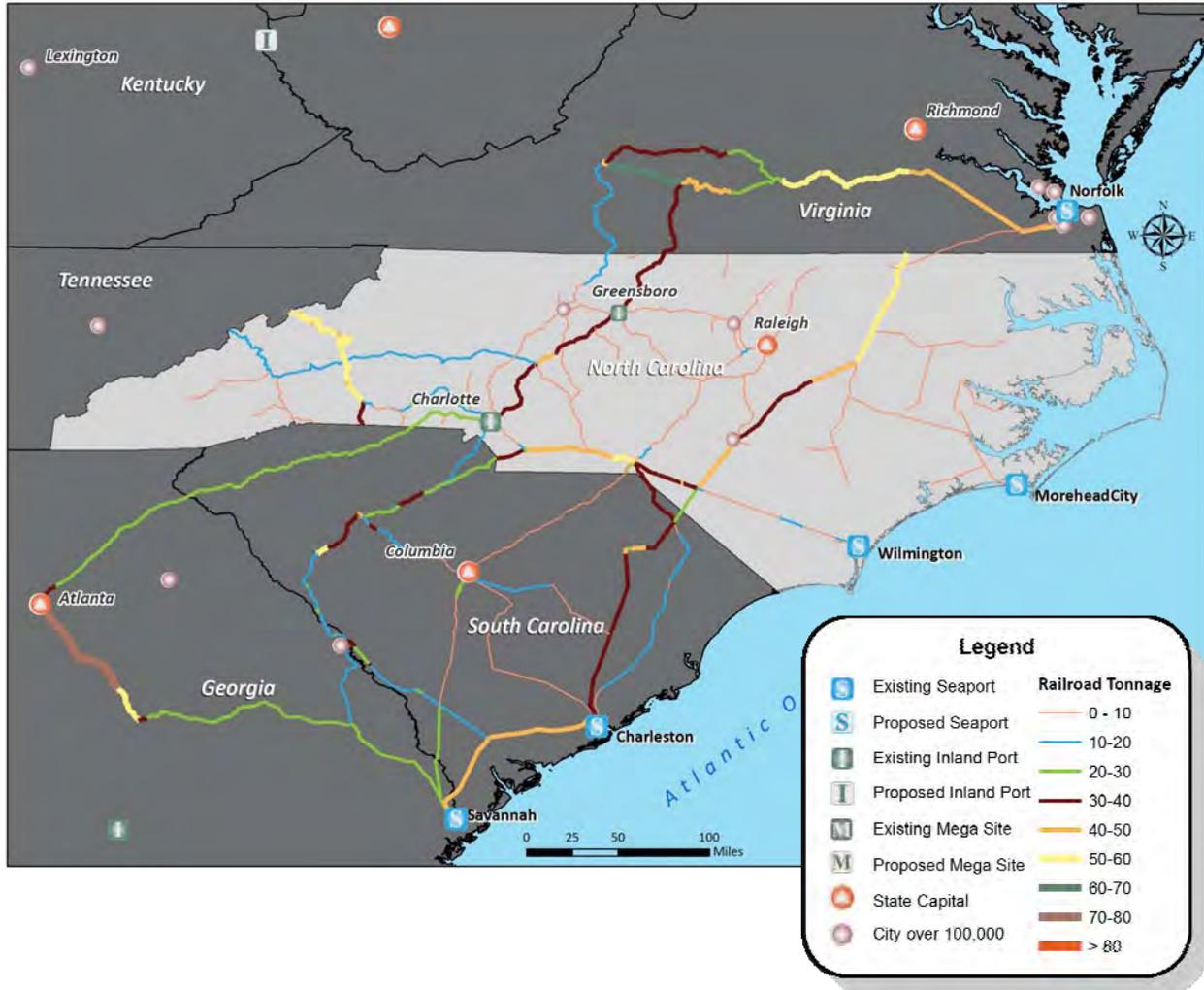
6.4.3 Rail Service Density and Frequency

Overall, the North Carolina freight rail network provides rail connection across most of the state and to many industries. Review of previous studies and discussions with stakeholders, however, identified both operational and physical constraints that challenge the cost-efficient movement of rail freight within North Carolina. With many in-state haul distances of 250 miles or less, it can

⁴² From www.ncrr.com NCRR Capital Investment Projects interactive map

be difficult for the railroads to compete with truck operators for this market. Rail service is generally more competitive for longer hauls and along corridors that generate higher freight tonnage.

Figure 47: Annual Rail Freight Tonnage on Primary Routes in North Carolina and Surrounding States (thousands)



Source: AECOM/URS from ESRI, NCDOT, NCDOC, FAF 3.1, and USGS ThematicMapping world borders dataset

Based upon a waybill analysis conducted by North Carolina Department of Commerce for the period of 1999 through 2003, more than five times more rail traffic was shipped into North Carolina than out of it. Ten commodity groups accounted for 95 percent of North Carolina rail tonnage and 88 percent of rail carloads on rail corridors within the state: coal, farm products, nonmetallic minerals, food products, lumber or wood products, pulp and paper products, chemicals, clay, concrete, glass and stone products, intermodal (containers), and hazardous materials.

Rail corridors within North Carolina geographically link the nation’s northeast and southeast regions, with the greatest amount of rail traffic through the state bridging these two regions. This

north-south traffic dominates the volumes carried on rail lines within North Carolina. Rail traffic on the NCR owned Charlotte-to-Greensboro segment of the NS north-south route, for example, comprises 50 to 60 freight trains each day. By contrast, the NS-leased NCR right of way between Raleigh and Morehead City is served by just three weekly freight trains in and out of the port. With daily train service provided by CSX, the Port of Wilmington generates approximately twice the rail traffic of Morehead City; however, freight tonnage moved by rail in and out of either port is less than 10,000 tons per year.

6.5 Inland Facilities

6.5.1 Inland Ports, Intermodal Facilities, Logistics Centers and Mega Sites

An inland ports, intermodal rail facilities and logistics sites support the distribution of waterborne goods in the port hinterland. These facilities may be used to perform tasks that package or repackage goods, loading containers, and transfer of containers between truck and rail. Tasks such as receiving processing, customs requirements, inspection, and handling for cross-dock shipment may also be handled at an inland port. Many functions previously performed dockside may be transferred to inland sites, thereby relieving demand for limited area on or near the marine terminal. It also may reduce the container handling space and activities dockside where space can be a premium.

NCSPA Inland Terminals (Charlotte and Piedmont Triad)

As described in Sections 4.2.3 and 4.2.4, NCSPA has two truck-only inland terminals in Charlotte and in Greensboro. The Charlotte Inland Terminal (CIT) is used to store and transfer containers destined for Wilmington, Charlotte, or other inland areas. The Piedmont Triad Inland Terminal (PTIT) is not being used. North Carolina shippers and transportation providers did not identify these facilities as key assets in transport of waterborne goods.⁴³

CSX Charlotte Intermodal Terminal

CSX operates an existing intermodal terminal west of downtown Charlotte. The existing facility has an annual capacity of 80,000 lifts.⁴⁴ As part of the National Gateway program and in cooperation with NCDOT, CSX has initiated the environmental analysis to create capacity and increase efficiency at this terminal. The proposed expansion would double the capacity of the terminal.

NS Charlotte Intermodal Terminal

NS has an existing 40-acre intermodal yard in north Charlotte with an annual lift capacity of approximately 125,000 lifts. The facility is now at maximum capacity and is not suitable for expansion due to its location near downtown Charlotte. As a result, NS has partnered with the Charlotte-Douglas International Airport (CLT) to relocate the NS facility to the airport. The new 200-acre terminal is forecast to have sufficient capacity to handle the railroad's intermodal

⁴³ From NC Maritime Strategy industry workshops

⁴⁴ A lift is the loading of one container or trailer on or off a railcar.

needs in Charlotte over the next 25 years.⁴⁵ The \$92 million project, partially funded by \$15.7 million in federal grants, is scheduled for completion in 2013.

NS Greensboro Intermodal Terminal

NS also maintains an intermodal terminal in Greensboro, from which they have recently initiated six-day-a-week double-stack intermodal service serving container ports at Hampton Roads VA.

Global TransPark

Global TransPark is an industrial site located in Kinston NC with 5,775 acres of industrial-permitted land nearby. It is owned by the State of North Carolina and has a focus on aerospace, logistics, and industrial activities. GTP is designated as a foreign trade zone and it has some sub-zones. The site will soon have access to four modes of transportation: air, road, rail, and sea. Road connections include US 70 and US 258. A rail connection to the Port of Morehead City on the North Carolina Railroad mainline is underway.

GTP's anchor tenant is Spirit AeroSystems, who has developed a \$200 million, 600,000-SF manufacturing facility on 304 acres, from which Spirit will fill airframe orders to Airbus and Gulfstream. Spirit was incented with a 100-year, \$100 annual ground lease.

GTP developments and operations have been funded through a combination of public (federal and state) and private sources. For the last nine fiscal years since its initial operation, GTP has received State funding to support annual operations; the most recent operations funding has been \$1.28 million per year. In return for this state investment, NCDOC⁴⁶ estimates the following economic benefits to the state due to tenant operations:

- \$27.5 million annual contribution to 13-county regional GDP, including \$16.3 million in taxes;
- \$52.9 million statewide economic impact; and
- \$583.9 million projected statewide economic impact in 2014, including \$26.2 million in future tax revenues from existing GTP tenant operations and future Spirit operations.

With rail connections (underway) and a functioning intermodal facility (proposed) GTP seeks to model itself after Virginia Inland Port. Targeted industries include: aerospace and aviation manufacturing; high-tech manufacturing; logistics services; emergency response; and defense & security. GTP seeks greater strategic coordination and alignment with NCCR and NCSPA. Infrastructure and development proposed in medium- and long-term: additional land acquisition, new Spine Road, transload facility, rail expansion, improved Interstate, and rail connection to Port of Wilmington.

Lenoir Transload Facility

The Lenoir Transload Facility, also called the Caldwell County Trans-Load Facility, opened in 2008 in Lenoir NC near US 321 and Southwest Boulevard. It has a total planned capacity of thirty-six 60-foot railcars. The Caldwell County Railroad Company, a short-line, serves the

⁴⁵ Seven Portals Study – Charlotte Region Report DRAFT, October 6, 2011

⁴⁶ Per North Carolina Global TransPark Authority Strategic Plan (December 2010)

facility with 22.7 miles of track between Hickory and Valmead NC. This rail line interchanges with the Asheville to Salisbury NS secondary mainline.

Virginia Inland Port (Fort Royal)

The Virginia Inland Port (VIP) at Front Royal VA was opened in 1989 to draw container business from the Ohio Valley and away from the Port of Baltimore by providing a direct Norfolk Southern rail connection to Norfolk International Terminal (NIT). The inland port is owned and operated by Virginia Port Authority (VPA). The site offers nearby highway access connection to I-66 and I-81. Rail service between VIP and NIT, which is 220 miles away, includes a minimum of five trains per day and also serves the NS Chesapeake VA facility. Major commodities handled at this facility include auto parts, logs/lumber, paper products, poultry, retail items, and rubber/plastics. VIP is a US Customs Recognized Port of Entry and a Foreign Trade Zone. This inland port has attracted at least 24 warehousing and distribution centers to the area.

Georgia Inland Ports

Georgia has three major inland ports, all linked to the Port of Savannah for deep sea service. Two, Port Bainbridge and Port Columbus, are owned by the Georgia Ports Authority (GPA). Port Bainbridge, operated by GPA, serves both dry and liquid bulk commodities on 107 acres and offers both short- and long-term storage in on-site transit sheds and warehouses. Port Bainbridge is served by two interstates (I-10 and I-85), CSX, and barge. Port Columbus handles liquid bulk on 14 acres on the Tri-Rivers system. It is served by highway, NS railroad, and barge.

Cordele Intermodal Center (CIC), opened in July 2011, was developed as a public-private partnership. The facility includes rail service by three carriers and direct interstate access, on an initial 200-acre parcel. By 2014, CIC is planned to expand to 900 acres. Ultimate rail lift capacity will be 100,000 lifts at full build out. CIC offers chassis operations, which are purported to be able to save shippers 40 percent in dray also.

Additional Planned Logistics Centers and Inland Ports

Legacy Park Mega Site (planned)

Project Legacy is a development proposed by the Union County Partnership for Progress, a public-private economic development organization. The site is located near the planned Monroe Connector and Bypass project on US 74 and would comprise 5,000 acres of industrial and commercial development, including several rail-served tracts. The site in Union County is adjacent to the existing CSX rail line.

Kingsboro-Rose Mega Site (planned)

The Carolinas Gateway Partnership of Rocky Mount NC is promoting a 1,307-acre industrial area in Edgecombe County NC called the Kingsboro-Rose Mega Site. Based on a 2006 study by the Center for Regional Economic Competitiveness, rubber products were identified as a potential growth market for economic development in the area. This site is served by rail (CSX) and highway (US 64). I-95 is approximately ten miles away via US 64.

International Logistics Park (planned)

International Logistics Park (ILP) in Leland NC is a joint economic development venture of Brunswick and Columbus counties in southeastern NC. It is within 16 miles of the Port of Wilmington via US 74 and I-140. It is an undeveloped mega site that has highway access but no direct rail access.

Mid-Atlantic Logistics Center (planned)

On the other side of US 74/76 across from ILP is the Mid- Atlantic Logistics Center which is a privately-owned facility. In addition to the road access noted for ILP, this site has access to a CSX rail line. It is zoned for light industrial and the economic development commission is looking for “rail-dependent logistics businesses such as plastics or furniture manufacturers.”

Brunswick Industrial River Park (planned)

This 900-acre site with 400 developable acres is located along I-140, the Cape Fear River, and the Brunswick County side of the border with New Hanover County in Navassa NC. It is just less than 10 highway miles from the Port of Wilmington. It is zoned heavy industrial and it is within 0.5 miles of a CSX key branch line; a spur extends to the southeast part of the property.

Lands East (planned)

Lands East is a 788-acre industrial park proposed by the Martin County Economic Development Corporation and Pitt County Committee of 100, Inc. The site is within one mile of US 64, US 13 and NC 11. It is bisected by CSX.

Western NC Inland Port (planned)

AdvantageWest is proposing an inland port to include, first, freight consolidation facilities, and later, a large-scale intermodal facility. Potential locations include an existing industrial park in Rutherford County near Progress Energy and CSX and a site in Marion adjacent to Clinchcross Crossing where the north-south CSX and east-west NS railroads intersect.

Planned Inland Ports in Neighboring States

Jafza South Carolina LLC has plans to develop a logistics, manufacturing and distribution park on 1,322 acres in Santee SC (Orangeburg County). The inland port would handle, store and transload containers arriving at Port of Charleston and destined for the US east coast and Midwest. Proposed storage capacity is 660,000 TEU. Highway improvements to the site are currently underway, including extension of SH301 and connections from SH301 to I-95, which recently received USDOT TIGER III funding.

The State of South Carolina has been considering the development of a publicly owned inland ports since 2003 and mega sites since 2009. The inland port locations discussed included: Summerville, the intersection of I-26 and I-95 (north of St. George), and the Upstate near the intersection of I-26, I-85, and I-385 (around Simpsonville). Three mega sites were also recommended for advancement: Chester County (Carolinas I-77 Mega Site), Dillon County, and Kershaw County.

6.5.2 Rail Yards

In addition to the intermodal terminals identified above, CSX and NS maintain several rail yards in North Carolina. CSX maintains transfer terminals and service bulk terminals in Winston-Salem, Raleigh, Charlotte, and Wilmington. CSX's major rail yards are located in Hamlet and Rocky Mount. NS maintains rail terminals in Raleigh, Winston-Salem (bulk transfer), and Asheville as well as a rail hub in Linwood.

6.5.3 Grain Elevators and Truck Scales

Inland grain elevators and truck scales are important assets to support transport of goods to port for export. The locations of both privately-owned and public grain elevators are shown in Figure 48. The locations of highway truck scales are also shown.

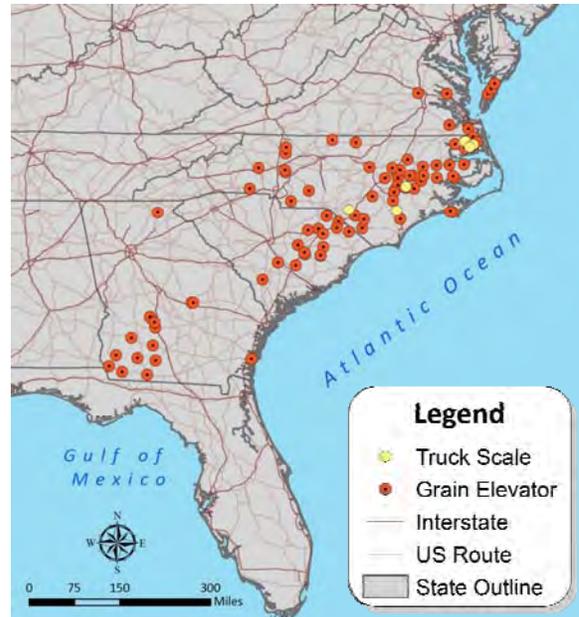
6.6 Infrastructure Supporting Military Activities

The US Military has identified 15 strategic seaports nationwide capable of simultaneously handling commercial and military requirements. Both the Port of Wilmington and the Port of Morehead City are on this list making the state an important location for military investment and the associated spin-off employment that is supported by military centers. The ports at Norfolk VA, Charleston SC, and Savannah GA are also strategic seaports that support military activities in the southeastern US. While not designated as a strategic seaport, Jacksonville FL is also used for military moves. Today, military uses are the predominant factors supporting USACE investments in channel dredging at Wilmington and at Morehead City.⁴⁷

Primary highways used by the military to access North Carolina's seaports include NC 24 and US 70 to Morehead City and I-40 to Port of Wilmington.

The United States Department of Defense (DOD) relies on a well-maintained, interconnected civil rail network to deploy its forces. DOD, in conjunction with the US Federal Railroad Administration (FRA), has defined the Strategic Rail Corridor Network (STRACNET) to identify key railroad lines most important to the national defense.

Figure 48: Location of Truck Scales and Grain Elevators in North Carolina and Surrounding States

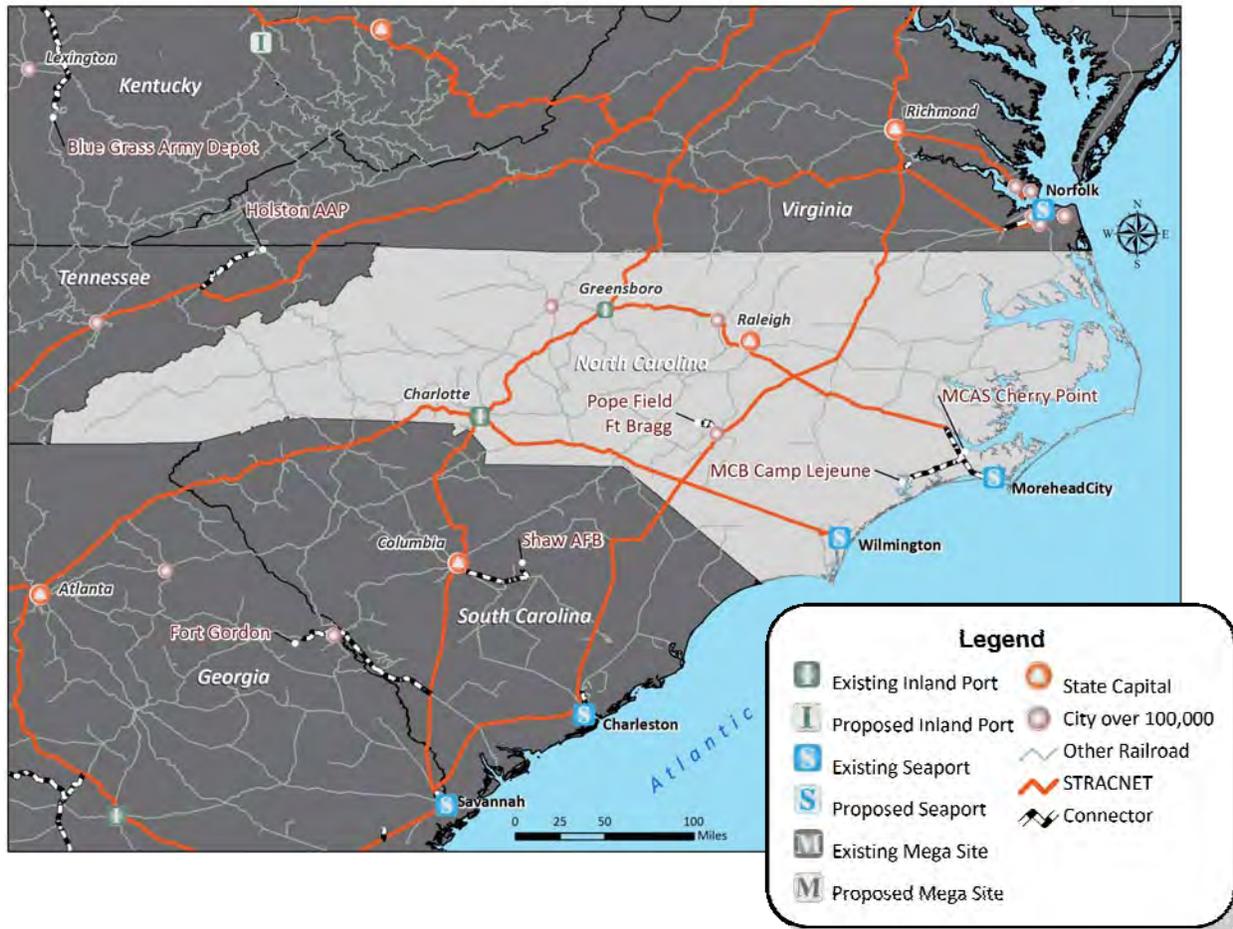


Source: AECOM/URS from (1) USDA (2010). Directory of Export Elevators at Export Port Locations including Facility Data. Grain Inspection, Packers and Stockyards Administration (GIPSA), Federal Grain Inspection Service. (2) <http://yellowpages.aol.com/grain-elevators/nc/>, (3) <http://www.nscorp.com/nscorpportal/nscorp/Customers/Industrial-Products/Agriculture/grain-directory.html> Grain Customer Directory, North Carolina Elevator Grain Facilities, and (4) North Carolina of Ag-USDA Market News, Raleigh, NC, Stephen Beasley Market Reporter, http://www.ncagr.com/market/mktnews/RA_GR110.TXT

⁴⁷ NC Maritime Strategy USACE stakeholder input, July 1, 2011

Within North Carolina, STRACNET and its connectors provides rail access over commercial rail lines to the military bases at Fort Bragg, Cherry Point, Camp Lejeune, and to the strategic military ports at Wilmington and Morehead City.

Figure 49: US Strategic Rail Corridor Network (STRACNET)



Source: AECOM/URS from ESRI, Military Surface Deployment and Distribution Command

7 INFRASTRUCTURE INVESTMENT NEEDS

7.1 Assumptions and Methods for Evaluating Infrastructure Investments

7.1.1 Port Terminal Capacity and Efficiency

Evaluation of existing and proposed port terminal capacity was performed using AECOM's proprietary Preliminary Capacity (PRECAP) spreadsheet analysis model. PRECAP is a static model of terminal capacity to analyze capacity of the terminal berth, backland storage area (container yard), rail operations, and gate operations. The primary outputs from PRECAP are annual capacity of each of these terminal elements, which can then be evaluated as independent features or as linked elements.

An important benefit of this model is its ability to identify the element that is constraining overall terminal capacity and to focus investments where the greatest capacity improvement can be achieved. For example, the model may be used to establish parameters for the container yard and for the gate to match available berth capacity so that the terminal has a balanced capacity across all elements. Table 23 summarizes the key inputs to PRECAP for each terminal element.

Table 23: List of Input Parameters in PRECAP Model

Berth	Backland (storage yard)	Rail	Gate
Cargo moved per vessel call	Mix of cargo types	Number of rail cranes in use	Gate to vessel move ratio
Cranes used per vessel	Dwell time	Rail crane productivity	Hourly arrival pattern
Crane productivity	Static storage capacity	Working hours	Number of gate stages
Work hours	Inventory peaking factors	Switching delay	Fraction of trucks that visit each stage
Non-work time at berth		Static working track capacity	Truck processing time at each stage
Seasonal peaking factors			
Maximum allowable berth utilization			

Actual capacity of a facility may be limited by one or more of these parameters, so, for example, container storage area alone cannot define the capacity of a container terminal.

PRECAP was used to analyze a range of alternatives and also to perform an independent evaluation of overall regional cargo (container, bulk, breakbulk, and Ro/Ro) capacity. PRECAP has been developed over many years of experience at port facilities around the globe in the planning and analysis of dozens of marine terminals. PRECAP is currently used by the Port of Los Angeles, the Port of Long Beach, and Port Metro Vancouver (Canada) as the standard tool for determining their port terminal capacity.

For NCSPA facilities, PRECAP analysis used actual labor costs and terminal productivity. For peer ports where this detailed operating data was not available, industry averages were used such as those for container yard storage capacity based on type of cargo handling equipment shown in Table 24.

Table 24: Comparative Storage Capacities of Container Yards using Various Types of Handling Equipment

Container Yard Cargo Handling Equipment	Static Storage Capacity (TEU per gross acre)
Rubber tired gantry cranes and top picks (RTG/TP)	7,500
Wheeled storage or top picks (Whl/TP)	3,500
Straddle carrier (Strad)	4,500
Automated stacking cranes (ASC)	10,000

Source: AECOM, from industry data

7.1.2 Water Access

Water access was evaluated based on location of navigation channels, sail distances and maneuverability within port navigation channels. In addition, existing depths and the volume of dredging that would be required to build and maintain navigation channels to design depths were considered to meet the vessel needs appropriate to each market scenario. Because geotechnical issues such as the type of dredge material can significantly change costs if harder material such as rock is encountered to meet the design depth, the presence of rock bottom or shell bottom was identified from available GIS datasets if channel deepening was proposed. The evaluation of alternative dredging alternatives considered not only the investment in initial deepening but also the higher annual costs for maintenance dredging.

Port terminal sites were evaluated for dredging requirements and costs associated with vessel types associated with the commodity type of each market scenario. This included variations on anticipated future vessel profiles for containerships, bulk cargo, Ro/Ro, military vessels, and barges. Table 25 summarizes vessel types or classifications and corresponding dredging depth requirements associated with their perspective nautical profiles. A keel clearance of four feet for interior navigation channels was used; a keel clearance of six feet was used for exterior, or offshore, segments of a prospective navigation channel.

Table 25: Approximate Required Dredge Depths Associated with Prospective Vessel Types

Vessel Class	Panamax	Post Panamax (PPX)	PPX 5th and 6th generation	Neo Panamax (NPX)
Capacity	5,000 TEU < 80,000 dwt	5,000-7,000 TEU	5,000-8,000 TEU	> 8,000 TEU
Dredge Depth	up to 42 ft	45 ft	47 ft	51 ft

Source: AECOM, from industry data

Screening of Potential Deepwater Container Port Sites

Analysis of potential new container port sites included a high-level screening of water access that considered meteorological-oceanographic (met-ocean) factors such as winds, waves, water levels, currents, and sedimentation. The analysis of water access relied on available data from the University of North Carolina (UNC), USACE, and the North Carolina Division of Coastal Resources (NC DCR), from previous reports as well as GIS datasets.

The port site screening process also included review and avoidance of environmental constraints, within the waterways and along coastal lands. Environmental factors evaluated to identify potentially suitable port locations included COBRA zones (Coastal Barrier Resource Act), presence of federal, state and county parks or national seashore, federal and state wildlife and waterfowl refuges and management, and existing land use and development concentration. Footprints within or proximity to coastal wetland, significant natural heritage areas, protected lands, public water wells or aquifers, NPDES sites, hazardous waste disposal sites, submerged aquatic vegetation (SAV), shellfish growing areas, hard bottom (rock or shell) areas were also considered. This screening-level evaluation did not include a full environmental assessment, which would be required to advance any of the project alternatives.

Ongoing USACE Wilmington Harbor Navigation Project Feasibility Study

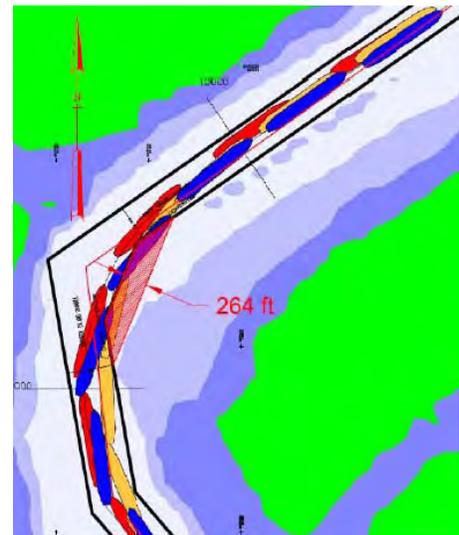
Maritime Strategy efforts relied upon available data from the US Army Corps of Engineers (USACE) and were coordinated with USACE to the extent possible. USACE conducted a *Reconnaissance Study 905(b) Analysis* of potential improvements to the Wilmington Harbor, upon conclusion that there is a federal interest in participating in a more detailed feasibility study, is now investigating the feasibility and challenges associated with modification of the Wilmington Harbor. USACE has identified several navigation challenges to be addressed in the feasibility study, including 1) Baldhead shoaling of navigation channel east side, 2) Battery Island turn restrictions, and 3) restricted turning basin dimensions.

Alternatives now under evaluation by USACE are summarized below. In consideration of this concurrent effort underway, the *Maritime Strategy* does not address the technical feasibility of these improvements, but has incorporated information available from USACE into the conceptual scope and cost of infrastructure investment alternatives.

Realignment or Widening of the Entrance Channel S-Turn

As part of its ongoing analysis, USACE is focusing on the recurrent challenges presented by the “S” turn at the Cape Fear Inlet. Alternative solutions to shoaling problems at Bald Head Island may include channel realignment.

Figure 50: Simulation of Vessel Maneuvers at Battery Island Turn



Source: Moffatt & Nichol, NCSPA Port Business Case Study, SHIPMA simulation results, February 2011
Red and blue represent Panamax inbound and outbound vessels; gold represents 8,000-plus TEU Post Panamax vessel

In addition, the turn at Battery Island is very difficult for vessels to navigate. Several past investigations have indicated that the lower reaches of the Wilmington Harbor Navigation Channel near Southport would have to be widened or realigned to accommodate larger vessels making that turn. Past numerical simulations (see Figure 50) and ship records indicate this turn is difficult to maneuver for large vessels making a port of call today. USACE has suggested that further ship simulation is required to identify a preferred solution, whether by straightening or widening the existing entrance channel alignment.

Anchorage (Turning Basin) Expansion

The USACE Wilmington Harbor study will also examine the feasibility and requirements to expand the anchorage and turning basin to accommodate larger vessels.

Figure 51: Turning (Anchorage) Basin Expansion at Site 5 - Port of Wilmington



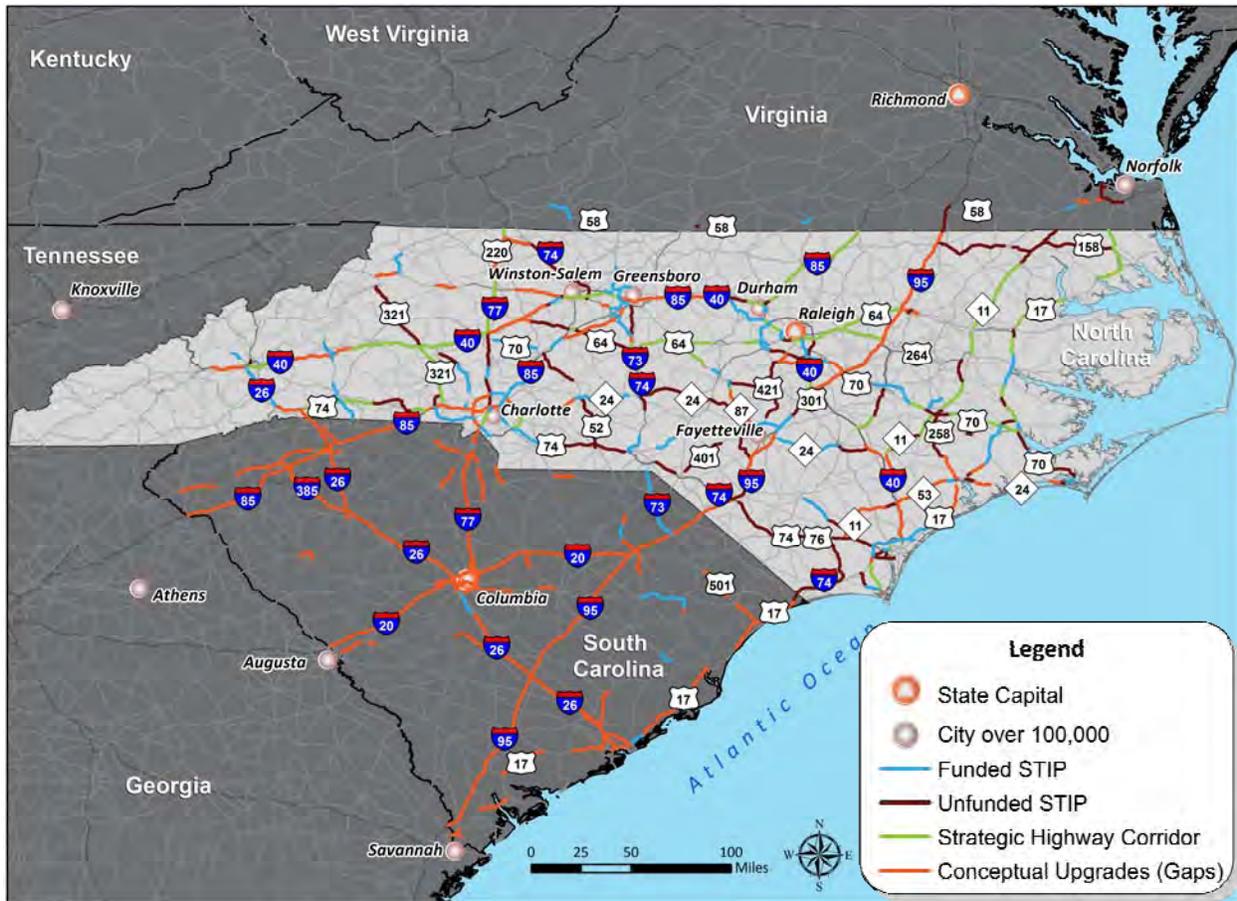
Source: USACE

7.1.3 Highway Network

Existing roadway conditions, along with future conditions under various scenarios, were evaluated based on funded highway projects, long range planning projects, and other projects under consideration. Travel time, distance, and potential capital costs were identified for various highway investment alternatives for existing and proposed ports and inland freight nodes. In consideration of freight movement patterns within the South Atlantic region, evaluation of regional highway infrastructure included interstate and state highway networks in North Carolina as well as Virginia, South Carolina and Georgia.

The multi-state highway network was evaluated using the Freight Analysis Framework-3 (FAF) model, developed by the Federal Highway Administration (FHWA) in cooperation with USDOT. The GIS-based FAF model is a national network of roads developed to evaluate 2007 truck flow and to assess systemwide congestion on the nation's highway system in forecast year 2040.

Figure 52: STIP, Long Range Transportation Plans, and Potential Additional Highway Improvements



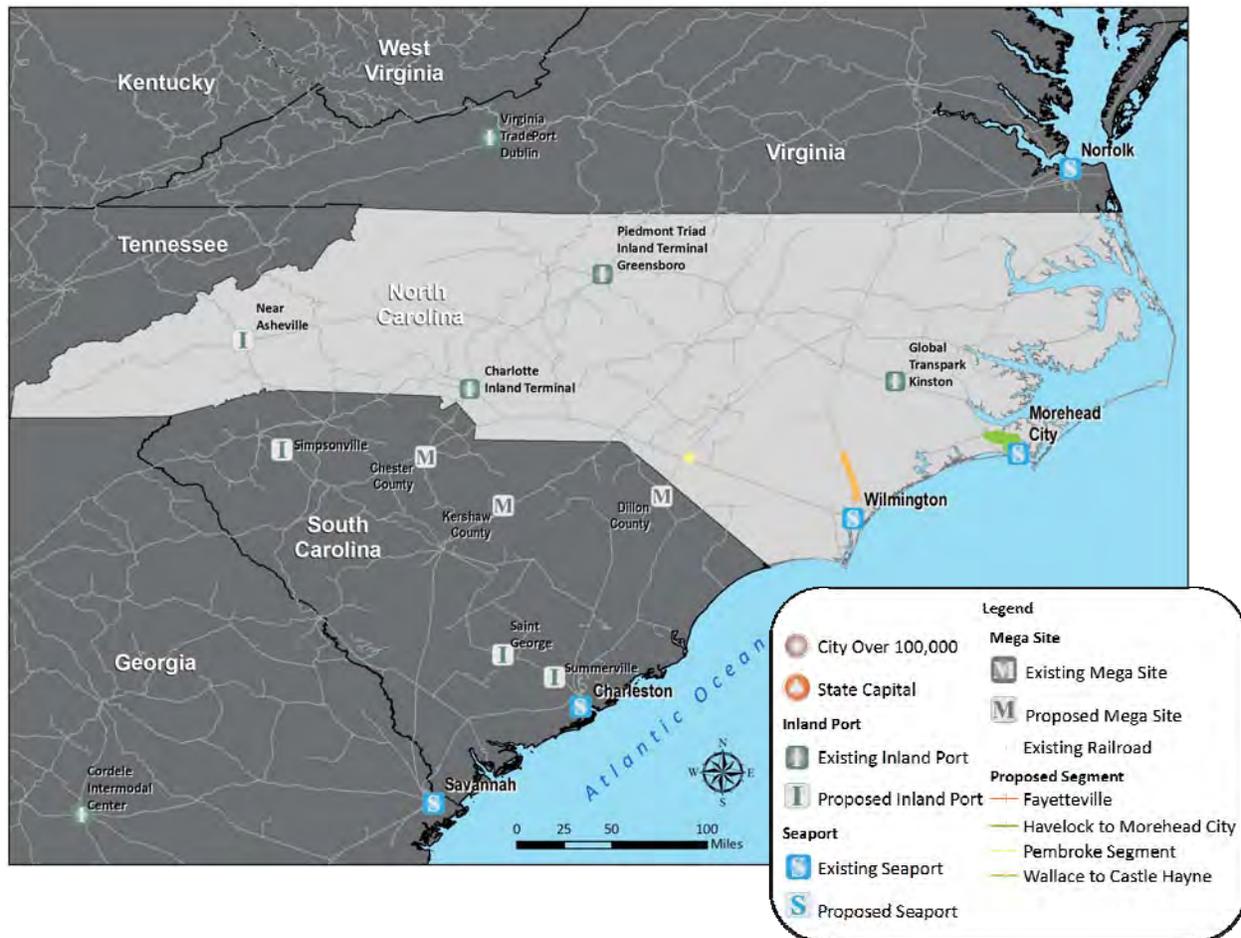
Source: AECOM/URS from ESRI, NCDOT, FAF v3.1, and USGS ThematicMapping world datasets

The 2007 FAF model was used without modification to represent current highway infrastructure operational conditions. To evaluate 2040 conditions, projects included in State Transportation Improvement Program (STIP) for subject states and funded through 2018 were incorporated into the 2040 FAF model. Unfunded STIP projects and projects included in long range transportation plans were also incorporated. Additional potential highway improvements were then added to complete remaining infrastructure gaps and identify associated travel time benefits that would be realized by North Carolina shippers.

7.1.4 Rail Network

Rail network needs were identified and prioritized through review of existing rail freight tonnage to identify challenges of securing regular, competitive rail service to port locations; and through discussions with railroad and industry stakeholders to identify known operational constraints. Attention focused primarily on a range of rail improvements projects currently under analysis or development. These projects are identified in Figure 53. The potential benefits of each project to the various market opportunities were evaluated.

Figure 53: Existing, Planned, and Proposed Railroad Infrastructure



Source: AECOM/URS from ESRI, FAF v3.1, USGS ThematicMapping world borders dataset

7.1.5 Delivered Cost Model

A key element of the *Maritime Strategy* assessment of the benefit of potential infrastructure investments on the cost-effective movement of goods in and out of North Carolina was the development and application of a comprehensive delivered cost model. Delivered cost, as defined by the team, is the cost of moving one unit of cargo from an origin to a destination in terms of both time and money. The delivered cost model was used to establish comparative costs of point-to-point goods transport over sea, through the port, via road and rail and including handling and transfers. Current and future transportation networks were evaluated under various infrastructure investment scenarios.

Input to the model included origin/destination information for target commodities, baseline regional commodity growth forecasts, highway investment scenarios and travel times generated from the FAF model, and potential port and inland terminal facilities. Where inland nodes were dispersed – for example timber and soybean growing areas – one or more central points were identified as the basis for travel time and cost calculations.

Ocean and landside routes were evaluated to include existing and potential ports of entry in North Carolina as well as ports in Virginia, South Carolina, and Georgia. For routes transiting the Panama Canal or Suez Canal, analysis of ocean-going costs extended to the common point of the canal. In consideration of forecasts provided IHS Global Insight and the study team's assessment of waterborne freight patterns in the Piedmont-Atlanta Megaregion, the potential for diversion of significant Asia-Pacific waterborne cargo via an all-water route through the Panama Canal was not evaluated. Rather, the evaluation of delivered costs focused on goods forecasted to use southeast regional seaports.

Output from the delivered cost model included potential shipper cost and time savings that could be realized from various sets of maritime infrastructure investments. In developing market opportunities and associated volumes, shippers were assumed to use the port and land route within the southeastern US that offered the lowest total delivered cost.

7.1.6 Consideration of Inland Facility Needs

The evaluation of inland facilities aimed to identify focused investments that would facilitate the loading, transfer, or warehousing of goods. The following factors were considered in the identification of potential new inland facilities:

- Current availability of freight loading/unloading/transfer or logistics facilities at locations convenient to identified shipper production, manufacturing or distribution centers that meet the needs of each market scenario.
- Proximity to production or distribution centers and the potential to generate synergistic benefits (e.g. serving more than one user or industry)
- Ease of highway and rail access to existing and proposed inland facilities
- Potential to focus investments in a strategic area (high-density production area) or corridor (where synergistic developments could be generated)

7.1.7 Development of Conceptual Capital Cost Estimates

For each infrastructure project proposed to realize potential market opportunities, conceptual cost estimates were prepared to quantify the required capital cost investment for proposed waterway, marine terminal, rail, highway and inland improvements. Costs were developed to a level to allow for fair comparison among the alternatives being evaluated.

Port and Terminal Costs

Construction cost estimates for port terminal development were developed to capture costs for on-terminal and adjacent off-terminal improvements. Rough order-of-magnitude (ROM) construction costs for wharves, terminals, on-dock rail yards, gate facilities, and utilities were generated based on recent bids and final design estimates for ports and harbor projects from throughout the US adjusted to the North Carolina construction market. Terminal development costs considered demolition, civil site work, wharves, electrical, security and communications, utilities, truck processing gates, buildings, design and contingencies. For port development alternatives affecting known wetlands, additional costs for wetland mitigation were also incorporated.

Highway Costs

In most cases, STIP and long range transportation plan data collected from the various states also provided project costs. Costs obtained for STIP projects, included both construction and right of way costs estimates. STIP projects that are currently under construction were assumed to be complete by 2040; therefore, the costs of those projects were excluded from the analysis. For additional improvement projects proposed to be implemented by 2040 and long range transportation plans without cost estimates reported, the NCDOT Construction Estimation Worksheet was utilized to develop high-level construction costs. These estimates are based on a cost per mile depending upon the type of improvement and include various contingency factors. For projects without right of way costs reported, a factor was applied to the construction cost estimates. While right of way costs are typically higher for urban projects, for the purposes of this report it was assumed the right of way costs would be around 29 percent of the construction costs.

Railroad Costs

Order of magnitude cost estimates for the identified railroad related improvements were developed from conceptual alignment or scope of the improvements. Major cost items were identified and assigned unit prices based on recent contract bids and self-performed track construction costs from railroad projects in the southeastern US. Existing available cost estimates were used where available from prior studies or reports. Consistent with highway costs, 29 percent was added to railroad projects requiring new right-of-way.

Dredging Costs

Dredging costs were based on the volume of material to dredge a new channel or modify an existing one. Dredge volumes calculated as the difference between the representative shape and dimension of the existing channel and a modified trapezoidal cross-section for the deeper depth. Volumes were then aggregated along all navigation channel reaches. It was assumed that the current federally-authorized channel width and depth has been maintained. Dredged volumes for berths and turning basins were calculated as an average deepening across the projected area of the dredging beyond the main channel. Unit dredging costs were developed from USACE's recent, historic dredging costs within North Carolina, with consideration given to geotechnical characteristics of each channel reach.

The costs for regular maintenance dredging was estimated from USACE maintenance records and costs, taking into account the higher shoaling rates in early years after initial deepening until equilibrium is reached in the channel.

7.2 Investments to Improve Overall Transportation Network

Many of the proposed investments in North Carolina's maritime infrastructure have the potential to improve the overall efficiency of goods movement within the state, serving to enhance the cargo under multiple market scenarios. In particular, improvements to inland highway and rail networks will improve freight access across the state. Near the state's port facilities, enhanced road and rail connections will serve all users of the port.

7.2.1 Highway Corridors

Freight mobility through North Carolina's highway network will rely on improvements that provide direct and timely access for trucks to port facilities from inland freight nodes and facilities, including rail intermodal terminals, manufacturing, agricultural production, warehousing and distribution centers.

Based on the maritime market opportunities identified for North Carolina, investment in the US 70, I-73/I-74, and I-40 highway corridors will have the greatest effect in reducing trucking travel times within the state. Focused investments along these targeted freight corridors is also consistent with the 2010 Statewide Logistics Plan recommendations for highway improvements, including creating of a multimodal corridor between Charlotte and Wilmington and enhancing the primary highways of the National Truck Network in North Carolina. The Logistics Plan also recommended improvements to I-95 to support pass-through traffic; while there are many benefits to the enhancement of this vital corridor, improvements to I-95 were not demonstrated to support the specific market scenarios evaluated under this study.

US 70

The 70 Corridor Commission, which was established to advance the needs of US 70, has identified this highway as a vital transportation corridor in North Carolina⁴⁸. This 135-mile strategic highway corridor is a vital farm-to-market road serving North Carolina's Eastern region and a travel route that supports the State's three major military bases. Enhancements to US 70 will more effectively move agricultural producers to end markets, will support efficient movement of US military troops, will logistically connect Global TransPark to the state's transportation network and port facilities, and will provide a safe and efficient roadway for visitor's the North Carolina's coastal communities.

US 70 provides primary access to the Port of Morehead City and eastern North Carolina. While portions of US 70 have already been improved to freeway or expressway standards, other segments need to be upgraded to enhance access from the interstate system and Raleigh Durham region to places such as the Global TransPark, military facilities, and the Port of Morehead City in eastern North Carolina. Projects such as the currently funded US 70 Havelock Bypass, the replacement of the Gallant's Channel Bridge, and currently unfunded projects such as the US 70 Kinston Bypass and upgrades in the vicinity of James City would enhance access. Additionally, the North Carteret Bypass would enhance access for freight movement to the Port of Morehead City.

I-73/74 (US 74)

US 74 connects the City of Charlotte with the Port of Wilmington. The CSX rail line also runs parallel to the corridor. Investments on US 74 enhance access to industries in the State's largest metropolitan area. Investments between Rockingham and Wilmington will also help complete I-73 / 74, enhancing access to the Triad. With upgrades to US 74 and the completion

⁴⁸ From remarks made by US 70 Corridor Commission executive director, Durwood Stephenson, to the GLTF and Seven Portals Study team.

of I-73/74, industrial parks and mega sites along this corridor could have access to both the rail and interstate systems.

Completion of this interstate will enhance access from Wilmington to the Triad area. The interstate will give motorists traveling to the Triad and other portions of the Central Piedmont an alternative to I-40 and I-85 in Raleigh, Durham, and Greensboro. In addition, improvements to US 74, west of Rockingham will enhance intrastate travel between Charlotte and the coast. Also, this highway is paralleled by the CSX rail line for much of its alignment, providing both modes of access to existing and potential industries.

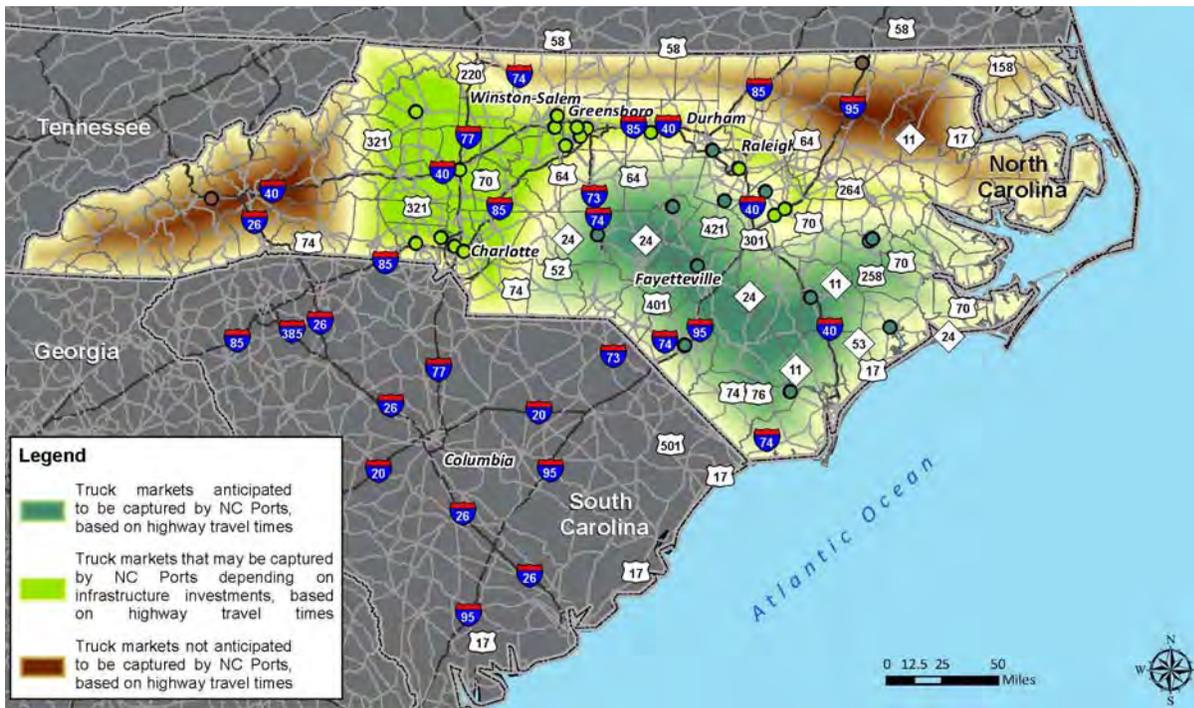
I-40

The Interstate 40 corridor is the backbone of the state's internal transportation network, running the length of the state and connecting to I-26, I-77, I-85, I-73 / 74, and I-95. The corridor serves as an important connection to the Triad and Triangle regions.

7.2.2 Potential Trucking Market Area for North Carolina Ports

Proposed highway improvements within North Carolina were evaluated for potential travel time savings and their ability to realize lower delivered costs for North Carolina shippers. In some cases, alternative regional ports remained a lower cost alternative to NC-based importers or exporters of waterborne goods. For those areas, continued focus on regional mobility along interstate routes such as I-26, I-40, I-95 and I-85 will be important to allowing North Carolina shippers to cost-effectively deliver goods to market. Other highways including NC 11 and US 17 in the northeast region of the state will also be critical routes to delivery of goods to port facilities to the north. The FAF and Delivered Cost Model analysis indicates that, in 2040 and based on projects in the regional STIPs, waterborne goods moving from the westernmost reaches of North Carolina will best be served by the Port of Savannah while waterborne goods originating from the state's northwesterly counties will best be served by the port facilities in Norfolk VA.

Figure 54: NC Regions that will Realize Shipper Savings from Proposed Highway Investments



Source: AECOM/URS from ESRI, NCDOT, USDOT Freight Analysis Framework v3.1, USGS ThematicMapping world borders dataset with proposed *Maritime Strategy* highway project improvements.

7.2.3 “Last Mile” Connections

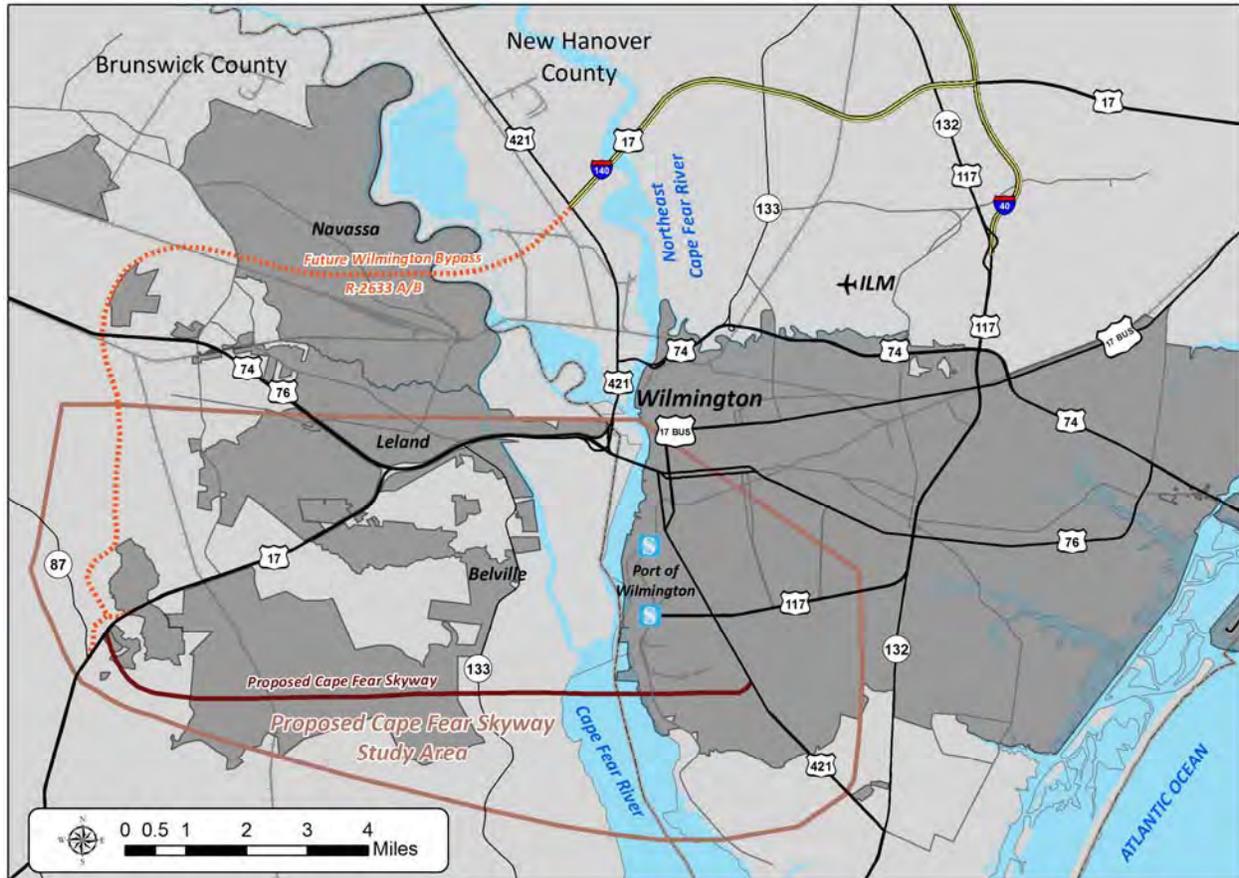
Access to Port of Wilmington

Located in downtown Wilmington, access to the Port of Wilmington currently utilizes several US routes which are concurrent with city streets and include numerous at-grade rail crossings and unsignalized and signalized intersections. The Cape Fear Skyway project has the potential to significantly improve access to and from the Port of Wilmington. The Cape Fear Skyway, which is included in the STIP as project U-4738, is described as a new route from US 17 in Brunswick County to Independence Boulevard-Carolina Beach Road intersection including a bridge over the Cape Fear River. While the Cape Fear Skyway has several potential purposes identified for the project, one specifically includes improving access to the Port of Wilmington.

With the completion of the Cape Fear Skyway and STIP Project R-2633, also known as the Wilmington Bypass, a full control of access freeway will completely surround the western and northern boundary of the City of Wilmington. These projects will provide a freeway facility from Wilmington to primary corridors such as US 74, US 76, US 17, US 421 and I-40.

These projects are planned to be funded through toll revenues and the existing STIP, respectively, so are included among the baseline infrastructure improvements supporting truck access to Port of Wilmington.

Figure 55: Access to Port of Wilmington via Planned Wilmington Bypass and Cape Fear Skyway



Source: AECOM/URS with North Carolina Turnpike Authority information.

Access to Morehead City and Radio Island

The North Carteret Bypass is one of six major projects identified under the “Super 70” corridor. This 23-mile project would reroute US 70 around downtown Morehead City via a four-lane divided expressway or freeway on new alignment.

Figure 56: The North Carteret Bypass



Source: ESRI, NCDOT, USDOT Freight Analysis Framework v3.1, USGS ThematicMapping world borders dataset, Seamap-SA, 2001 and Moser and Taylor, 1995.

Productive development of Radio Island, which is today largely unused, will also require improved site access under any market scenario. All infrastructure investment alternatives that include potential port facilities on Radio Island have incorporated a new access road and connection to US 70, similar to that shown in Figure 57.

Figure 57: Enhanced Roadway Access to Radio Island



Source: Long-term recommended roadway improvements as prepared for NCSA by Moffatt & Nichol (2007) and included in the request for letters of interest for development of Radio Island.

7.2.4 Rail Network

North Carolina's freight rail network today serves primarily north-south traffic, with major regional intermodal facilities in Charlotte and Greensboro. Improved rail service is an important component of inland distribution for market opportunities that include large or heavy loads, containerized goods, or transport of goods beyond a cost-efficient truck distance. For the most part, North Carolina's rail network offers sufficient capacity to accommodate additional rail trips. The completion of several projects under development to improve rail system operation, such as the Pembroke Turn and the Fayetteville Connector, will improve the operational efficiency of the rail network.

NCDOT is currently pursuing the rehabilitation of the existing bascule railroad bridge that provides access between the Port of Morehead City general cargo terminal and Radio Island. Built in 1950, the bridge has suffered significant deterioration over recent years. The bridge span will be rehabilitated by adding plates to the main girder, replacing floor beams and track stringers, and repairing support towers and bearings. This approach will allow for operation of the bridge lift function and will support E60 loading over the span.

The critical driver of success in realizing effective and cost-competitive rail service is the ability to attract sufficient freight volumes to make train service a viable alternative to trucking. Market scenarios were evaluated for potential to attract rail service based on the following factors:

- Potential rail freight tonnages to support minimum daily train service for containerized goods, or weekly train service for bulk and breakbulk commodities
- Proximity of rail yards to shippers that would use rail service
- Anticipated train haul distance of 200 miles or more
- Potential for rail-delivered freight to avoid highway bottlenecks and congestion, particularly in and around North Carolina's urban centers.

Proposed rail improvements were also aimed to be complementary to associated highway investments to achieve the greatest overall travel time savings for North Carolina’s shippers.

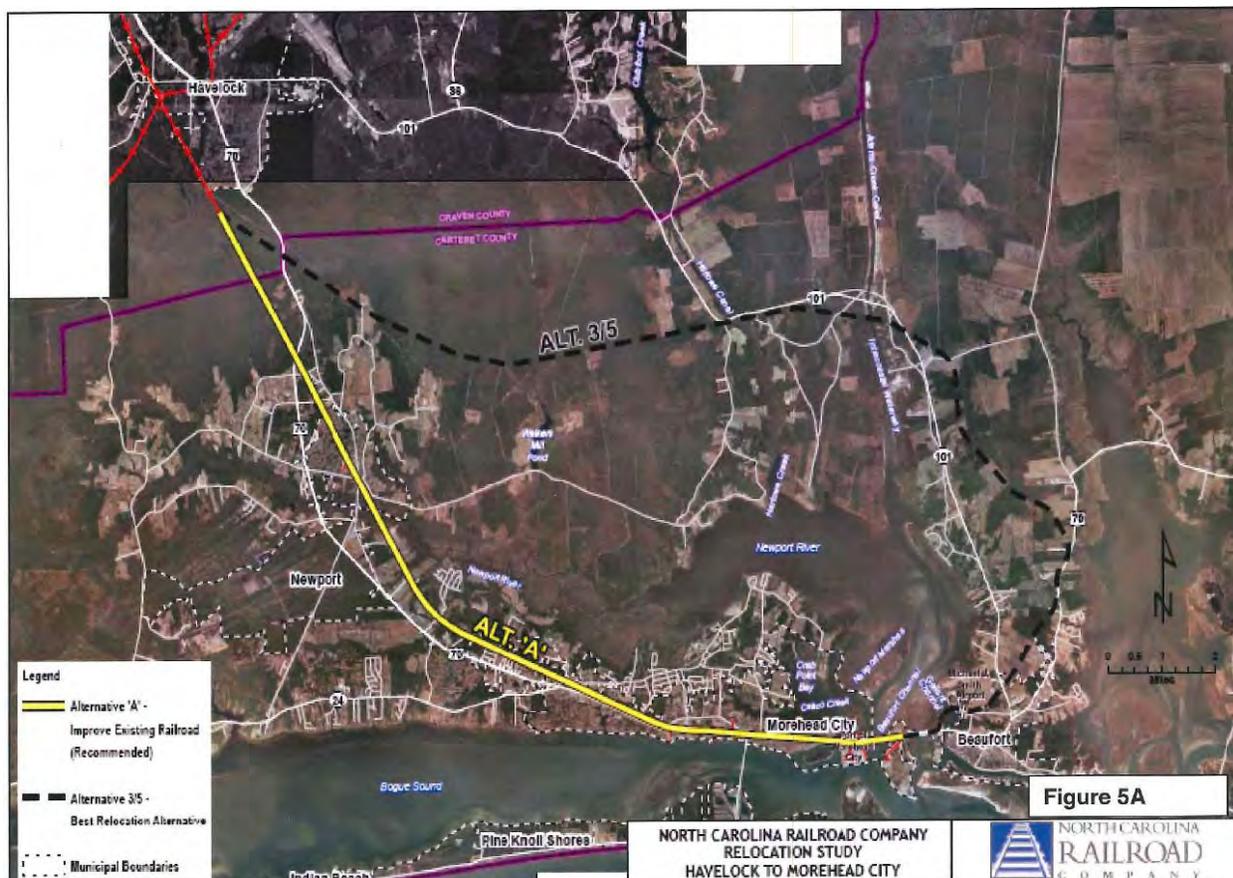
Access to Port of Wilmington

The existing CSX mainline provides direct access to the Port of Wilmington. Implementation of the Pembroke Turn project will improve efficiency rail service to Wilmington by reducing delays at this location, where CSX’s primary east-west and north-south lines cross.

Access to Morehead City

The Morehead City Rail Relocation project proposes to address the railroad operational constraints and local traffic impacts of the NCCR single main track between Havelock and the Morehead City port. The NCCR rail line, over which NS operates and serves the Port of Morehead City, runs generally within the median of Arendell Street through the downtown Morehead City area. This 17-mile stretch of railroad includes 25 at-grade crossings, of which only six have automatic warning devices. The current railroad speed is limited to 15 mph.

Figure 58: Havelock to Morehead City Rail Relocation



Source: Earth Tech and Wilbur Smith Associates for NCCR (2007). *Track Relocation Feasibility Study: Havelock to Morehead City*.

The proposed Rail Relocation is based upon the alignment recommended in the Havelock to Morehead City Rail Relocation Study. The project would reroute rail traffic around the downtown district and eliminate grade crossing between the railroad and US 70.

7.2.5 Inland Facilities

The market opportunities evaluated each have unique transport requirements and origin or destination of goods. The needs for inland loading, transfer, or distribution for each scenario is therefore different and there is no set of inland developments that would support all market opportunities. Rather, the availability and effectiveness of inland facilities was evaluated individually for each market scenario.

7.3 Infrastructure Needs to Support Grain Exports

The limited volume of grain handled by North Carolina ports to date has been via containers. While the volume of containerized grain, particularly soybeans, is projected to grow over the planning period, the significant market opportunity lies in bulk grain exports. North Carolina does not have facilities to handle bulk grain exports from either of its ports, so new port terminal infrastructure and road and rail connections would be required. The existing animal feed/grain facility at the port of Wilmington is dedicated for import use by a single user.

An overview of the infrastructure needs and North Carolina's existing facilities are provided in Table 26. Proposed investments and associated capital costs are identified in the sections that follow.

Table 26: Overview of Infrastructure Needs for Grain

Infrastructure	North Carolina's Needs
Channel depth of at least 40 ft	Bulk grain is expected to be handled by Panamax or smaller Handymax vessels. Each of North Carolina's existing port facilities maintains water depth sufficient to accommodate a typical dry bulk cargo vessel so no additional deepening would be required.
Bulk grain terminal	<p>A new bulk grain export facility similar to the existing Perdue grain terminal in Chesapeake VA would be required to support North Carolina's projected demand for grain exports. The terminal would include silos to store approximately 90,000 tons (3.2 million bushels) of soybeans.</p> <p>Rail unloading at the terminal would require a loop track and storage for approximately 75 railcars as well as an adjacent support yard for managing empty railcars.</p>
Highway access and inland road network	<p>Due to the proximity of North Carolina's soybean growing counties to its ports (refer to Figure 4 on page 25), the delivery of soybeans to a new grain export terminal would be primarily accomplished by truck. The North Carolina Soybean Growers Association reports that about 75 percent of the state's soybeans are grown in the eastern part of North Carolina, from approximately 50 miles west of I-95 and all the way to the coast.⁴⁹</p> <p>Based on the competitive trucking distance from grower to port and the state's current heavy reliance on truck for in-state transport, 90 percent of soybeans are estimated to be delivered to port by truck. Based on 2040 projections, this represents an additional 130 to 150 daily truck trips to the port.</p> <p>Sufficient highway capacity must be provided between soy-producing counties in Eastern North Carolina and the port terminal. Efficient highway connections to existing public and private grain elevators as well as local road connections at the marine terminal are also needed.</p>
Rail access and inland rail network	<p>The most efficient means to transport the volume of grain required to fill a bulk vessel is by rail; however, as described above, rail deliveries are anticipated to handle only about ten percent of total grain volume. This new rail service comprises one 45- to 75-car train per week to the port terminal.</p> <p>The freight rail network within North Carolina includes rail access to each of North Carolina's ports via CSX (to Wilmington) and NS on tracks leased from NCRR (to Morehead City). Grain elevators in the western part of the state are served by NS.</p>
Grain elevators	Grain elevators are required near soy growing areas to support the loading of grains onto truck for export. As illustrated in Figure 48 on page 99, numerous public and private grain elevators are located in the eastern part of the state.

⁴⁹ www.ncsoy.org

7.3.1 Port and Terminal Improvements for Bulk Grain

North Carolina does not currently have dedicated facilities to handle bulk grain exports. There is not sufficient space within existing terminals at Morehead City or Wilmington to accommodate this operation (which requires 30 acres or more depending on rail configuration and connections), so a new dedicated wharf and terminal is proposed. The facility would include silos and conveyors dedicated to grain storage and loading.

Figure 59: Grain Terminals at Port MetroVancouver Canada



Source: Port MetroVancouver

Figure 59, an aerial photograph of the inner harbor at the Port of Vancouver Canada, illustrates a similar grain terminal operation with storage silos at the left and a bulk cargo ship at berth.

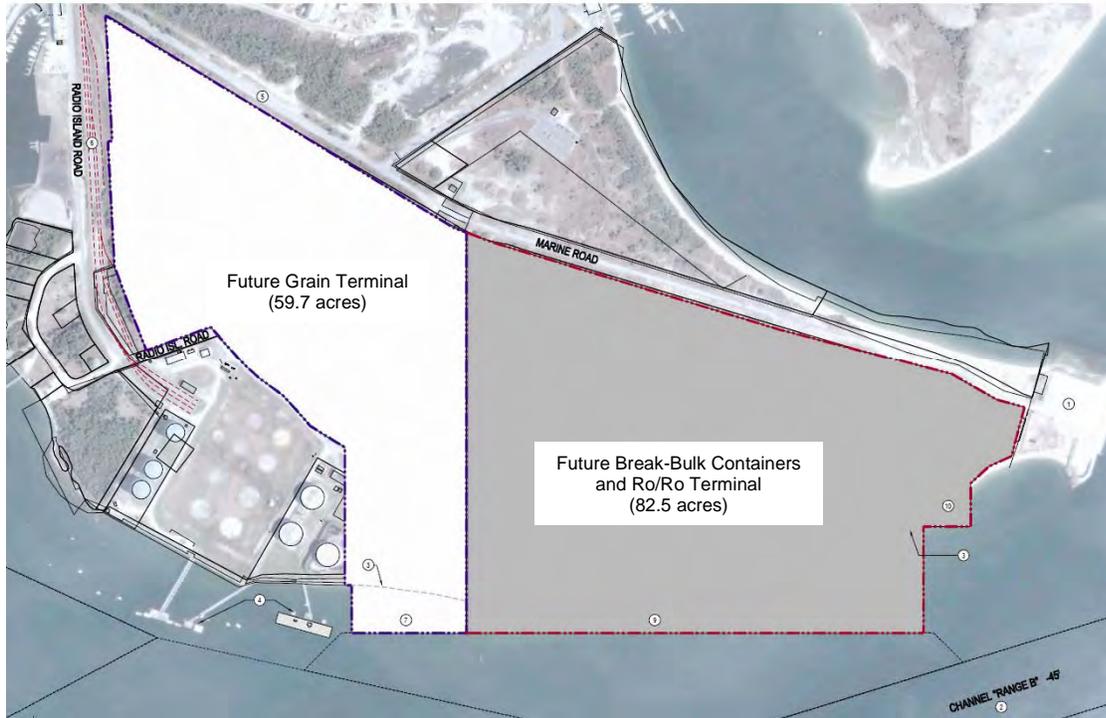
The product is moved from high density storage silos to the vessel via conveyor systems. These systems will likely be enclosed to allow for all-weather operations and to minimize dust emissions.

Rail and truck access to the silos facilitates bulk unloading. The product is released by gravity through the bottom of the truck or railcar into a pit with a conveyor system. This conveyor discharges into the top of the silo. Another conveyor removes material from the bottom of the silo and takes it to a loader arm which can be maneuvered lengthwise along a ship.

The grain terminal would require domestic and fire water infrastructure, domestic wastewater infrastructure, electrical and communication infrastructure, storm water runoff drains and mitigation, and natural gas service for hot water heating within buildings. Dust suppression systems would be used to prevent fires and explosions

Conceptual site locations for new bulk facilities at either Radio Island in Morehead City or the currently unutilized north property at Port of Wilmington are shown in Figure 60 and Figure 61 below. Two alternative sites have been evaluated, but the development of only one of these sites would be required. The terminal area shown is dictated by the space needs for a rail loop and yard to support unloading of unit trains up to 75 cars in length. Some of the area within the loop could be dedicated to other uses because this area is larger than needed for grain storage.

Figure 60: Radio Island Grain Terminal Footprint



Source: AECOM

Figure 61: Port of Wilmington Grain Terminal Footprint



Source: AECOM

7.3.2 Highway Improvements for Bulk Grain

The majority of soy-producing counties are located in either eastern or southeastern North Carolina, including areas surrounding Lumberton and Kinston. Grain improvements will also include local truck access to the terminal. Based on 2040 grain volume projections, approximately 130 trucks per day would deliver soybeans to on-dock silos. Proposed highway network improvements are illustrated in Figure 62.

Radio Island

Local truck access to Radio Island will be achieved through construction of a new access road and tight, modified diamond interchange on US 70. These improvements are illustrated in Figure 57.

For the Radio Island site, key highway corridors for grain include US 70, NC 24 to US 17, and US 74 / 76. Proposed highway network improvements include the construction of the US 70 North Carteret Bypass, the funded Havelock Bypass, improvements in James City, and improvements to NC 24 in Onslow County. These projects are listed in Table 27 below.

Table 27: Detail of Highway Projects to Support Grain Access to Radio Island

ID Number	Route	Description	County
SHC 344	NC 11	new location from US 70 to SR 1732	Lenoir
SHC 345	NC 11	upgrade expressway to freeway from SR 1744 to SR 1835	Lenoir
SHC 346	NC 11	upgrade expressway to freeway from SR 1835 to SR 1110	Lenoir, Pitt
SHC 347	NC 11	upgrade expressway to freeway from SR 1110 to R-2250	Pitt
CU1 24	NC 24	widening from Atlantic Beach Causeway to NC 24	Carteret
CU2 24	NC 24	widening from NC 58 to White Oak River	Carteret
CU3 24	NC 24	widening lanes from NC 172 to FS-1103A	Onslow
FS-1103A	NC 24	access management and drainage improvements from NC 24 to SR 1459	Onslow
R-4431	New Route	new location (Havelock Bypass) to Beaufort	Carteret
CU1 17	US 17	upgrade to freeway from US 17 Bypass in Jacksonville to Maysville	Onslow
FS-1002A	US 70	widening from Morehead City to Beaufort Causeway	Carteret
FS-0802B	US 70	access improvements from James City to proposed Havelock Bypass	Craven
SHC 336	US 70	upgrade to interstate standards from SR 1200 to Kinston Bypass	Craven, Jones
SHC 341	US 70	upgrade to interstate standards from east of La Grange to Goldsboro Bypass	Lenoir
FS-1106B	US 74	upgrade to interstate standards from NC 41 in Lumberton to SR 1585 (Union Valley Road) in Columbus County	Robeson, Columbus
R-4462	US 74/US 76	upgrade to interstate standards from Whiteville to the proposed US 17 Wilmington Bypass	Columbus, Brunswick

Source: AECOM/URS from FAF 3.1 and AECOM Delivered Cost Model

Project ID numbers explained: Please note that although some projects may have STIP numbers (i.e. numbers that start with I, U, R, or X) they are not currently included in the funded STIP. Instead they are projects that have been identified previously or are schedule for potential reprioritization. Projects whose identification numbers begin with an FS are projects for which feasibility studies have been conducted or are currently being conducted. Projects with identification numbers that start with SHC are projects that have been identified as potential future projects in the North Carolina Department of Transportation's Strategic Highway Corridor Plan. Identification numbers that begin with CU are conceptual upgrade projects that the NC Maritime Strategy team has identified as potential needs that have not been identified to date in any NCDOT programs or plans. These projects help fill gaps or address anticipated future capacity deficiencies (based on a review of Freight Analysis Framework data) in the landside highway network.

Port of Wilmington

Local truck access would be provided by the planned Cape Fear Skyway and Wilmington Bypass, to be funded by toll revenues. Development of the North Property could also incorporate on-port circulation and truck access that would minimize truck impacts to the adjacent Sunset Park neighborhood.

Improvements to US 74 / 76 and NC 24 and US 258 provide access to Port of Wilmington from major soy-producing counties. Key highway improvements include completion of I-140, improvements to US 74 / 76 between the port and I 95, completion of I-795, south of Goldsboro, and improvements to US 17 and US 258 between Jacksonville and Lenoir. Capacity additions to these corridors will be required to maintain competitive travel times. Improvements to US 74 / 76 to upgrade it to interstate standards, bypassing segments of existing US 17 between Wilmington and Jacksonville, and widening the two-lane portions of US 258 between Jacksonville and Lenoir are needed. These proposed projects are detailed in Table 29.

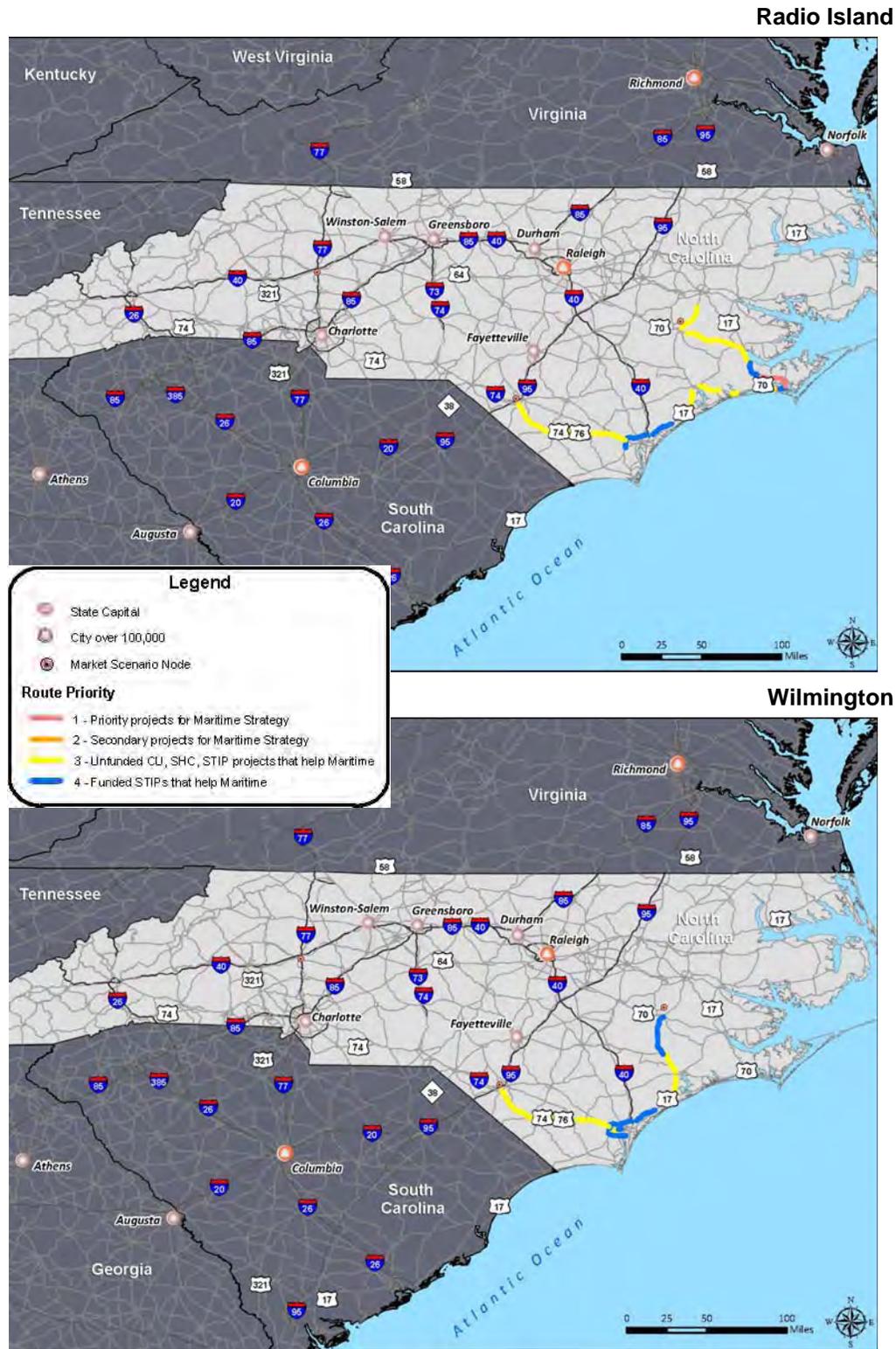
Table 28: Detail of Highway Projects to Support Grain Access to Port of Wilmington

ID Number	Route	Description	County
CU4 24	NC 24	widening from NC 24 Business to NC 111	Onslow
FS-0803A	US 17	widening from proposed I-140 to NC 133 (Village Road)	Brunswick
CU1 17	US 17	upgrade to freeway from US 17 Bypass in Jacksonville to Maysville	Onslow
CU2 258	US 17/US 258	widening from NC 24 Business to NC 111	Onslow
FS-1106B	US 74	upgrade to interstate standards from NC 41 in Lumberton to SR 1585 (Union Valley Road) in Columbus County	Robeson, Columbus
R-4462	US 74/US 76	upgrade to interstate standards from Whiteville to the proposed US 17 Wilmington Bypass	Columbus, Brunswick

Source: AECOM/URS from FAF 3.1 and AECOM Delivered Cost Model

Note: CU = Conceptual Upgrade; SHC = Strategic Highway Corridor; FS = Feasibility Study. For more information, please refer to the "Project ID numbers explained" text below Table 27.

Figure 62: Highway Network Improvements to Support Grain Market



Source: AECOM/URS from ESRI, NCDOT, FAF v3.1, USGS ThematicMapping world borders dataset

7.3.3 Rail Improvements for Bulk Grain

Because centers for soybean production in North Carolina are located in the eastern part of the state (generally east of I-95), only a small percentage of grain is anticipated to be delivered by rail. The additional estimated rail traffic of one train per week would not require additional investment in off-port rail infrastructure. Rail connection would be required to the new grain terminal.

For the Radio Island site, rail access would be accomplished through upgrade of the existing track onto the parcel proposed for grain use and connection to the on-. Although the proposed Havelock to Morehead City Rail Relocation project would enhance access to the Port of Morehead City, the majority of the grain market is within trucking distances.

For the Port of Wilmington site, a rail connection to the CSX mainline, which runs immediately west of the proposed terminal, would be required.

7.3.4 Estimated Cost of Infrastructure Investment for Bulk Grain

Estimated capital improvements required to realize the projected 2040 grain volumes are summarized in Table 29. Although a bulk grain facility at Radio Island requires greater highway investment (and therefore has a greater estimated total capital cost), this location lies closer to eastern North Carolina’s predominant soy growing counties and would provide rail access from producers in the western part of the state via a single rail carrier (NS). North Carolina’s soybean growers have also expressed an interest in exporting from Morehead City.

Table 29: Infrastructure Investment to Support Grain Market (\$ Millions, 2011)

Required Infrastructure Investment	Radio Island	Wilmington
Port and terminal	\$80	\$80
Highway network	\$1,408	\$578
Local highway access	\$23	\$0
Rail network	\$0	\$0
Local rail access	\$12	\$12
Total	\$1,523	\$670

Source: AECOM/URS

7.4 Infrastructure Needs to Support Wood Products Market

The wood products market comprises a combination of cargo types, including wood pellets that would be transported by bulk, and other timber products that would be transported by a combination of bulk (woodchips) and breakbulk (lumber and rolled pulp). North Carolina’s port facilities have sufficient available overall storage and berth capacity to handle the projected growth of its traditional market of bulk woodchips and breakbulk wood products; however, a new bulk export terminal would be required to handle wood pellets.

An overview of the infrastructure needs to realize the market opportunity for wood products is provided in Table 30 below. Proposed investments and associated capital costs are identified in the sections that follow.

Table 30: Overview of Infrastructure Needs for Wood Products

Infrastructure	North Carolina's Needs
Channel depth of at least 40 ft	Wood cargos are expected to be handled by Panamax or smaller Handymax vessels. Each of North Carolina's existing port facilities maintains water depth sufficient to accommodate a typical dry bulk or breakbulk cargo vessel so no additional deepening would be required.
Bulk wood pellet terminal	<p>A new wood pellet export facility similar to the Enviva terminal in Chesapeake VA would be required to support North Carolina's projected demand for wood pellet exports. The terminal would include silos to store approximately 55,000 tons of wood pellets.</p> <p>Rail unloading at the terminal would require a loop track and storage for up to 75 railcars as well as an adjacent support yard for managing empty railcars.</p>
Bulk and breakbulk wood terminal	<p>Other wood products do not require the same kind of specialized facilities as wood pellets. Wood chips may be stored in an open area on the terminal. Wood pulp must remain clean and dry, but requires only a covered warehouse or transit shed and careful handling using traditional equipment. Based on projected 2040 volumes of 1.3 million tons, existing marine terminals could be used to accommodate this growth.</p> <p>At Port of Wilmington, the existing allocation of storage areas within the terminal offers sufficient capacity to handle more than six million tons⁵⁰ combined of woodchips, wood pulp, and lumber.</p> <p>At Port of Morehead City, the terminal capacity currently assigned to forest products is limited to 170,000 tons; however, the general cargo terminal could be repurposed to focus on the handling of wood products.</p>
Highway access and inland road network	<p>Trucks are expected to be the primary mode of delivery for wood products from Lumberton and producers east of I-95. It is estimated that 50 percent of wood pellets and 80 percent of woodchips and breakbulk wood products would arrive at the port by truck, representing about 30 percent of the combined tonnage for the wood market.</p> <p>Delivery of wood products to port, including wood pellets to a new bulk export facility and other traditional wood products to existing bulk and breakbulk facilities will require efficient highway connections between inland timber growing areas North Carolina and the port.</p> <p>Improvements to facilitate transport of wood products for export will also include local truck access to the terminal. Based on 2040 wood product volume projections and anticipated mode split between truck and rail, this market would generate a total of approximately 250 trucks per day in and out of the port.</p>
Rail access and inland rail network	<p>Like bulk grain, the most efficient means to transport the volume of grain required to fill a bulk vessel is by covered railcar. Rail deliveries are anticipated to handle about thirty percent of total wood tonnage, primarily wood pellets but also including a share of the woodchip and breakbulk volumes. This new rail service is projected to require two 45- to 75-car trains per week.</p> <p>The freight rail network within North Carolina includes rail access to each of North Carolina's ports via CSX (to Wilmington) and NS on tracks leased from NCRP (to Morehead City). Grain elevators in the western part of the state are served primarily by NS and various short line railroads that interchange with NS and CSX.</p>

⁵⁰ Source: AECOM, from NCSPA operating data

7.4.1 Port and Terminal Improvements for Wood Products

Bulk wood pellets have transport, storage, and handling needs that are similar to bulk grain, so their infrastructure needs will be similar. Refer to Figure 60 and Figure 61 above for grain terminal location options that could alternatively be used to support wood pellet exports. The terminal area shown is dictated by the space needs for a rail loop and yard to support unloading of unit trains up to 75 cars in length. Some of the area within the loop could be dedicated to other uses or made available for upside growth of the wood pellet market. Wharves and berths at the new terminal would be designed to accommodate Panamax vessels to provide maximum flexibility for use over its life. The wood pellet terminals have similar utility requirements as for bulk grain handling, most notably dust suppression systems would be used to prevent fires and explosions.

There is sufficient capacity at the Port of Wilmington accommodate the projected market volumes for other wood products, including bulk wood chips wood pulp and breakbulk lumber. At Morehead City, some existing cargos would have to be displaced to accommodate the entire 2040 projected wood product at a single location. This could include relocation of warehousing for raw rubber, which is currently stored on-terminal for 30 days or more. Alternatively, the demand for these wood products could be split between the two port locations.

Although ongoing maintenance is required to maintain wharf structures in good working order, no additional investment should be needed to enhance the water depth or mooring capability of wharf structures to accommodate additional cargo volumes anticipated for other wood products.

7.4.2 Highway Improvements for Wood Products

Trucks are expected to be the primary mode of delivery for wood products to port from Lumberton, Riegelwood, and other timber production areas east of I-95. Proposed highway network improvements are illustrated in Figure 63.

Radio Island

Local truck access to Radio Island will be achieved through construction of a new access road and tight, modified diamond interchange on US 70. The potential configuration of these improvements are illustrated in Figure 57.

NC 24, US 17, I-140, and US 74 / 76 are the primary corridors that provide access from southeastern North Carolina to Radio Island. Because of route taken to reach truck markets of wood product-producers, the construction of the North Carteret Bypass is not identified as a need for this scenario. Highway network improvements to support wood transport include upgrades to NC 24, US 17, and US 74 / 76. These projects are listed in Table 32.

Table 31: Detail of Highway Projects to Support Wood Access to Radio Island

ID Number	Route	Description	County
I-3806	I-95	widening from US 74 to US 301	Robeson
CU1 24	NC 24	widening from Atlantic Beach Causeway to NC 24	Carteret
CU2 24	NC 24	widening from NC 58 to White Oak River	Carteret
CU3 24	NC 24	widening lanes from NC 172 to FS-1103A	Onslow
FS-1103A	NC 24	access management and drainage improvements from NC 24 to SR 1459	Onslow
CU1 17	US 17	upgrade to freeway from US 17 Bypass in Jacksonville to Maysville	Onslow
R-4462	US 74/US 76	upgrade to interstate standards from Whiteville to the proposed US 17 Wilmington Bypass	Columbus, Brunswick
FS-1002A	US 70	widening from Morehead City to Beaufort Causeway	Carteret
SHC 341	US 70	upgrade to interstate standards from east of La Grange to Goldsboro Bypass	Lenoir
FS-1106B	US 74	upgrade to interstate standards from NC 41 in Lumberton to SR 1585 (Union Valley Road) in Columbus County	Robeson, Columbus

Source: AECOM/URS from FAF 3.1 and AECOM Delivered Cost Model

Note: CU = Conceptual Upgrade; SHC = Strategic Highway Corridor; FS = Feasibility Study. For more information, please refer to the "Project ID numbers explained" text below Table 27.

Port of Wilmington

Local truck access would be provided by the planned Cape Fear Skyway and Wilmington Bypass, to be funded by toll revenues (see Figure 55). Development of the North Property could also incorporate on-port truck access and circulation that would minimize truck impacts to the adjacent Sunset Park neighborhood.

For the Port of Wilmington site, I-140 and US 74 / 76 are the primary corridors that provide access from timber production areas in southeastern North Carolina. Highway improvements to US 74 / 76 are proposed to provide efficient highway connections to the port. These projects are listed below.

Table 32: Detail of Highway Projects to Support Wood Access to Port of Wilmington

ID Number	Route	Description	County
FS-0803A	US 17	US 17; widening from proposed I-140 to NC 133 (Village Road)	Brunswick
FS-1106B	US 74	US 74; upgrade to interstate standards from NC 41 in Lumberton to SR 1585 (Union Valley Road) in Columbus County	Robeson, Columbus
R-4462	US 74/US 76	US 74/US 76; upgrade to interstate standards from Whiteville to the proposed US 17 Wilmington Bypass	Columbus, Brunswick

Source: AECOM/URS from FAF 3.1 and AECOM Delivered Cost Model

Note: CU = Conceptual Upgrade; SHC = Strategic Highway Corridor; FS = Feasibility Study. For more information, please refer to the "Project ID numbers explained" text below Table 27.

7.4.3 Rail Improvements for Wood Products

Wood sources in the western part of the state, including areas around Roanoke Rapids, Canton and Wilkesboro, are expected to use rail to deliver products to the port.

The additional estimated rail traffic of two trains per week is not anticipated to have a significant impact on surrounding rail capacity; however, focused rail improvements are proposed. For the Radio Island site, this includes improvement of rail access through Morehead City via the Morehead City to Havelock Rail Relocation Project, and upgrade of rail access onto Radio Island. For the Port of Wilmington site, a rail connection would be required to the CSX mainline, which runs immediately west of the proposed terminal.

7.4.4 Estimated Cost of Infrastructure Investment for Wood Products

Estimated capital improvements required to realize the projected 2040 wood product volumes are summarized in Table 33. The Wilmington site lies closer to the timber growing region in Southeastern North Carolina around Lumberton, and would require lower anticipated total infrastructure investment. This site would also allow all wood products to be handled at a single location, which would allow highway investments to be focused on a single corridor.

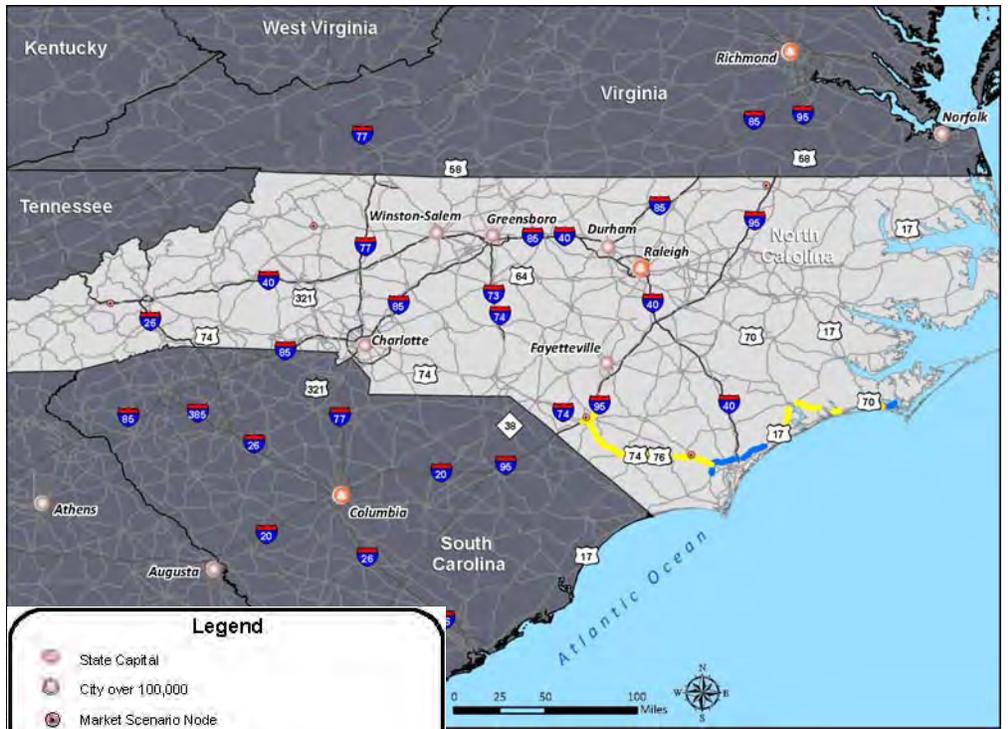
Table 33: Infrastructure Investment to Support Wood Products Market (\$ Millions, 2011)

Required Infrastructure Investment	Radio Island	Wilmington
Port and terminal (for pellets only)	\$55	\$55
Highway network	\$754	\$350
Local highway access	\$23	\$0
Rail network	\$204	\$0
Local rail access	\$14	\$12
Total	\$1,050	\$417

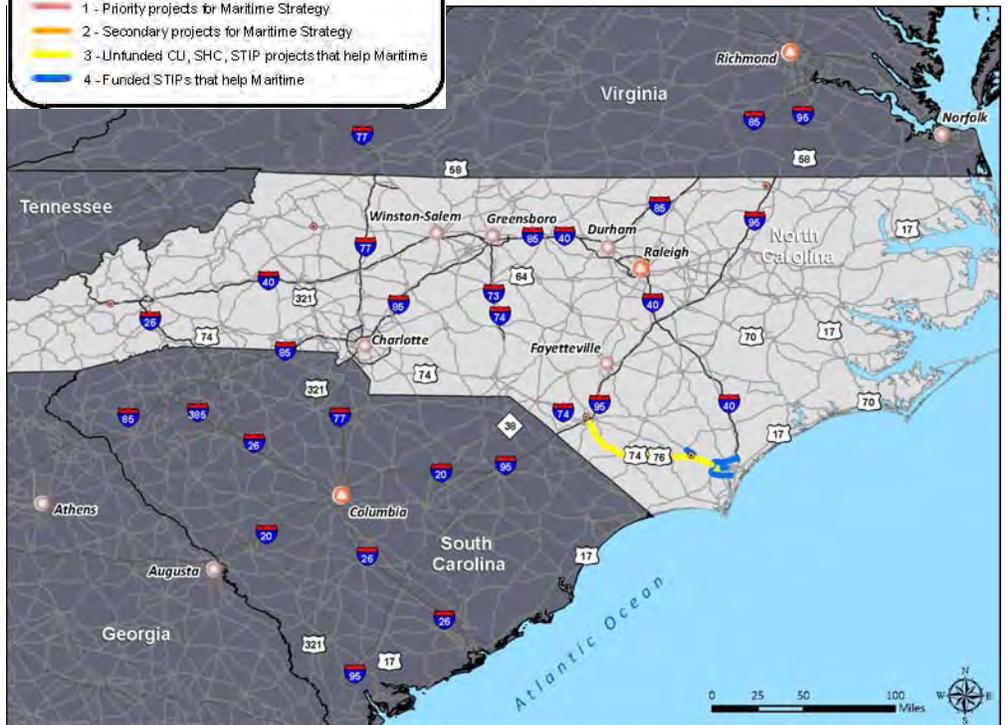
Source: AECOM/URS

Note: For serving only the wood products (not wood pellets), the wood pellet terminal and the loop rail access are not necessary.

Figure 63: Highway Network Improvements to Support Wood Products Market
Radio Island



Wilmington



Source: AECOM/URS from ESRI, NCDOT, FAF v3.1, USGS ThematicMapping world borders dataset

7.5 Containerized Cargo

North Carolina's ports currently handle containers at the Wilmington Container Terminal; however, this facility does not have the capacity to accommodate projected container demand of 1.3 million annual TEU (comprising both imports and exports) in 2040. The existing container facility, with a single premium berth served by four 100-foot-gage dockside cranes, can accommodate Panamax vessels (3,000 to 5,000 TEU) but not the 5th and 6th generation Post-Panamax vessels (5,000 to 8,000 TEU) that are anticipated to become the workhorse of global container trade. While Neo Panamax (up to 13,000 TEU) and even larger (18,000 TEU) vessels are in service and on order, these ships are not expected to serve US east coast ports.

As contrasted to bulk carriers that call on ports as needed to meet demand, container lines maintain regular service schedules along trade lanes, as illustrated by example in Figure 64.

Container lines are attracted to those seaports that offer access to nearby population centers, that can provide the infrastructure to handle their vessels, and that maintain efficient road and rail connections to inland

distribution centers and intermodal facilities. Discussions with container shipping lines that currently call on Wilmington or other regional ports indicates that an operating water depth of 45 feet to 47 feet would accommodate the vessels that they would likely use on their Asia-US east coast routes in the future. Assuming the existing rotation patterns persist, these 6,000- to 8,000-TEU vessels would call on three to four ports on the US east coast, loading and unloading 1,000 to 2,500 TEU at each destination.

Containerships serving the Central and South American trade lanes are able to navigate the existing Cape Fear channel.

An overview of infrastructure needs for a cost-efficient container port is provided in Table 34 below. Proposed investments and associated capital costs are identified in the sections that follow.

Figure 64: Hanjin Asia-Pacific Service to Wilmington NC



Source: Hanjin

Table 34: Overview of Infrastructure Needs for Containers

Infrastructure	North Carolina's Needs
Channel depth of at least 40 ft for Panamax vessels and up to 51 ft for Post-Panamax vessels	At 42 feet MLLW, North Carolina's Wilmington Harbor and Cape Fear Channel, which serves the existing container terminal, has sufficient water depth to accommodate Panamax vessels. Authorized depth at the Morehead City Harbor is 45 feet. Water depth of up to 51 feet, however, is needed to serve the larger Neo Panamax vessels. A deeper channel would accommodate a greater proportion of the container fleet likely to call on the US east coast in the future.
Turning basin with diameter of 1.2 to 1.5 times the maximum ship length	The turning basin at Wilmington has a diameter of 1,200 feet. The larger of the two turning basins at Morehead City is 1,350 feet in diameter. These existing facilities are large enough to maneuver Panamax vessels. Implementation of post-Panamax service to a port in North Carolina would require a turning basin of 1,400 feet diameter or greater.
Two or more premium berths	The existing Wilmington Container Terminal includes a single premium berth, including four dock cranes that have an outreach of 18 containers to serve Panamax and post-Panamax vessels up to about 8,000 TEU. For greatest capacity and efficiency of container terminal operations, a minimum of two contiguous berths are needed, each equipped with 100'-gauge dockside cranes capable of reaching across at least 18 containers.
Container yard area of at least 150 to 200 acres	The existing container terminal area at Wilmington is limited to approximately 85 acres, although there is potential to rearrange and repurpose adjacent terminal areas for container storage.
Highway access and inland road network	70 percent of containers moving in and out of the container yard are expected to be transported by truck. At 2040 potential volumes of 1.3 million TEU, this would generate approximately 1,800 trucks per day in and out of the terminal. The container terminal must be equipped with an efficient gate and local road connections to the national highway network. Minimum four-lane divided highways are recommended to support truck movements.
Rail access and inland rail network	Rail is the most efficient means to move containers in and out of the port. Integrated rail service at the container yard is needed to support rapid turnover of containers. At-port rail connections to North Carolina's freight rail network will be required. Local access must be able to support the anticipated train volumes. Based on regional mode split typical for the regional container market, it is expected that up to 30 percent of container would be arrive or leave the port by train. For an annual container volume of 1.3 million TEU, this means that 16 to 24 double-stack intermodal trains of 80 to 120 cars would arrive at the port each week.
Inland intermodal facilities	Inland intermodal terminals and inland port facilities support the distribution of containerized goods, including consolidation, warehousing truck-to-rail transfer, and other logistics support that provide for efficient connection to the statewide and regional goods movement network. NS maintains intermodal facilities in Charlotte and Greensboro. The NS Charlotte intermodal facility is in the process of expanding and relocating to the Charlotte-Douglas International Airport. As part of the National Gateway project, CSX has identified the need to expand its intermodal yard in Charlotte.

7.5.1 Identification of Potential Deepwater Port Sites

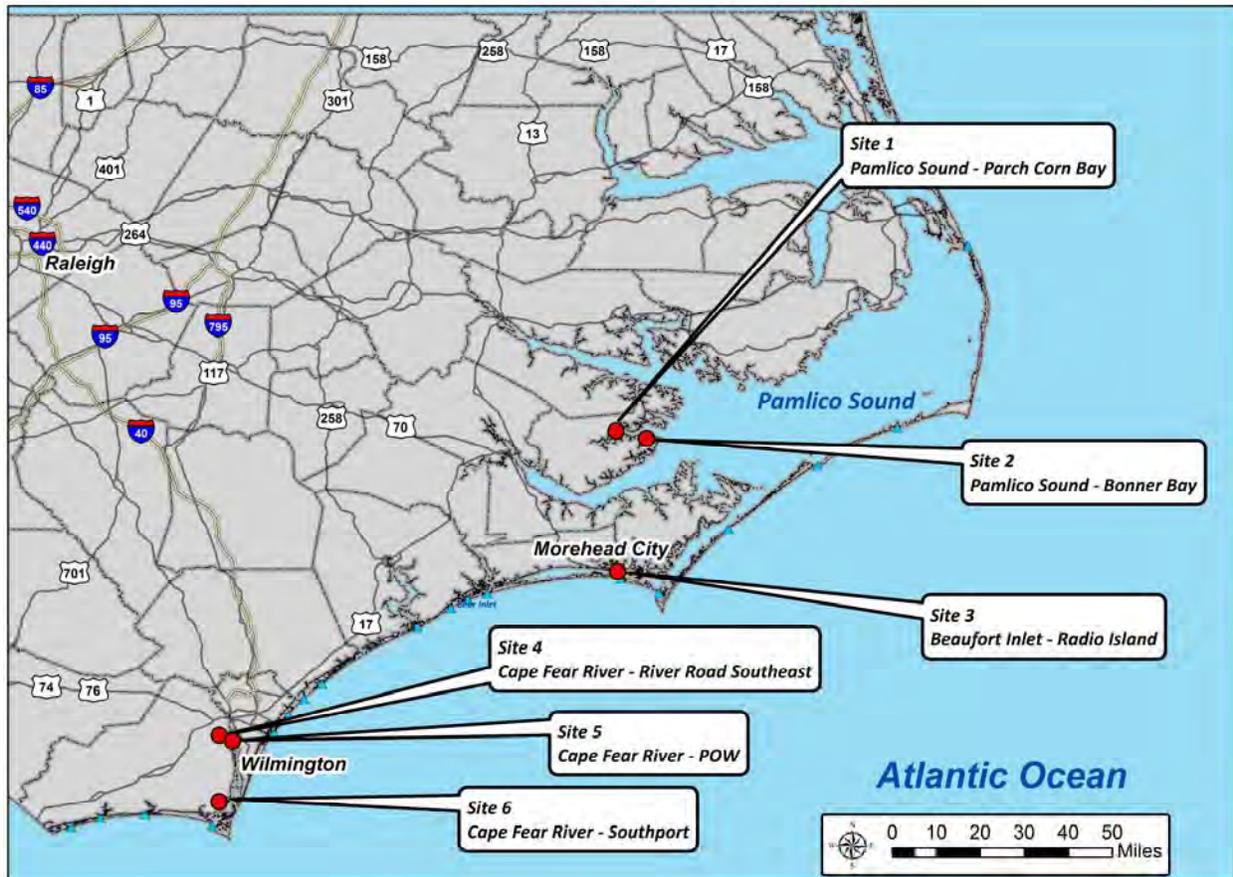
A statewide screening was performed to identify locations that could support container terminal operations within North Carolina. This assessment considered land suitability and infrastructure proximity as well as meteorological and navigation factors affecting water access. Initial screening analysis eliminated coastal sites not suitable for port development, including lands designated as COBRA (Coastal Barrier Resource Act) zones; federal, state and county parks; national seashore; federal and state wildlife and waterfowl refuges and management areas. Areas of concentrated development and salt/brackish marshlands were also eliminated from consideration.

After excluding lands not suitable for port development, GIS analysis was conducted to identify vacant single or multiple contiguous parcels that would meet minimum requirements for port development with least potential environmental impact. The evaluation included parcels at the existing Port of Wilmington and Port of Morehead City. Potential sites were evaluated against the following criteria:

- Vacant, contiguous parcels to accommodate terminal yard needs of 200 acres or more and with minimum 3,000 linear feet of shoreline frontage to accommodate two containership berths
- Local geology, including presence of shell- or hard-bottom
- Compatibility with zoning and future surrounding land use
- NC Coastal Region Evaluation of Wetland Significance (NC CREWS)
- Proximity to natural and historic resources

From this evaluation, six potential deepwater sites as shown in Figure 65 were identified for potential container terminal capacity expansion within North Carolina; however Sites 1 and 2 in Pamlico Sound were discarded after initial evaluation because dredging cost analysis revealed these sites to be prohibitively expensive. Comparative evaluation of the remaining sites – Sites 3, 4, 5, and 6 – are described below.

Figure 65: Candidate Deepwater Port Container Sites

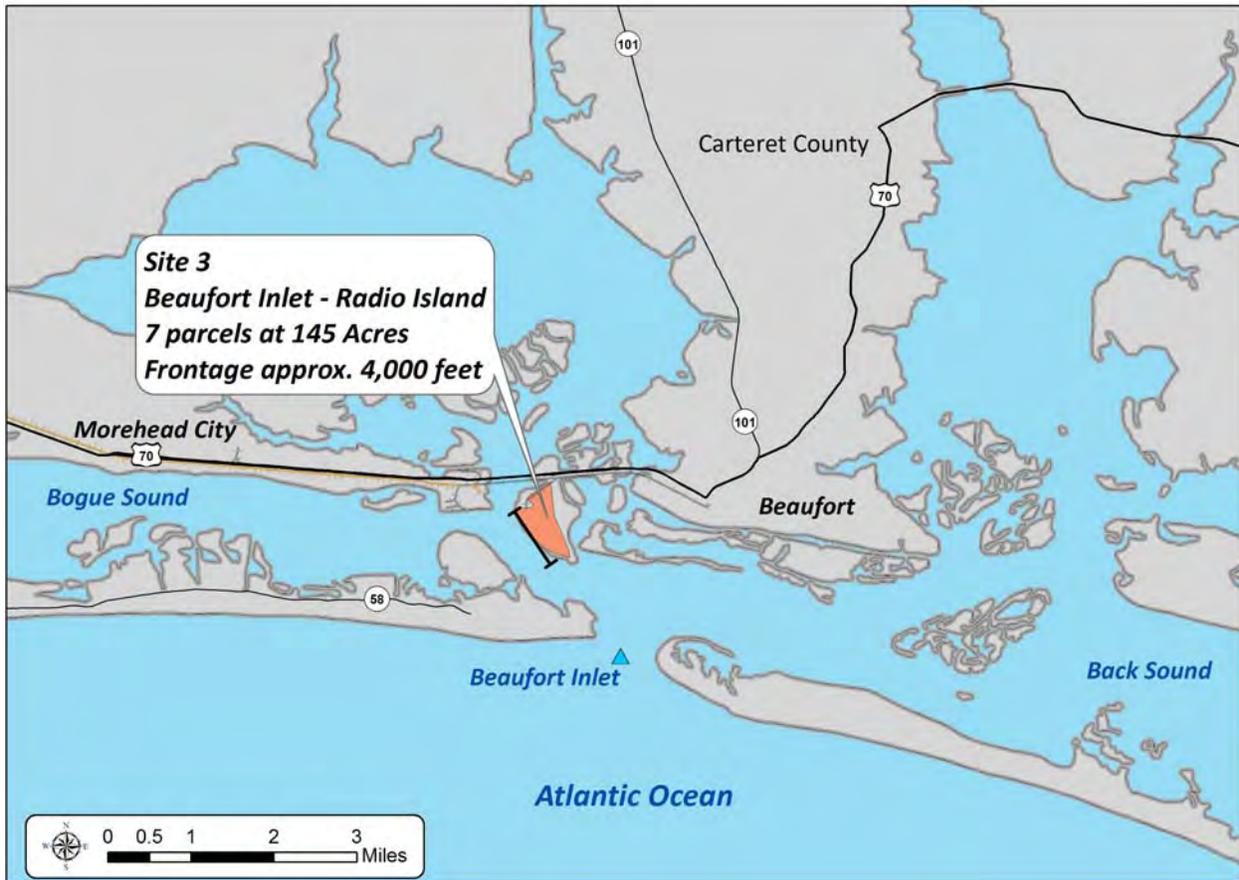


Source: AECOM/URS from ESRI, NCDOT, FAF v3.1, USGS ThematicMapping world borders dataset

Site 3 – Radio Island

Site 3 is located on existing port property at Radio Island in Carteret County, and sits just east of the existing Port of Morehead City terminals along US 70. The site offers the frontage of approximately 4,000 linear feet. At only 145 total acres, the site is the smallest of the sites considered and container storage area would be limited. The closest highway to Site 3 is US 70. There is a Class 3 rail line on the property; the NCCR Class I rail line, which provides access to the Port of Morehead City, is less than one mile to the west.

Figure 66: Deepwater Container Port Site 3

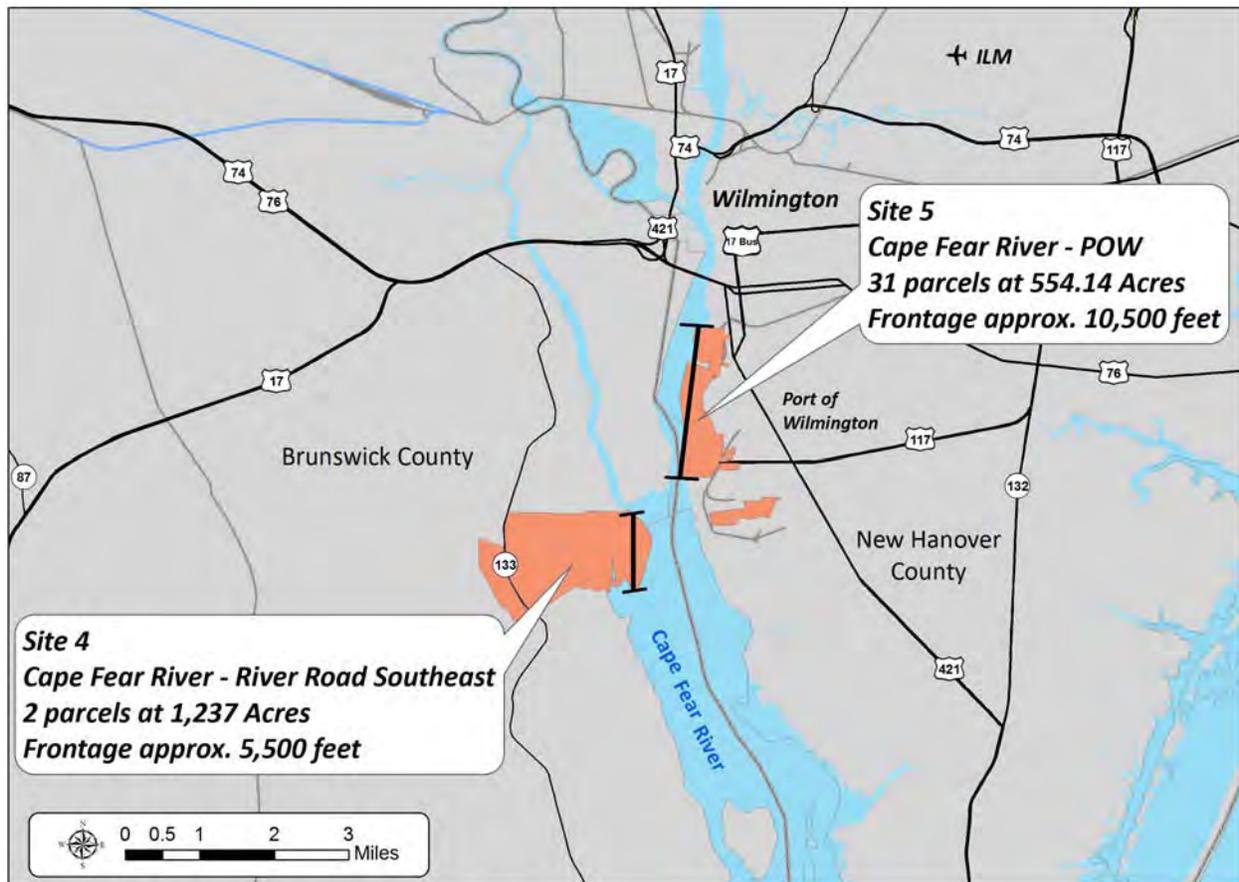


Source: AECOM/URS from ESRI, NCDOT, FAF v3.1, USGS ThematicMapping world borders dataset

Site 4 – River Road Southeast

Site 4 is located on River Road in Brunswick County on the western bank of the Cape Fear River as shown in Figure 67. The closest highway is NC133, which connects to US 17 in Leland (6 miles away). There are no rail lines providing direct access to the property. There is a Class 0 USG rail line approximately 2.4 miles west of the site.

Figure 67: Deepwater Container Port Sites 4 and 5



Source: AECOM/URS from ESRI, NCDOT, FAF v3.1, USGS ThematicMapping world borders dataset

Site 5 – Port of Wilmington

As also illustrated on Figure 67 above, Site 5 is located at the existing Port of Wilmington in New Hanover County on the eastern bank of the Cape Fear River. The closest highway is US 17 over the Cape Fear River, providing connection to I-140 and I-40. The site has direct rail access via the Class I CSX rail line.

Site 6 - Southport

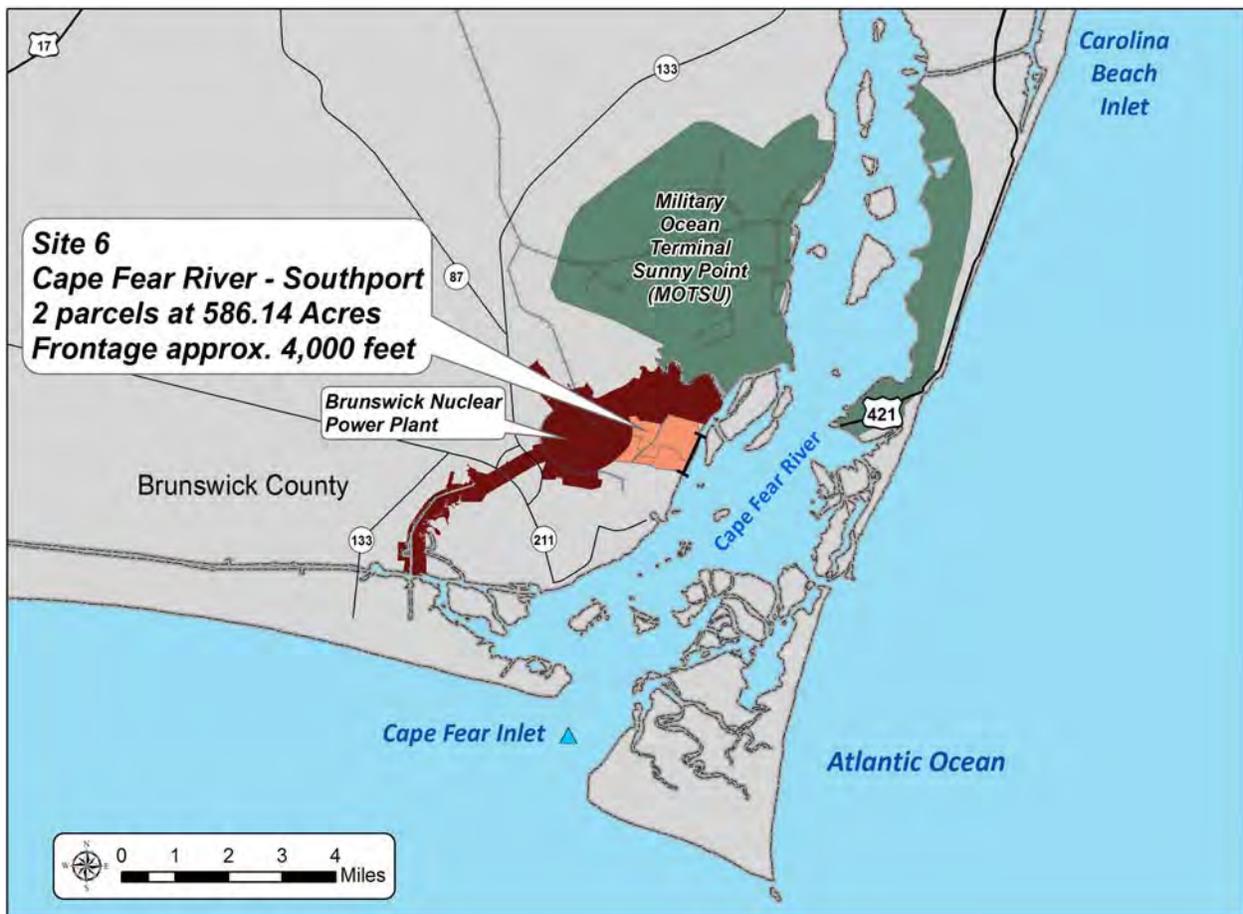
The Southport site, Site 6, as shown in Figure 68, is located in southern Brunswick County on the western bank of the Cape Fear River, just east of the city of Southport. The nearest four-lane divided highway is US 17, 17 miles from the site via NC 87. There are several Class 0 USG rail lines in the vicinity of the proposed site, mainly associated with the adjacent Military Ocean Terminal at Sunny Point (MOTSU).

While local stakeholders have expressed concern about safety and security issues related to placement of a container terminal next to a munitions facility, the representatives from the US Coast Guard and MOTSU do not identify any unique challenges due to adjacency of these two operations.

Progress Energy has several identified concerns with the Southport site, but will not take an official position on the site until these concerns are vetted and satisfactorily resolved. Issues include concerns related to the intake canal, security with respect to the berthing and storage of containers in close proximity to the plant / intake, and nuclear-specific concerns such as the presence of additional people in close proximity to the plant and the need for an updated evacuation plan. The two reactors at the Progress Energy Brunswick Plant require one million gallons of water per minute for cooling purposes. A primary concern is whether or not the dredging or activities associated with a Southport port site have the potential to interrupt or reduce flows. In addition, the water used in the cooling system must remain free of any potentially introduced chemicals and hazardous materials. Any required crossing of the nuclear plant's discharge canal could not restrict flow.

Conversations with the US Nuclear Regulatory Commission (NRC) identified similar concerns regarding potential environmental impacts, security, and evacuation needs. The NRC could not provide any more detailed comments and review without more detailed information on any potential proposal, should a port development at the Southport site be advanced.

Figure 68: Potential Deepwater Container Port Site 6 – Southport



Source: AECOM/URS from ESRI, NCDOT, FAF v3.1, USGS ThematicMapping world borders dataset

7.5.2 Water Access to Support Container Market

Water Access to Potential Container Port Sites on the Cape Fear River

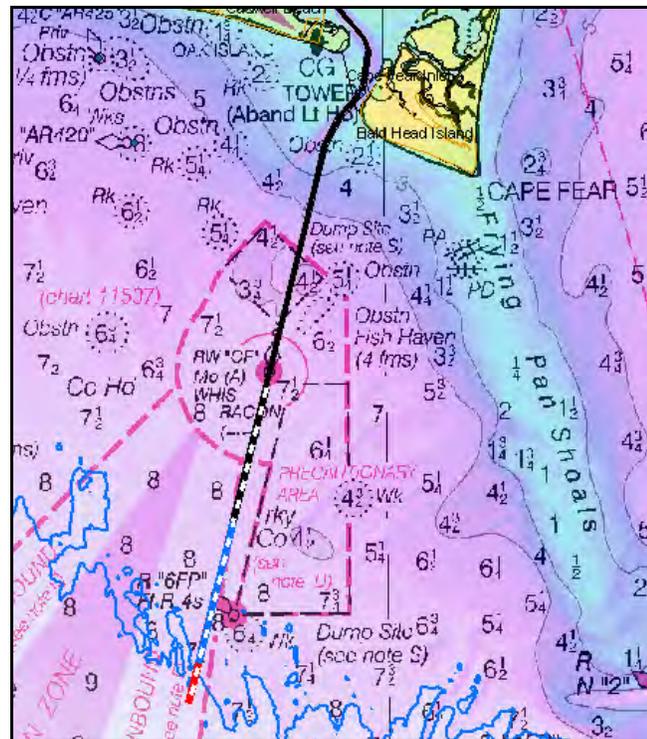
Potential container port Sites 4, 5, and 6 each lie along the Cape Fear River within the Wilmington Harbor. The Cape Fear channel has an authorized depth of 42 feet; the largest container vessels able to navigate the Wilmington Harbor are in the Panamax classification, with capacity of approximately 5,000 TEU. Because vessel size affects the potential capacity of a container berth, the following incremental depth alternatives were evaluated: 42 feet (existing), 45 feet, 47 feet, and 51 feet. Any alternative beyond 42 feet would require dredging of the Cape Fear Channel. Channel deepening would also involve offshore extension of the navigation channel to reach natural depth. Figure 69 shows the length of the extension to the Wilmington Harbor navigation channel that would be required to reach each prospective depth. The existing turning basin (or anchorage basin) at the Port of Wilmington is 1,200 feet and is considered small for current industry standards. Container port alternatives that would serve post Panamax vessels (refer to Figure 17) will require a larger turning basin.

In addition to constraints on channel depth, the navigation channel alignment (specifically at the “S” curve near the entrance section) limits the size of vessels calling on the port to approximately 965 feet (NCSPA 2011). The “S” turn is too sharp for post-Panamax vessels that would be accommodated in 45-foot, 47-foot and 51-foot depth alternatives. Evaluation of the realignment of the Cape Fear entrance channel is currently underway by USACE as part of a Detailed Feasibility Report for the Wilmington Harbor Navigation Improvement Project.

New access channels would be required to greenfield site alternatives; new container berths would require dredging to the prospective design depth.

The channel dredging costs associated with various deepening options – including entrance and channel dredging, turning basin, and berth dredging -- was input to a cost efficiency analysis to compare the relative cost efficiency of various

Figure 69: Extension of Wilmington Harbor Navigation Channel for Channel Deepening



Dredge Depth (ft)	Navigation Channel Extension Length (ft)
45	18,000 (dashed black)
47	41,000 (dashed blue)
51	63,000 (dashed red)

Source: AECOM/URS GIS features on NOAA Raster Navigation Charts

improvement alternatives. The range of alternatives considered (port site, depth, and operating mode), along with the results of this analysis, is presented in Section 7.5.8 below.

The purpose of this comparative dredging evaluation was to identify the relative costs of container port alternatives. Important technical concerns, including potential shoreline impacts of a deeper (and therefore wider) channel would require further consideration as part of a detailed feasibility analysis.

Site 4 – River Road

Development of a container port at the River Road Site would involve a turning basin to accommodate Post Panamax vessels, a short access channel (this site is very close to the main channel itself), and dredging at the berth. For the purposes of this analysis, the proposed navigation depth evaluated at Site 4 was 51 feet.

Figure 70: Access Channel, Turning Basin and Berth Dredging at Site 4 – River Road



Source: AECOM/URS GIS features on aerial imagery from NC OneMap

Figure 71: Potential Impacts of Additional Cape Fear Channel Deepening to Adjacent Shorelines



Source: AECOM/URS GIS features on aerial imagery from NC OneMap

Note: red areas depict those sections of shoreline potentially impacted by a wider channel footprint that would be required to deepen Cape Fear Channel

Site 5 – Port of Wilmington

Various incremental channel deepening alternatives – to depths of 45 feet, 47 feet, and 51 feet – were considered to provide improved water access to the Port of Wilmington. Each option would require expansion and deepening of the turning basin. Information available from USACE was used to define the scope of these improvement alternatives.

Site 6 – Southport

Development of a container port at the Southport Site would involve a turning basin to accommodate Post Panamax vessels, a new access channel from the main channel, and dredging at the berth. For the purposes of this analysis, the proposed navigation depth evaluated at Site 6 was 51 feet.

Figure 72: Access Channel, Turning Basin and Berth Dredging at Site 6 - Southport



Source: AECOM/URS GIS features on aerial imagery from NC OneMap

Figure 73: Access Channel, Turning Basin and Berth Dredging at Site 3 – Radio Island



Source: AECOM/URS GIS features on aerial imagery from NC OneMap

Water Access to Container Site at Beaufort Inlet

Site 3 – Radio Island

Development of a potential container port at Site 3 – Radio island would require dredging of the berth area, as well as a larger turning basin to accommodate post Panamax vessels. Alternatives evaluated included maintaining the existing 45-foot depth and also deepening the existing channel to 47 feet or to 51 feet. The proposed Radio Island berth lies immediately adjacent to the shipping channel, so no additional access channel would be required.

7.5.3 Port and Terminal Improvements for Container Market

Port improvements associated with each of the candidate container terminal sites would include the construction of one or more new berths and associated wharf structure to accommodate 100-foot gage dock cranes. Development of the container yard would include paved storage areas, container handling equipment and supporting infrastructure, support buildings and entrance gates.

The container terminals would require domestic and fire water infrastructure, domestic wastewater infrastructure, electrical and communication infrastructure, storm water runoff drains and mitigation, natural gas service for hot water heating, and fuel lines for stevedoring vehicles. High mast light poles provide security and night-time operational lighting. Electrical infrastructure is dependent on the number of dock cranes, types of yard vehicles and cargo handling equipment (diesel or electric), number of reefer assemblies and building sizes.

Since container terminals are typically completely paved and developed, storm water runoff will be greater than pre-development conditions. Therefore, best management practices including but not limited to storm water oil and trash separators, engineered wetlands, detention ponds, and retention ponds will be required to mitigate peak runoff flows and filter out contaminants present in the runoff.

Site 3 – Radio Island

Proposed container terminal development at Site 3 includes a new two-berth, rubber-tired gantry crane (RTG)-based terminal as illustrated in Figure 74.

Figure 74: Site 3 at Radio Island (Port of Morehead City); Two-Berth RTG Terminal



Source: AECOM

Site 4 – River Road

For Site 4, where no current facilities exist, two cases were considered: an RTG terminal and an ASC terminal, both including two berths and 51 feet of water depth. No facilities at lesser depths were considered for a new facility at Site 4 because lower depths cannot handle the larger containerships in the market today, and the cost of any new facility would be too great to have the water depth be obsolete before it is even built. Figure 75 shows a conceptual layout of a two-berth + RTG container terminal serviced by an on-port rail terminal at Site 4.

Figure 75: Two-Berth RTG Container Terminal at Site 4 – River Road



Source: AECOM

Site 5 – Port of Wilmington

For Site 5 at the Port of Wilmington, the following options were considered as incremental improvements to the existing container facility at the Port of Wilmington: two-berth reach stacker-based terminal, and a two-berth RTG-based facility.

Figure 76 presents the first of two potential terminal layouts considered for this location, increasing the gross terminal area that is dedicated to container use by 26 acres over the existing Wilmington Container Terminal area. As compared to the existing terminal, this layout has following key features:

- A second berth, with two additional 100-foot gauge cranes, is added, providing a total berth length of 2,670 feet.
- The entry/exit gate has been realigned to provide a more contiguous container storage area
- 26 acres of expanded container storage area
- This layout continues to use reach stackers (RS) inside the yard for handling of all containers.

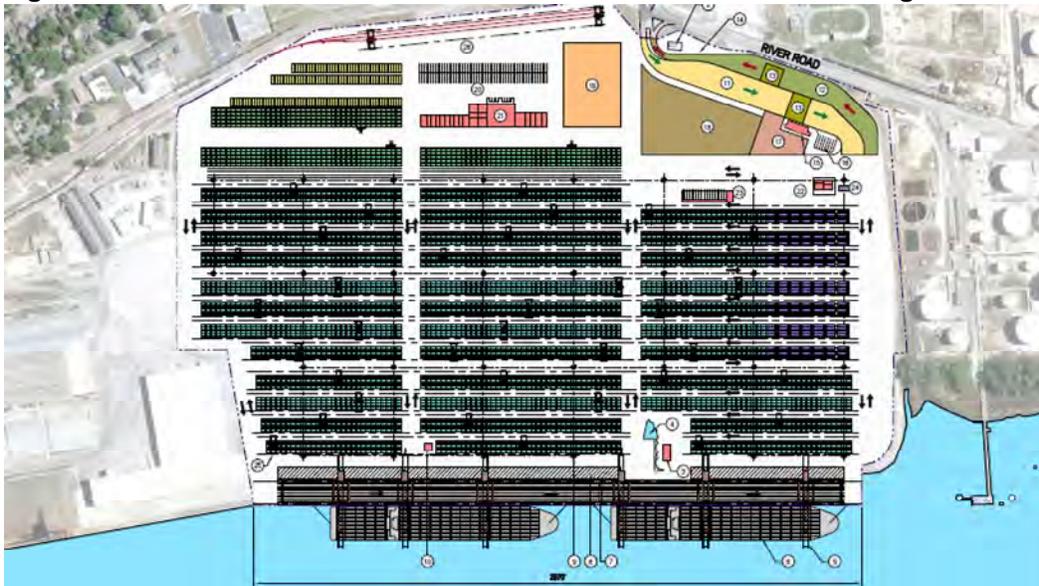
Figure 76: Two-Berth Reach Stacker Container Terminal at Site 5 – Port of Wilmington



Source: AECOM

As a second alternative to increase container capacity at the Port of Wilmington, a second, denser layout was also prepared as shown in Figure 77. Container movements in this denser layout would use rubber-tired gantry (RTG) cranes to handle containers inside the yard.

Figure 77: Two-Berth RTG Container Terminal at Site 5 – Port of Wilmington



Source: AECOM

As compared to the existing terminal, this layout has following key changes:

- A second berth, with two additional 100-foot gauge cranes, is added, providing a total berth length of 2,670 feet
- The entry/exit gate has been realigned to provide a more contiguous container storage area by moving the gate out of the middle of the yard to the northeast corner of the port property.
- 37 acres of expanded container storage area

Site 6 – Southport

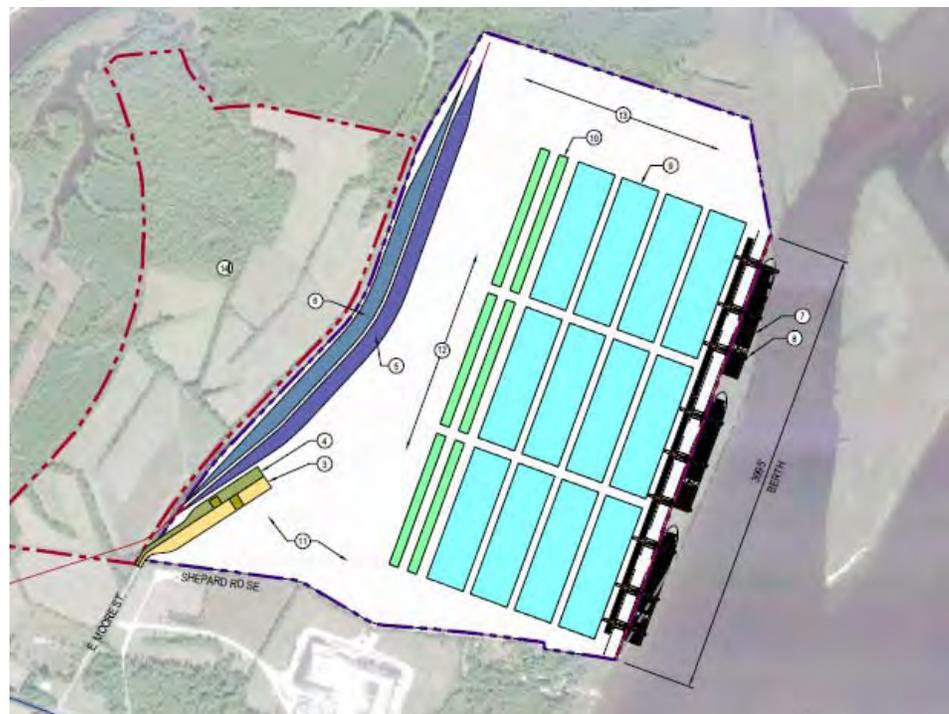
Like Site 4, Site 6 would be an entirely new facility with on a greenfield site. Two cases were considered: RTG- or ASC-based three-berth facilities. (A third berth was considered here because of its more extensive frontage length than the other sites evaluated.)

Figure 78 shows a conceptual layout of a three-berth + RTG container terminal serviced by an on-port rail terminal. It should be noted that Site 6 allows for additional

undeveloped area for future development of ancillary facilities near the container terminal such as a container freight station (CFS), comprising storage and warehousing facilities for loading/unloading of less-than-full container orders, on the west side of the proposed intermodal rail yard.

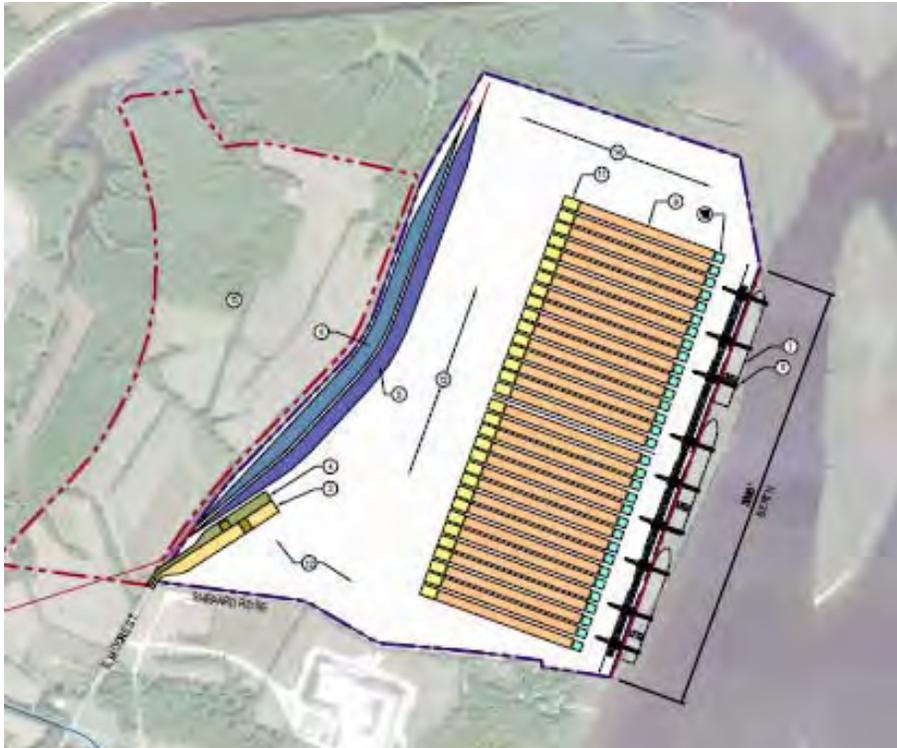
Figure 79 shows a conceptual layout of a three-berth + ASC container terminal serviced by an on-port rail terminal.

Figure 78: Three-Berth RTG Container Terminal at Site 6 - Southport



Source: AECOM

Figure 79: Three-Berth ASC Container Terminal at Site 6 – Southport



Source: AECOM

7.5.4 Highway Improvements to Support Container Market

To support the transport of containers to and from major North Carolina markets in Charlotte, the Triad and Triangle regions, upgrades to major corridors are proposed. These highway network improvements are illustrated in Figure 80.

Site 3 - Radio Island

Highway travel times from Radio Island to the container nodes are higher than those of competing ports (Charleston and Savannah) for all container nodes, except for the Triangle Region. Both Charlotte and the Triad would require transport by rail. To enhance access to Radio Island from the Triangle, and to enhance access to the interstate network, upgrades to US 70 would be required. In order to have a minimum of a four-lane expressway from Radio Island to the interstate system and on to the Triangle, unfunded projects such as the North Carteret Bypass and Kinston Bypass are needed. Other critical projects include the funded Havelock Bypass. These and other projects that would facilitate travel to and from a container terminal at Radio Island are listed next page.

Table 35: Detail of Highway Projects to Support Container Access to Site 3 - Radio Island

ID Number	Route	Description	County
R-2829	Future NC 540	(Eastern Wake Freeway/ Triangle Expressway Southeast Extension/ Raleigh Outer Loop); new location from I-40 to US 64/US 264 Bypass	Wake, Johnston
SHC 139	I-40	widening from Wade Avenue to NC 147	Durham, Wake
SHC 158	I-40	widening from I-95 to NC 42	Johnston
SHC 153	I-40	widening from Lake Wheeler Road to I-440/US 1/ US 64	Wake
SHC 154	I-40	widening from I-440/US 64 to Lake Wheeler Road	Wake
I-5111BB	I-40	widening from I-95 to NC 42	Wake, Johnston
FS-1005A	I-40/US 64	widening, pavement, interchange mod, operation improvements from West of SR 1728 (Wade Avenue) to east of SR 1375 (Lake Wheeler Road)	Wake
CU1 24	NC 24	widening from Atlantic Beach Causeway to NC 24	Carteret
R-4431	New Route	new location (Havelock Bypass) to Beaufort	Carteret
FS-1002A	US 70	widening from Morehead City to Beaufort Causeway	Carteret
FS-0802B	US 70	access improvements from James City to proposed Havelock Bypass	Craven
SHC 336	US 70	upgrade to interstate standards from SR 1200 to Kinston Bypass	Craven, Jones
CU1 70	US 70	upgrade to interstate standards from Goldsboro Bypass to Selma Bypass	Johnston, Wayne
R-2553	US 70	new location (US 70 Kinston Bypass) from Craven County line to west of Kinston	Lenoir
SHC 341	US 70	upgrade to interstate standards from east of La Grange to Goldsboro Bypass	Lenoir
SHC 357	US 70	upgrade to interstate standards from Kinston Bypass to LaGrange Bypass	Lenoir
CU1 95	I-95	widening from I-40 to Virginia state line	New Hanover, Pender
CU2 70	US 70	Selma Bypass at US 70/I-95	Wake, Johnston

Source: AECOM/URS from FAF 3.1 and AECOM Delivered Cost Model

Note: CU = Conceptual Upgrade; SHC = Strategic Highway Corridor; FS = Feasibility Study. For more information, please refer to the "Project ID numbers explained" text below Table 27.

Site 4 – River Road

In 2040, with highway infrastructure improvements, the River Road container terminal site provides shorter travel times than competing ports (Savannah, Charleston, and Norfolk) to the markets of the Triangle, Triad, and Charlotte; however, travel times to portions of the Triangle suggest that Norfolk may be able to reach eastern portions of the Triangle with a similar travel time. To further enhance access to each of these regions, improvements to I-40 at various locations between Wilmington and Durham, completion of the I-73 / 74 interstate corridor, and improvements to US 74 between Rockingham and Monroe are included. Currently unfunded projects that would enhance access to this potential port location are listed next page.

Table 36: Detail of Highway Projects to Support Container Access to Site 4 – River Road

ID Number	Route	Description	County
I-3801	Future I-74/US 74	upgrade to interstate standards from Rockingham-Hamlet Bypass to Laurinburg Bypass	Richmond, Scotland
R-2829	Future NC 540	(Eastern Wake Freeway/ Triangle Expressway Southeast Extension/ Raleigh Outer Loop); new location from I-40 to US 64/US 264 Bypass	Wake, Johnston
CU2 I-40	I-40	widening NC 24 segment Exit 364 to 373	Duplin
SHC 139	I-40	widening from Wade Avenue to NC 147	Durham, Wake
FS-1104B	I-40	widening from NC 42 to NC 210	Johnston
SHC 158	I-40	widening from I-95 to NC 42	Johnston
CU1 I-40	I-40	widening Exit 398 (NC 53) to Exit 416 (US 17)	New Hanover, Pender
SHC 153	I-40	widening from Lake Wheeler Road to I-440/US 1/ US 64	Wake
SHC 154	I-40	widening from I-440/US 64 to Lake Wheeler Road	Wake
I-5111BB	I-40	widening from I-95 to NC 42	Wake, Johnston
FS-1005A	I-40/US 64	widening, pavement, interchange mod, operation improvements from West of SR 1728 (Wade Avenue) to east of SR 1375 (Lake Wheeler Road)	Wake
CU1 73	I-73	widening from US 220 Bus in Asheboro to SR 2269	Randolph
SHC 264	I-73	widening from US 220 Bus in Asheboro to SR 2269	Randolph
UFSTIP 133	NC 133	widening from Cape Fear Skyway to US 17/US 74/US 76	Brunswick
FS-1106B	US 74	upgrade to interstate standards from NC 41 in Lumberton to SR 1585 (Union Valley Road) in Columbus County	Robeson, Columbus
R-4441	US 74	upgrade to freeway standards with bypass of Wadesboro from Monroe Bypass (F-2559) to Rockingham Bypass (R-512)	Union, Anson
R-4462	US 74/US 76	upgrade to interstate standards from Whiteville to the proposed US 17 Wilmington Bypass	Columbus, Brunswick

Source: AECOM/URS from FAF 3.1 and AECOM Delivered Cost Model

Note: CU = Conceptual Upgrade; SHC = Strategic Highway Corridor; FS = Feasibility Study. For more information, please refer to the “Project ID numbers explained” text below Table 27.

Site 5 - Port of Wilmington

To enhance access to container destinations from Port of Wilmington, improvements to I-40 at various locations between Wilmington and Durham, completion of the I-73 / 74 interstate corridor, and improvements to US 74 between Rockingham and Monroe are proposed. The Cape Fear Skyway would also provide better local access. Currently unfunded projects that would enhance access to this potential port location are listed below:

Table 37: Detail of Highway Projects to Support Container Access to Site 4 – Port of Wilmington

ID Number	Route	Description	County
I-3801	Future I-74/US 74	upgrade to interstate standards from Rockingham-Hamlet Bypass to Laurinburg Bypass	Richmond, Scotland
R-2829	Future NC 540	(Eastern Wake Freeway/ Triangle Expressway Southeast Extension/ Raleigh Outer Loop); new location from I-40 to US 64/US 264 Bypass	Wake, Johnston
CU2 I-40	I-40	widening NC 24 segment Exit 364 to 373	Duplin
SHC 139	I-40	widening from Wade Avenue to NC 147	Durham, Wake
SHC 158	I-40	widening from I-95 to NC 42	Johnston
CU1 I-40	I-40	widening Exit 398 (NC 53) to Exit 416 (US 17)	New Hanover, Pender
SHC 153	I-40	widening from Lake Wheeler Road to I-440/US 1/ US 64	Wake
SHC 154	I-40	widening from I-440/US 64 to Lake Wheeler Road	Wake
I-5111BB	I-40	widening from I-95 to NC 42	Wake, Johnston
FS-1005A	I-40/US 64	widening, pavement, interchange mod, operation improvements from West of SR 1728 (Wade Avenue) to east of SR 1375 (Lake Wheeler Road)	Wake
CU1 73	I-73	widening from US 220 Bus in Asheboro to SR 2269	Randolph
SHC 264	I-73	widening from US 220 Bus in Asheboro to SR 2269	Randolph
FS-0803A	US 17	widening from proposed I-140 to NC 133 (Village Road)	Brunswick
FS-1106B	US 74	upgrade to interstate standards from NC 41 in Lumberton to SR 1585 (Union Valley Road) in Columbus County	Robeson, Columbus
R-4441	US 74	upgrade to freeway standards with bypass of Wadesboro from Monroe Bypass (F-2559) to Rockingham Bypass (R-512)	Union, Anson
R-4462	US 74/US 76	upgrade to interstate standards from Whiteville to the proposed US 17 Wilmington Bypass	Columbus, Brunswick

Source: AECOM/URS from FAF 3.1 and AECOM Delivered Cost Model

Note: CU = Conceptual Upgrade; SHC = Strategic Highway Corridor; FS = Feasibility Study. For more information, please refer to the "Project ID numbers explained" text below Table 27.

Site 6 - Southport

To enhance access to container destinations from Southport, improvements to NC 87 from Southport to US 17 must be completed. The NC 87 project should include a bypass of Boiling Springs Lakes. To further enhance access, improvements to I-40 at various locations between Wilmington and Durham, completion of the I-73 / 74 interstate corridor, and improvements to US 74 between Rockingham and Monroe are included. Currently unfunded projects that should be considered to enhance access to this potential port location are listed below:

Table 38: Detail of Highway Projects to Support Container Access to Site 6 - Southport

ID Number	Route	Description	County
I-3801	Future I-74/US 74	Future I-74/US 74; upgrade to interstate standards from Rockingham-Hamlet Bypass to Laurinburg Bypass	Richmond, Scotland
R-2829	Future NC 540	(Eastern Wake Freeway/ Triangle Expressway Southeast Extension/ Raleigh Outer Loop); new location from I-40 to US 64/US 264 Bypass	Wake, Johnston
CU2 I-40	I-40	widening NC 24 segment Exit 364 to 373	Duplin
SHC 139	I-40	widening from Wade Avenue to NC 147	Durham, Wake
SHC 158	I-40	widening from I-95 to NC 42	Johnston
CU1 I-40	I-40	widening Exit 398 (NC 53) to Exit 416 (US 17)	New Hanover, Pender
SHC 153	I-40	widening from Lake Wheeler Road to I-440/US 1/ US 64	Wake
SHC 154	I-40	widening from I-440/US 64 to Lake Wheeler Road	Wake
I-5111BB	I-40	widening from I-95 to NC 42	Wake, Johnston
FS-1005A	I-40/US 64	widening, pavement, interchange mod, operation improvements from West of SR 1728 (Wade Avenue) to east of SR 1375 (Lake Wheeler Road)	Wake
CU1 73	I-73	widening from US 220 Bus in Asheboro to SR 2269	Randolph
SHC 264	I-73	widening from US 220 Bus in Asheboro to SR 2269	Randolph
SHC353-354	NC 87	widening from US 17 to NC 133	Brunswick, New Hanover
CU1 S87U17	NC 87/US 17	widening from NC 87 to I-140	Brunswick
SHC 352	NC 87/US 17	widening from NC 211 to N of Orton Creek	Brunswick
FS-0803A	US 17	widening from proposed I-140 to NC 133 (Village Road)	Brunswick
FS-1106B	US 74	upgrade to interstate standards from NC 41 in Lumberton to SR 1585 (Union Valley Road) in Columbus County	Robeson, Columbus
R-4441	US 74	upgrade to freeway standards with bypass of Wadesboro from Monroe Bypass (F-2559) to Rockingham Bypass (R-512)	Union, Anson
R-4462	US 74/US 76	upgrade to interstate standards from Whiteville to the proposed US 17 Wilmington Bypass	Columbus, Brunswick

Source: AECOM/URS from FAF 3.1 and AECOM Delivered Cost Model

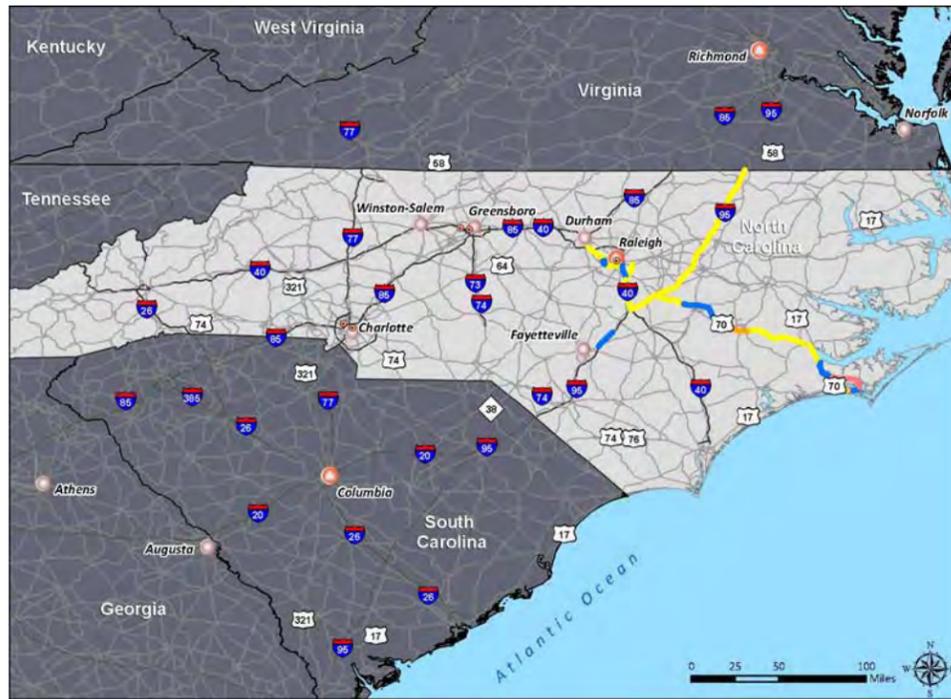
Note: CU = Conceptual Upgrade; SHC = Strategic Highway Corridor; FS = Feasibility Study. For more information, please refer to the "Project ID numbers explained" text below Table 27.



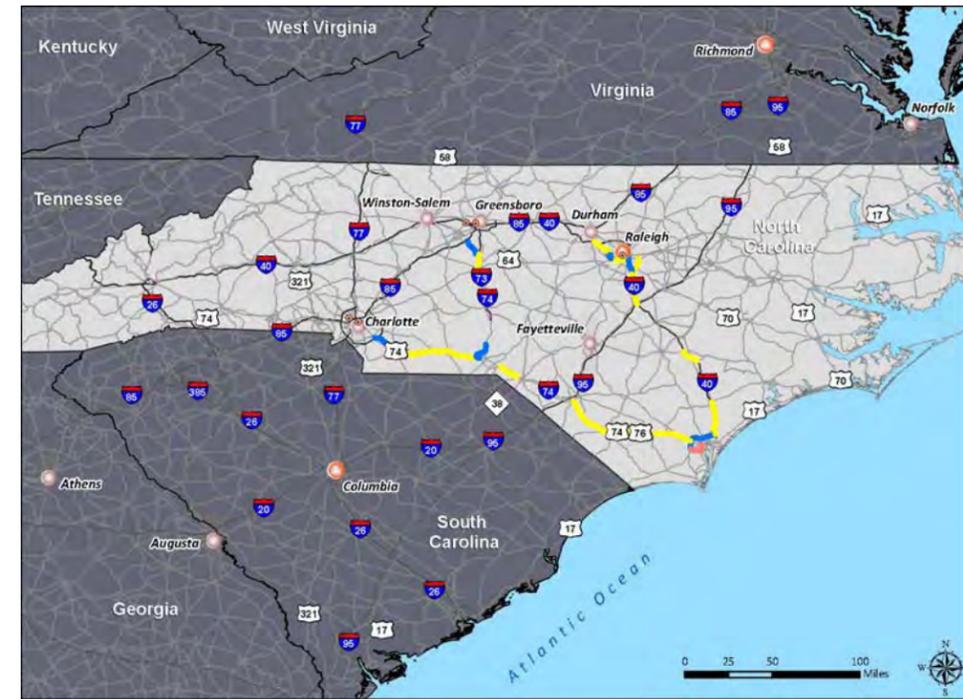
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Figure 80: Highway Network Improvements to Support Container Market

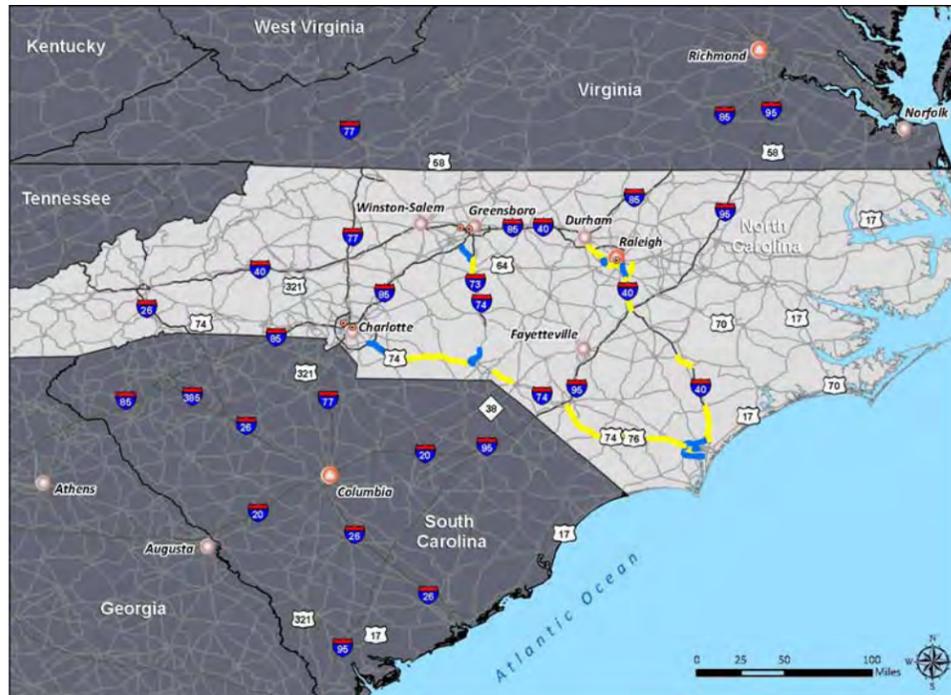
Site 3 – Radio Island



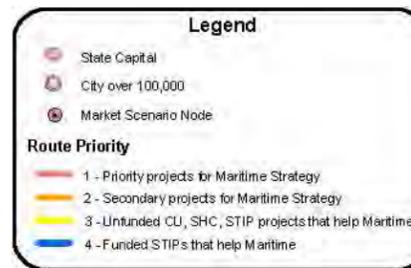
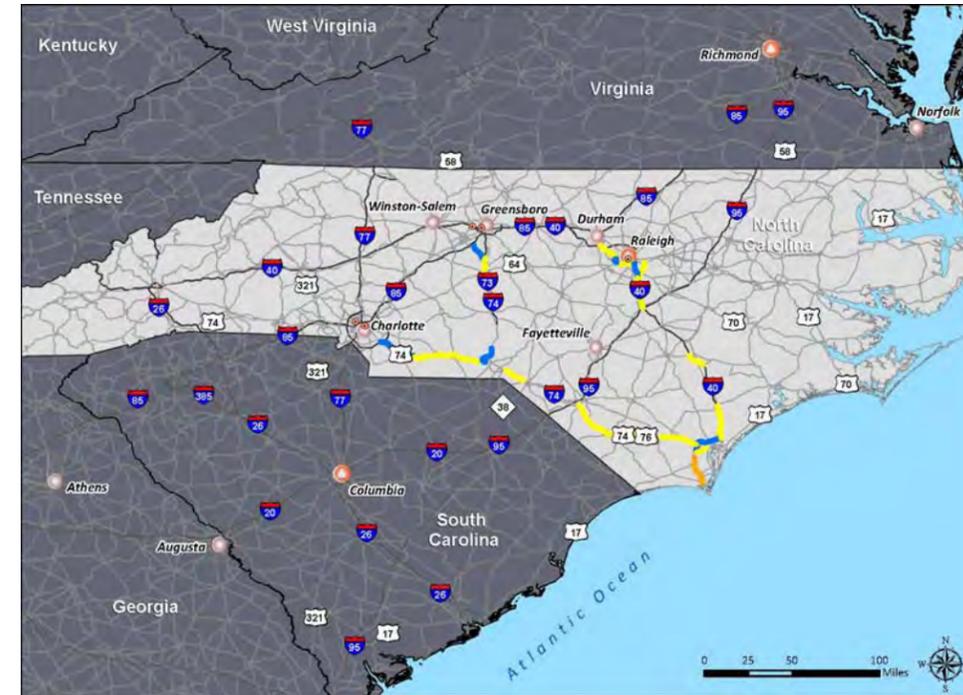
Site 4 – River Road



Site 5 – Port of Wilmington



Site 6 – Southport



Source: AECOM/URS from ESRI, NCDOT, FAF v3.1, USGS ThematicMapping world borders dataset

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7.5.5 Site Access – “Last Mile” Connections

The “last mile” to seaports can be a critical and challenging freight connection. This last link, which may comprise one mile or twenty miles, is an important component of the overall cost to deliver goods to market.

Port access or “last mile” connections to the prospective container terminal are described below.

Site 3 – Radio Island

Site 3 will require roadway upgrades to provide container truck access to Radio Island as described in Section 7.2.3. Because the potential site is close to the current port site, it can be assumed that the same highways used to access the Port of Morehead City would be used to reach the new container terminal. Access to the port from I-40, I-95, and I-795 is typically accomplished using NC 24 and US 70. US 70 provides the most direct route via a mostly median-divided multiple lane facility. Multiple recommended upgrades to US 70 to enhance overall highway network for goods movement would improve access to the Radio Island site. These improvements include, but are not limited to the North Carteret Bypass and Kinston Bypass. Cost estimates for port access projects include the construction of an access road onto Radio Island with a modified tight diamond interchange.

Site 4 – River Road

Access to the proposed port site from I-40, I-73/74, and I-95 could be accomplished using I-140 to US 421 to US 17 to NC 133. However, depending on the final alignment of the Cape Fear Skyway, a portion of it could be constructed to connect NC 133 with US 17. Recommended improvements to the highway network from I-40 and I-95 as described in Section 7.2.3 above would also benefit this location. Additionally, truck access to Site 4 would require a new highway connection to NC 133 as presented in Figure 81.

Figure 81: Highway Access to Site 4 – River Road



Source: AECOM/URS with ESRI, I-Cubed Imagery

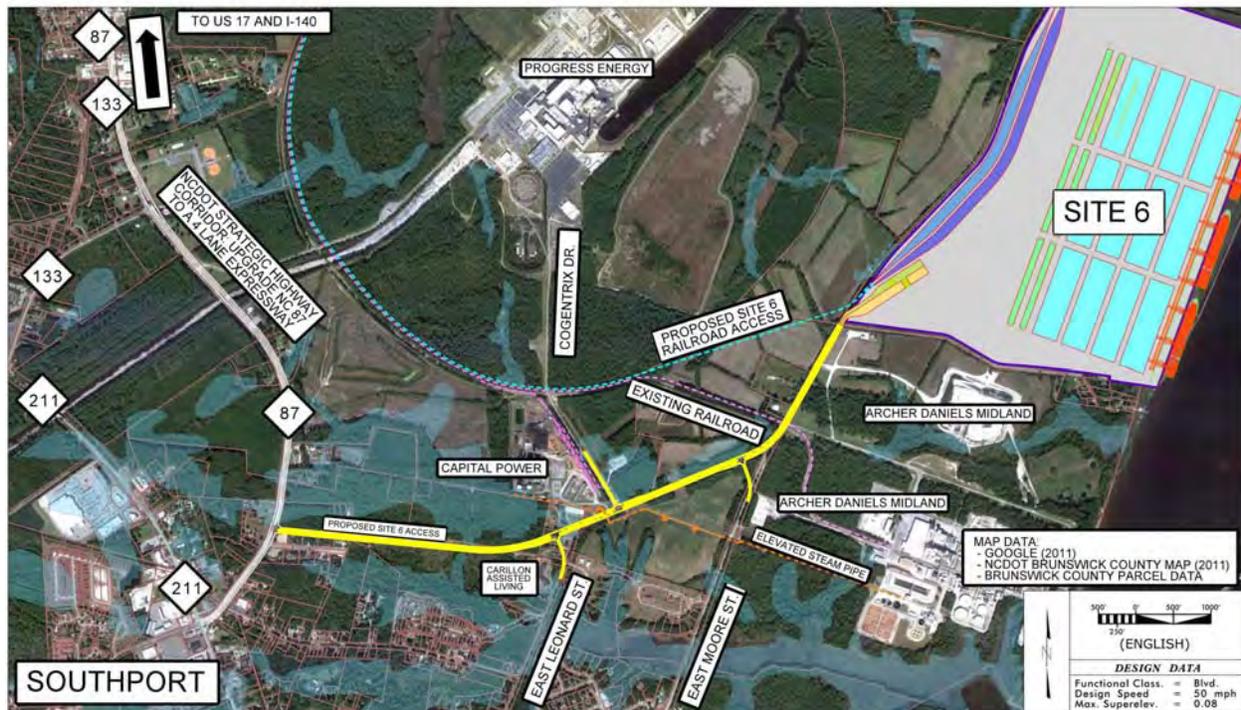
Site 5 – Port of Wilmington

Highway access to the Port of Wilmington is typically accomplished from I-40 and I-95 is typically accomplished using I-140 to US 421 to US 17/421 to US 17. Recommended improvements recommended to improve the highway network from I-40 and I-95 as described in Section 7.2.3 above would also improve access to the proposed site. No additional highway connections would be required.

Site 6 – Southport

Access to the proposed site from I-40 and I-95 would be accomplished using I-140 to US 421 to US 17 and to an improved NC 87, with a bypass of Boiling Springs Lakes. The improvements to NC 87 and bypass of Boiling Springs Lakes are identified Strategic Highway Corridor projects, but they are currently unfunded. In addition, a connection similar to that shown in the figure below would provide access to the container terminal from NC 87.

Figure 82: Highway Access to Site 6 – Southport



Source: AECOM/URS with ESRI, I-Cubed Imagery

7.5.6 Rail Improvements for Container Market

Each container yard site would require rail access to the nearest railroad mainline to support intermodal rail service.

Site 3 – Radio Island

Because a new container facility and intermodal container service would increase train traffic through Morehead City, rail improvements to Radio Island would include completion of the Havelock to Morehead City Rail Relocation Project, as described in Section 7.2.4. This project would improve speed and reliability of intermodal rail service and minimize impacts of increased train frequency on local traffic.

The ability to have support trackage for switching of rail cars is essential to an efficient operation. In addition, the ability to not trap motive power while serving the terminal is equally important.

Figure 83: Rail Access to Site 3 - Radio Island

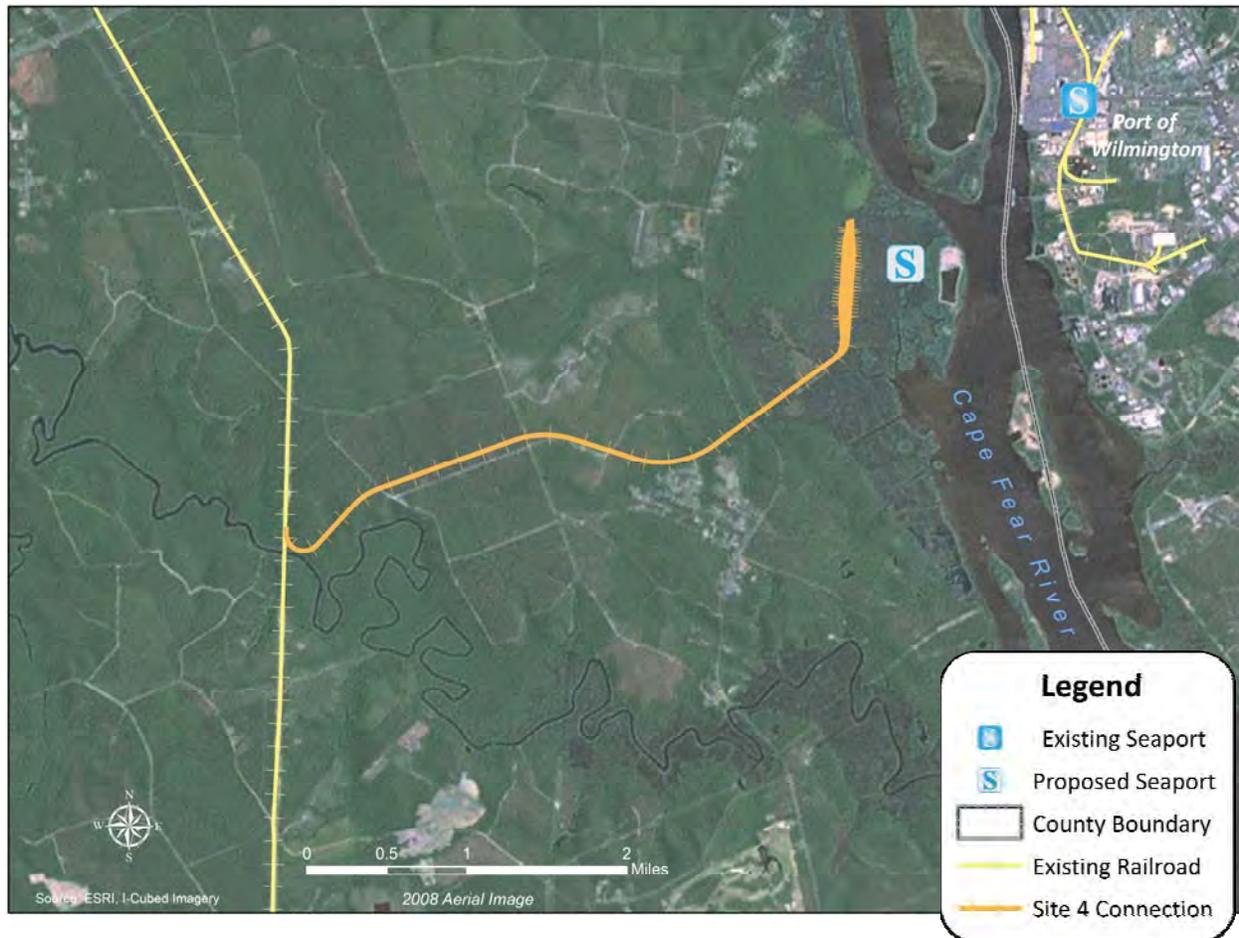


Source: AECOM/URS with ESRI, I-Cubed Imagery

Site 4 – River Road

This site is proposed to be accessed by a 22,000-foot lead track off of the existing north/south US Military track that runs from Sunny Point Junction to MOTSU. The long lead allows for reasonable track geometry and allows unit trains to be built outside the facility.

Figure 84: Rail Access to Site 4 – River Road



Source: AECOM/URS with ESRI, I-Cubed Imagery

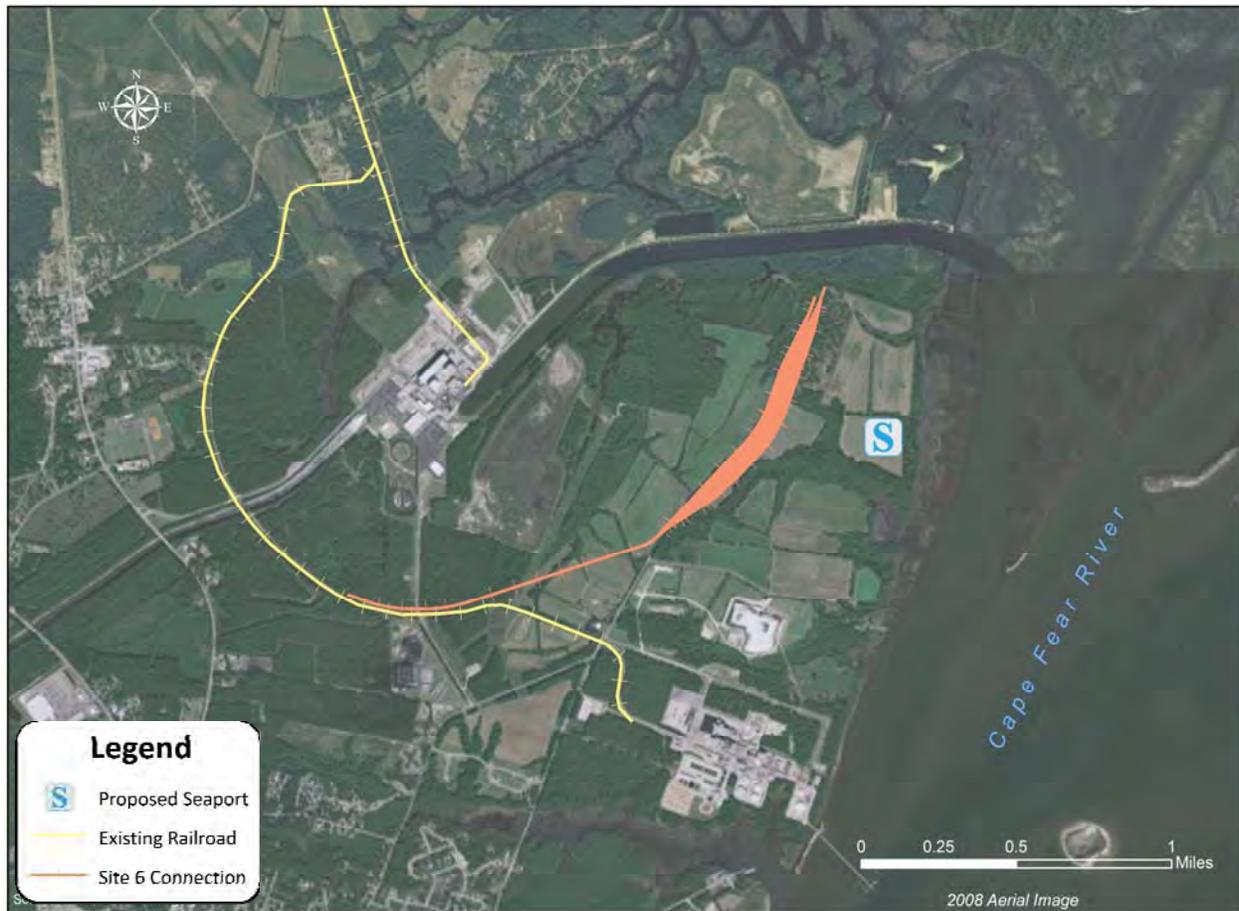
Site 5 – Port of Wilmington

The proposed container yard at the Port of Wilmington lies immediately adjacent to the existing CSX mainline. A new yard lead would be required to provide on-dock rail access for loading and unloading of intermodal containers.

Site 6 – Southport

To provide rail access to Site 4, a 5,400-foot lead track is proposed off the existing track that is currently serving nearby industries. The US Military track from MOTSU to Sunny Point Junction would be utilized to gain access to/from the CSX mainline. While the potential lead track to the facility is identified, review of the entire rail operation will be required to locate siding and receiving and departure tracks. The size of the property allows for satellite industries to the terminal to locate within proximity of the facility.

Figure 85: Rail Access to Site 6 - Southport



Source: AECOM/URS from ESRI data

7.5.7 Inland Facilities to Support Container Market

Through improved inland road and rail networks a new or expanded container terminal in North Carolina can be more effectively connected to existing intermodal facilities in Charlotte and Greensboro as well as distribution centers in the Raleigh-Durham area.

To enhance efficiency and capacity of container movements through Charlotte, the Norfolk Southern Corporation entered into a lease agreement with the City of Charlotte that would allow the railroad to construct and operate a new regional intermodal facility at property adjacent to the Charlotte-Douglas International Airport (CLT). The new 200-acre intermodal facility, scheduled to open in 2014, will replace NS's existing 40-acre intermodal facility in uptown Charlotte. Implementation of the \$90 million facility is already underway; it is being constructed by the railroad with the assistance of \$15.7 million in federal and state funds.⁵¹

Several previous studies and transportation programs have identified the need for improved access to Charlotte's rail yards as well as the need to expand existing container capacity at the

⁵¹ Source: Norfolk Southern press release.

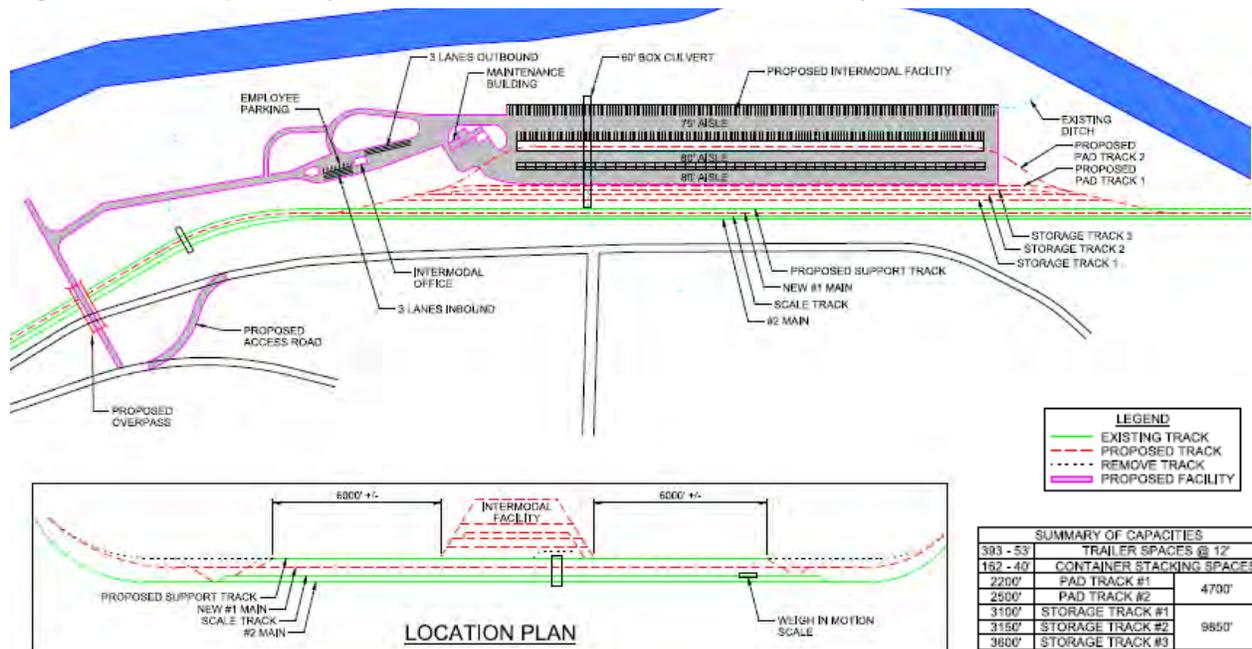
CSX facility. Evaluation of truck access to the existing intermodal facility on the west side of Charlotte identified significant challenges to future truck mobility within the I-485 urban loop. Conversations with railroad stakeholders also reveals that the location of the current CSX Charlotte facility does not provide efficient rail access to westerly destinations due to double-stack clearance constraints; CSX trains must now make indirect switching moves through their lines east of Charlotte in order to move double-stack trains to Atlanta.

Infrastructure improvements evaluated to support the container market includes the potential relocation of the existing CSX Charlotte Intermodal Terminal to a location east of Charlotte. Development of a new intermodal facility to east of Charlotte and repurposing of the existing rail yard to another use has the potential to achieve the following:

- Avoids \$1.3 billion in highway infrastructure improvements that would be required to efficiently move trucks into the urban center of Charlotte.
- Reduces 2040 truck travel times from Port of Wilmington to the national intermodal rail network by more than one hour
- Eliminates an estimated 600 daily truck trips through downtown Charlotte
- Reduces at-grade road-rail conflicts and associated traffic delays within downtown Charlotte
- Improves intermodal interface with the east-west CSX network, potentially providing enhanced rail connectivity to Atlanta and the rest of the Piedmont-Atlanta Megaregion.

To enhance its effectiveness, the new East Charlotte intermodal facility could be integrated into larger plans for an inland port, logistics park, or mega site. Collocation of the Charlotte Inland Terminal with the East Charlotte facility could enhance NCSPA's "Sprinter" truck service to reposition containers and make them more readily available for use by NC shippers.

Figure 86: Conceptual Layout of Inland Intermodal Container Facility



Source: AECOM

7.5.8 Relative Cost Effectiveness of Container Terminal Alternatives

In order to evaluate the relative cost effectiveness of the various container terminal alternatives, a variety of facility types and channel depths were analyzed. The locations considered, along with facility types and depths analyzed at each location, are summarized in Table 39.

Table 39: Container Terminal Sites Summary

Site #	Location	Facility Description	Channel Depth
3	Radio Island, Port of Morehead City	2-Berth RTG	45 ft (Existing)
3	Radio Island, Port of Morehead City	2-Berth RTG	51 ft
4	Cape Fear River, River Road Southeast	2-Berth RTG	51 ft
4	Cape Fear River, River Road Southeast	2-Berth ASC	51 ft
5	Cape Fear River, Port of Wilmington	2-Berth RS	42 ft (Existing)
5	Cape Fear River, Port of Wilmington	2-Berth RTG	42 ft (Existing)
5	Cape Fear River, Port of Wilmington	2-Berth RTG	45 ft
5	Cape Fear River, Port of Wilmington	2-Berth RTG	47 ft
5	Cape Fear River, Port of Wilmington	2-Berth RTG	51 ft
6	Cape Fear River, Southport	2-Berth RTG	51 ft
6	Cape Fear River, Southport	2-Berth ASC	51 ft

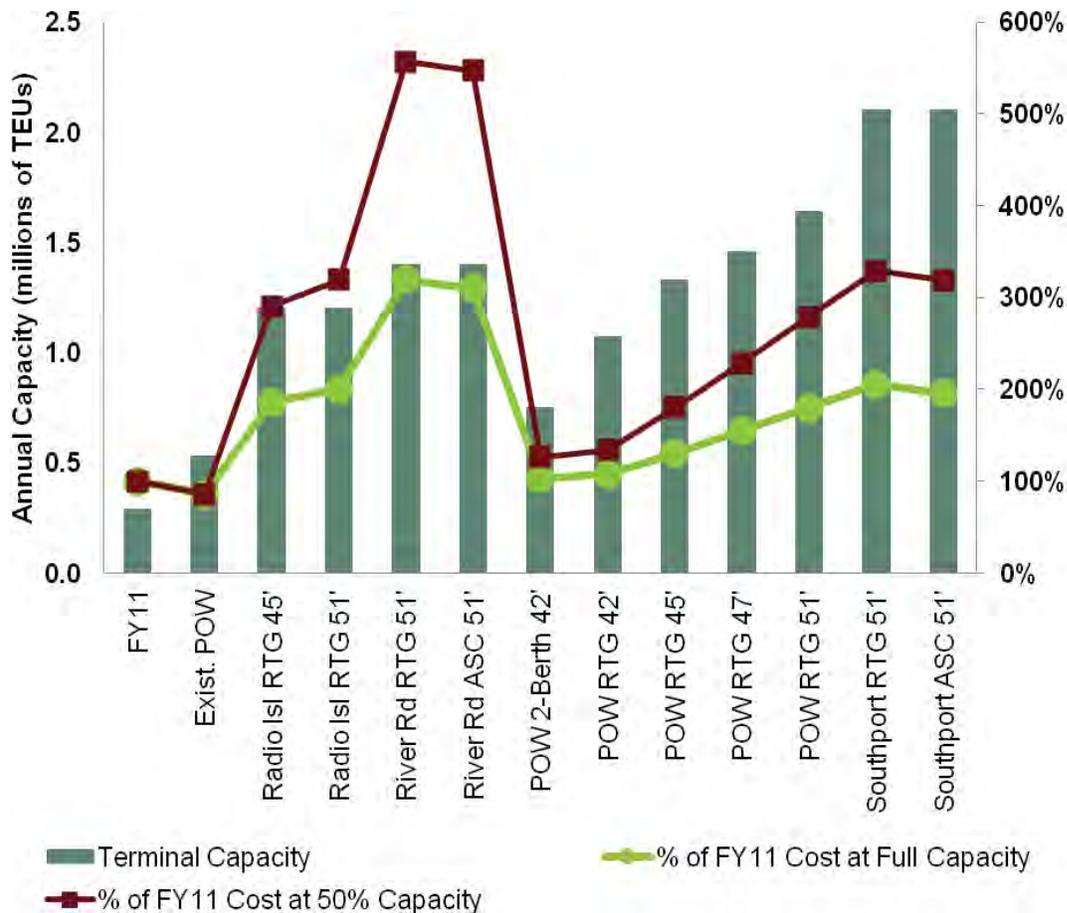
RS = reach stacker RTG = rubber-tired gantry crane ASC = automated stacking crane

The cost comparison of the various container terminal alternatives incorporated both operating costs and capital costs. Operating costs included direct variable costs such as labor, energy, equipment, terminal lease, and information technology that are required to operate the terminal at full capacity. Capital costs included estimated cost of upgrading or building a new terminal along with the initial capital cost for channel and berth deepening (if required) and marginal costs for maintenance dredging to maintain the new or deeper channel. Costs included in this analysis include cost categories that may be paid by others (e.g. dredging costs shared with USACE, stevedoring costs). Capital costs to develop “last mile” landside road and rail connections to the container terminal are also incorporated; however, additional inland highway and rail network enhancements that may support the realization of total container market potential were excluded. Capital upgrades were annualized over 30 years at six percent discount rates to obtain an equivalent annualized cost. Indirect costs such as port management, administration and security were not included.

Figure 87 summarizes the analysis results, comparing the annual capacity (on the left axis, expressed in millions of TEU) and relative cost efficiency (on the right axis, expressed as a percent of existing FY11 cost per move at the existing Wilmington Container Terminal) of the various container terminal alternatives considered. The optimal case will have a high capacity bar, but low lines for cost as a percentage of the current mode of operation at Wilmington. Because a newly developed or expanded terminal would not immediately realize its full

capacity, the analysis considered per-move costs for each alternative if the terminal is operating at 50 percent capacity.

Figure 87: Terminal Capacity vs. Cost per Move



Source: AECOM

Comparison of operating costs at 50 percent of capacity and at 100 percent capacity reveals the relative risk of building unused capacity for the various container terminal alternatives. Alternatives with a significant reduction in annualized cost efficiency when not operating at full capacity may suffer unrecoverable costs in early years of operation or if anticipated demand is not realized.

Overall, this analysis of annualized costs reveals that Site 4 - River Road is the least desirable of the container port sites evaluated. This location has the highest relative cost per container move because it would require extensive initial capital investment in a new wharf and terminal development, new landside road and rail connections, and has dredging needs similar to the existing Port of Wilmington terminal. Due to adjacent wetland constraints, this site also has more limited channel frontage as compare to Site 6 – Southport.

The various expansion alternatives at Site 5 – Port of Wilmington offer the best potential efficiency, operating at either 50 percent or 100 percent capacity, because those alternatives utilize existing infrastructure to the greatest extent. There are also opportunities to expand the existing Wilmington Container Terminal incrementally, thereby limiting the capital cost burden of unused terminal capacity in early years as compared to a new terminal.

Annualized costs for the Site 3 – Radio Island and Site 6 – Southport are similar. With channel frontage to accommodate three contiguous berths and significant additional backland area available for development, the Southport site offers greater capacity for expansion. The maximum capacity that could be developed at Radio Island is about 1.3 million TEU, which is sufficient to meet projected 2040 demand.

7.5.9 Estimated Cost of Infrastructure Investment for Containers

The estimated total infrastructure investment for each container port alternative is summarized in Table 40 below. The following factors were used to select a single alternative for further economic evaluation:

- Total estimated infrastructure investment (Table 40),
- Terminal capacity and operational efficiency (Figure 87),
- Proximity to existing manufacturing and distribution centers (Figure 6), and
- Potential conflict or synergy with other maritime investment alternatives

Because of its comparative infrastructure needs, capacity and efficiency, and proximity to existing distribution centers, the Port of Wilmington was selected for further economic impact evaluation. This site also takes advantage of significant existing highway and rail infrastructure. The POW alternative with the highest estimated cost (Site 5 – RTG +51 ft) was selected as the basis for the benefit/cost analysis; however, it is important to note that the feasibility of deepening the Cape Fear channel to 51 feet is not known, and dredging to this depth could have significant environmental consequences. Comparative benefit-cost analysis of the two greenfield sites have also been prepared in response to stakeholder input (refer to Section 12.4).

Table 40: Infrastructure Investment to Support Container Market (\$ Millions, 2011)

Investment	Site 3 – Radio Island		Site 4 – River Road		Site 5 –Wilmington	
	RTG + 45 ft	RTG + 51 ft	RTG + 51 ft	ASC + 51 ft	RS + 42 ft	RTG + 42 ft
Berth / dredging	\$ 11	\$68	\$432	\$432	\$0	\$0
Port and terminal	\$ 395	\$395	\$1,486	\$1,556	\$137	\$258
Highway network	\$ 3,208	\$3,208	\$2,921	\$2,921	\$2,892	\$2,892
Highway access	\$ 23	\$23	\$98	\$98	\$0	\$0
Rail access	\$ 5	\$ 5	\$21	\$21	\$1	\$1
Rail network	\$ 204	\$204	\$0	\$0	\$0	\$0
Inland facilities	\$ 131	\$131	\$131	\$131	\$131	\$131
Total	\$3,977	\$4,034	\$5,089	\$5,159	\$3,161	\$3,282

Investment	Site 5 – Wilmington			Site 6 – Southport	
	RTG + 45 ft	RTG + 47 ft	RTG + 51 ft	RTG + 51 ft	ASC + 51 ft
Berth / dredging	\$197	\$315	\$427	\$362	\$362
Port and terminal	\$272	\$287	\$301	\$1,065	\$1,170
Highway network	\$2,892	\$2,892	\$2,892	\$3,203	\$3,203
Highway access	\$0	\$0	\$0	\$17	\$17
Rail access	\$1	\$1	\$1	\$17	\$17
Rail network	\$0	\$0	\$0	\$0	\$0
Inland facilities	\$131	\$131	\$131	\$131	\$131
Total	\$3,493	\$3,626	\$3,752	\$4,795	\$4900

Source: AECOM/URS

7.6 Infrastructure Needs for Refrigerated Cargo

The unique requirement of refrigerated cargo, as compared to other market scenarios, is infrastructure to support cold storage. An overview of infrastructure needs for refrigerated cargo is provided in Table 41 below.

Table 41: Overview of Infrastructure Needs for Refrigerated Cargo

Infrastructure	North Carolina's Needs
Container yard plug-ins	Refrigerated goods, particularly foodstuff, are most commonly shipped via refrigerated container (reefer). The existing Wilmington Container Terminal offers limited reefer plug-ins at the wharf. These connections would be required as part of any new or expanded container terminal.
Temperature-controlled warehousing	Local refrigerated exports may be delivered to distribution facilities at or near port prior to being stuffed into containers. There are no existing cold storage warehouses near either of the state's port facilities. Realization of this market will require development of a refrigerated warehouse, to store and consolidate goods into reefers or to handle breakbulk cargo requiring temperature controlled storage. This facility should be located within easy drayage distance from the container terminal.

7.6.1 Port and Terminal Improvements for Refrigerated Cargo

Refrigerated containers, or reefers, as they are known in the industry, can be stored on street chassis or in grounded stacks serviced by racks. Reefer racks provide access for personnel to plug and unplug the reefers as needed. Reefers are typically run on 440V power. Other than the electrical outlets and racks for grounded storage, no special facilities are required for reefer handling on a container terminal.

Figure 88: Racks and Plug-Ins for Refrigerated Containers



Source: AECOM

7.6.2 Inland Facilities to Support Refrigerated Cargo

An estimated 80,000 SF refrigerated warehouse would be required to provide storage of palletized goods.

7.6.3 Estimated Cost of Infrastructure Investment for Refrigerated Cargo

The estimated total infrastructure investment required for each refrigerated cargo alternative evaluated is summarized in Table 42 below. Because there are not site-specific requirements for water or port improvements, or for road or rail access, the estimated investment needs for refrigerated cargo would be the same for site at Morehead City or a site at Wilmington. Because this investment would be complementary to the proposed container terminal development and its location is close proximity to existing distribution facilities, the Wilmington site was selected for further evaluation of economic benefits and impacts.

Table 42: Infrastructure Investment to Support Refrigerated Cargo (\$ Millions, 2011)

Required Infrastructure Investment	Estimated Capital Cost
Cold storage warehouse	\$ 24
Total	\$ 24

Source: AECOM/URS

7.7 Infrastructure Needs for Ro/Ro and Oversize Cargo

Roll-on/Roll-off (Ro/Ro) cargo includes wheeled equipment that may be rolled onto a specialized Ro/Ro vessel. Wharf-side storage area must be provided to accommodate forecasted volumes or units. The market considered for North Carolina would be focused on construction and industrial equipment, which may also be heavy or oversize. Ro/Ro cargo requires no cargo handling equipment at the berth; however, handling of very large or heavy that will be lifted on or off of vessels will require special handling equipment.

Oversize cargo comprises breakbulk goods that may be too heavy, too tall, or too wide to transport, handle, or store with conventional facilities. This includes Lift-on/Lift-Off (Lo/Lo) cargo that requires high-capacity cranes at the wharf. Large components for wind power installation are among the cargo included in the oversize category. It is important that inland road and rail infrastructure can accommodate the size and weight requirements of this cargo. Dedicated routes designated for heavy loads are ideal. Because the cost to transport this cargo to port can be significant, manufacturers would benefit from collocation at or near facilities that offer infrastructure that can accommodate heavy and oversize loads.

An overview of infrastructure needs for Ro/Ro and Oversize cargo is provided in Table 43.

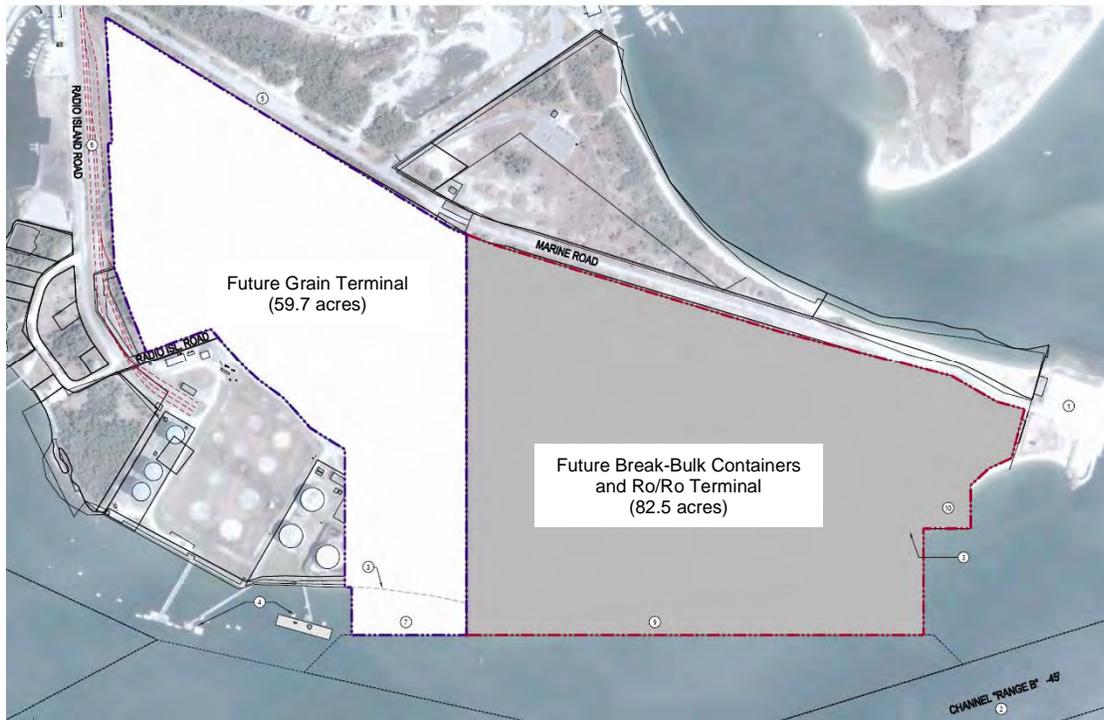
Table 43: Overview of Infrastructure Needs for Ro/Ro and Oversize Cargo

Infrastructure	North Carolina's Needs
Channel depth of at least 35 ft and minimum 900 ft wharf	Each of North Carolina's existing port facilities maintains water depth and berth capacity sufficient to accommodate a typical Ro/Ro vessel; no additional deepening would be required.
Open storage area near the wharf	Existing berths and terminal infrastructure are adequate to handle the projected volumes of Ro/Ro and oversize cargo. Unused or underutilized terminal areas can be dedicated as open laydown areas. Some strengthening of existing wharves may be required.
200-ton mobile harbor cranes	High-capacity mobile harbor cranes would be required on the wharf to handle large and heavy cargo such as wind turbine components. For capacity and operational flexibility two cranes are recommended.
Highway network and local access	Large and heavy cargo benefit from highway routes that are designated for oversize loads. Efficient highway connections to port from manufacturing centers in the Triangle Region and along the US 70 corridor would facilitate the movement of goods for export.
Rail network and local access	<p>Rail is often the best means to handle heavy and oversize loads. A direct rail connection from manufacturing center to port will facilitate transport of these goods for export. Due to distance and cost of moving equivalent weight by truck, rail would be the best option for transporting goods from manufacturing centers in Greensboro, Winston-Salem, and Charlotte to port.</p> <p>The availability of rail lift facilities at inland manufacturing locations would facilitate the transfer of heavy and over size goods to the port. These would ideally be located at inland port or mega sites, where the benefit of this infrastructure to support Ro/Ro and heavy cargo would be shared by multiple users. Such a mega site location could attract manufacturers with common needs for transport of oversize goods to port.</p> <p>On-terminal rail is also required at the marine terminal so that cargo may be lifted or rolled directly on/off the railcar at the dock.</p>

7.7.1 Port and Terminal Improvements for Ro/Ro and Oversize Cargo

Two potential sites to accommodate a Ro/Ro and oversize breakbulk cargo at either Radio Island or at the Port of Wilmington north property are illustrated in Figure 89 and Figure 90 below. The areas illustrated are larger than would be required to support projected 2040 volumes, so only a portion of the footprint shown, totaling approximately 21 acres, would be developed. Alternatively, the additional storage area could support upside growth in this market. For example, if wind power production is located in NC. Two mobile harbor cranes would be provided at each site.

Figure 89: Radio Island Ro/Ro Terminal Footprint



Source: AECOM

Figure 90: Port of Wilmington Ro/Ro Terminal Footprint



Source: AECOM

7.7.2 Highway Improvements to Support Ro/Ro and Oversize Cargo

Large and heavy cargo benefit from highway routes that are designed for oversize loads. Highway investments were targeted to improve access from manufacturing centers in the Triangle region and Kinston to potential port locations.

Radio Island

Key improvements to enhance access to the Port of Morehead City – Radio Island include the North Carteret Bypass and Kinston Bypass. Additional improvements to US 70, I-40, NC 42, US 401, and US 421 have been identified. Currently unfunded projects included in cost estimates for this scenario are listed below. Proposed highway network improvements to support the transport of Ro/Ro and oversize goods are illustrated in Figure 91.

Table 44: Detail of Highway Projects to Support Ro/Ro and Oversize Access to Radio Island

ID Number	Route	Description	County
SHC 139	I-40	widening from Wade Avenue to NC 147	Durham, Wake
SHC 153	I-40	widening from Lake Wheeler Road to I-440/US 1/ US 64	Wake
SHC 154	I-40	widening from I-440/US 64 to Lake Wheeler Road	Wake
I-5111BB	I-40	widening from I-95 to NC 42	Wake, Johnston
FS-1005A	I-40/US 64	widening, pavement, interchange mod, operation improvements from West of SR 1728 (Wade Avenue) to east of SR 1375 (Lake Wheeler Road)	Wake
CU2 24	NC 24	widening from NC 58 to White Oak River	Carteret
CU3 24	NC 24	widening lanes from NC 172 to FS-1103A	Onslow
FS-1103A	NC 24	access management and drainage improvements from NC 24 to SR 1459	Onslow
R-3410	NC 42	widening from NC 50 to US70	Johnston
CU1 42	NC 42	widening from Fuquay Varina to NC 50	Wake, Johnston
R-4431	New Route	new location (Havelock Bypass) to Beaufort	Carteret
R-2609	US 401	widening from North of Fayetteville to Fuquay Varina	Wake, Harnett, Cumberland
UF STIP	US 421	widening from Sanford to US 401	Harnett, Lee
FS-0802B	US 70	access improvements from James City to proposed Havelock Bypass	Craven
SHC 336	US 70	upgrade to interstate standards from SR 1200 to Kinston Bypass	Craven, Jones
CU3 70	US 70	upgrade to interstate standards from Buffalo Road to Clayton Bypass	Johnston
CU1 70	US 70	upgrade to interstate standards from Goldsboro Bypass to Selma Bypass	Johnston, Wayne
R-2553	US 70	new location (US 70 Kinston Bypass) from Craven County line to west of Kinston	Lenoir
SHC 341	US 70	upgrade to interstate standards from east of La Grange to Goldsboro Bypass	Lenoir
CU2 70	US 70	Selma Bypass at US 70/I-95	Wake, Johnston

Source: AECOM/URS from FAF 3.1 and AECOM Delivered Cost Model

Note: CU = Conceptual Upgrade; SHC = Strategic Highway Corridor; FS = Feasibility Study. For more information, please refer to the "Project ID numbers explained" text below Table 27.

Wilmington

Key improvements to enhance access to the Port of Wilmington to market scenario nodes include US 74 / 76, I-40, and US 17 to US 258. Currently unfunded projects included in cost estimates for this scenario are listed below.

Table 45: Detail of Highway Projects to Support Ro/Ro and Oversize Access to Wilmington

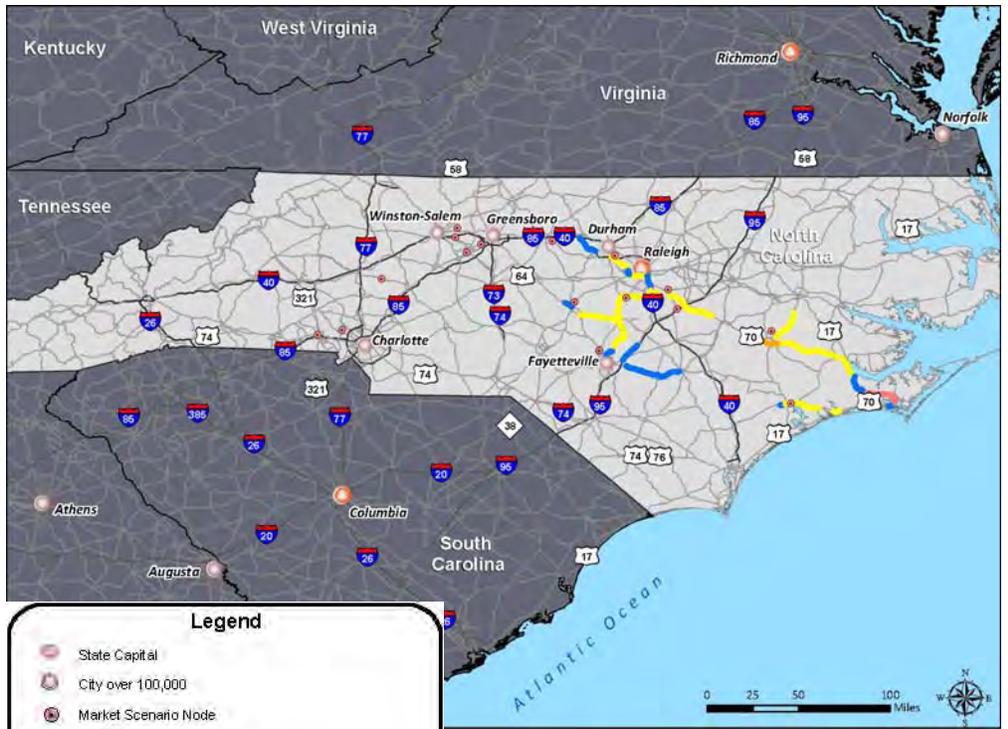
ID Number	Route	Description	County
CU2 I-40	I-40	widening NC 24 segment Exit 364 to 373	Duplin
SHC 139	I-40	widening from Wade Avenue to NC 147	Durham, Wake
SHC 158	I-40	widening from I-95 to NC 42	Johnston
CU1 I-40	I-40	widening Exit 398 (NC 53) to Exit 416 (US 17)	New Hanover, Pender
SHC 153	I-40	widening from Lake Wheeler Road to I-440/US 1/ US 64	Wake
SHC 154	I-40	widening from I-440/US 64 to Lake Wheeler Road	Wake
I-5111BB	I-40	widening from I-95 to NC 42	Wake, Johnston
FS-1005A	I-40/US 64	widening, pavement, interchange mod, operation improvements from West of SR 1728 (Wade Avenue) to east of SR 1375 (Lake Wheeler Road)	Wake
CU4 24	NC 24	widening from NC 24 Business to NC 111	Onslow
R-3410	NC 42	widening from NC 50 to US70	Johnston
CU1 42	NC 42	widening from Fuquay Varina to NC 50	Wake, Johnston
FS-0803A	US 17	widening from proposed I-140 to NC 133 (Village Road)	Brunswick
CU1 17	US 17	upgrade to freeway from US 17 Bypass in Jacksonville to Maysville	Onslow
CU2 258	US 17/US 258	widening from NC 24 Business to NC 111	Onslow
R-2609	US 401	widening from North of Fayetteville to Fuquay Varina	Wake, Harnett, Cumberland
UF STIP	US 421	widening from Sanford to US 401	Harnett, Lee
CU3 70	US 70	upgrade to interstate standards from Buffalo Road to Clayton Bypass	Johnston
CU2 70	US 70	Selma Bypass at US 70/I-95	Wake, Johnston
FS-1106B	US 74	upgrade to interstate standards from NC 41 in Lumberton to SR 1585 (Union Valley Road) in Columbus County	Robeson, Columbus
R-4462	US 74/US 76	upgrade to interstate standards from Whiteville to the proposed US 17 Wilmington Bypass	Columbus, Brunswick

Source: AECOM/URS from FAF 3.1 and AECOM Delivered Cost Model

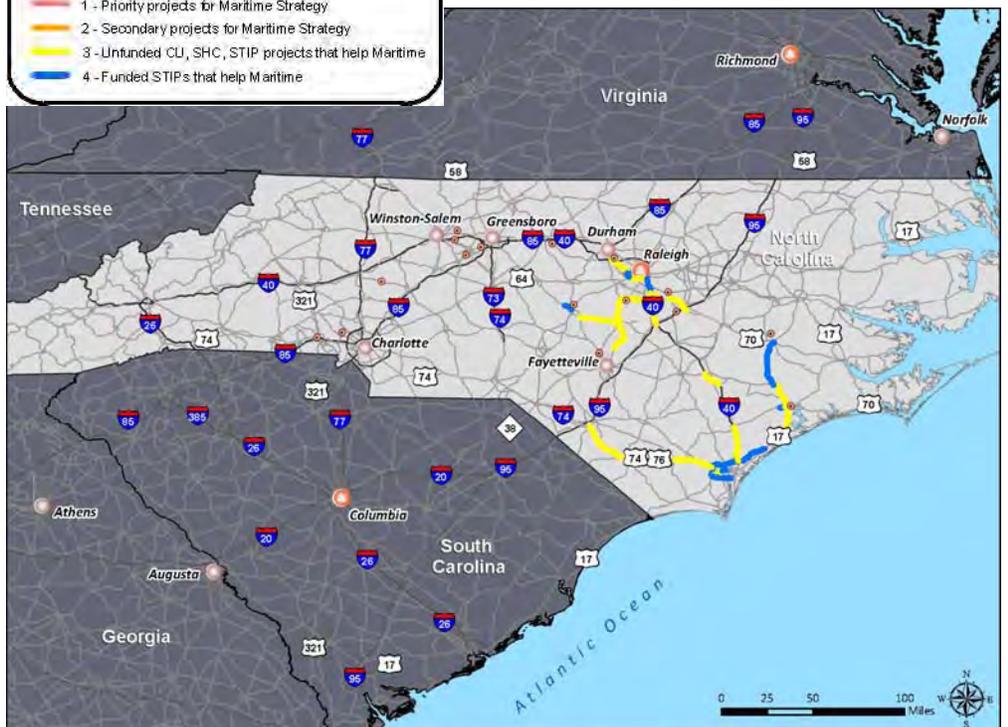
Note: CU = Conceptual Upgrade; SHC = Strategic Highway Corridor; FS = Feasibility Study. For more information, please refer to the "Project ID numbers explained" text below Table 27.

Development of the North Property could also incorporate on-port circulation and truck access that would minimize truck impacts to the adjacent Sunset Park neighborhood.

**Figure 91: Highway Network Improvements to Support Ro/Ro and Oversize Market
Radio Island**



Wilmington



Source: AECOM/URS from ESRI, NCDOT, FAF v3.1, USGS ThematicMapping world borders dataset

7.7.3 Rail Improvements for Ro/Ro and Oversize Cargo

The movement of heavy or oversize goods by rail requires a rail connection and the ability to roll or lift goods onto the railcar at the manufacturing site.

For the transport of oversize cargo to Morehead City, the construction of the Havelock to Morehead City Rail Relocation Project is proposed.

To support inland manufacturing centers, the development of two Ro/Ro-Lo/Lo ramps are proposed. Locations for ramp development should be identified in collaboration with in-state manufacturing and economic development interests. Figure 92 illustrates the rail connection to the Global TransPark which, when complete, will allow for transport of aircraft components from the SpiritAir facility to Morehead City.

Figure 92: Planned Rail Connection at Global TransPark



Source: Defense Logistics Initiative Transportation Memorandum, Draft, Kimley-Horn (December 2011)

7.7.4 Estimated Cost of Infrastructure Investment for Ro/Ro and Oversize Cargo

The estimated total infrastructure investment required to support Ro/Ro and oversize cargo at either Radio Island or at Wilmington is summarized in Table 46 below. While the Radio Island site would require a somewhat higher investment rail infrastructure, this alternative would also improve access to Morehead City for military use. With its location on US 70, along which corridor several heavy manufacturers are located, the Radio Island site was selected for further evaluation for economic benefits and impacts.

Table 46: Infrastructure Investment to Support Ro/Ro and Oversize Cargo Market (\$ Millions, 2011)

Required Infrastructure Investment	Radio Island	Wilmington
Port and terminal	\$49	\$49
Highway network	\$2,157	\$2,365
Local highway access	\$23	\$0
Rail network	\$204	\$0
Local rail access	\$14	\$12
Inland facilities	\$78	\$78
Total	\$2,525	\$2,503

Source: AECOM/URS

7.8 Chemicals and Phosphates

Chemicals and phosphates represent a commodity classification that is important to North Carolina.

Phosphates are currently stored and handled at the Port of Morehead City in a combination of concrete domes and warehouses that are connected with a series of conveyors to move the phosphates between the berth and the storage facilities.

PCS Phosphate operates private barge service to carry export materials from their facilities in Aurora NC to Morehead City. It is assumed that this service would be expanded by PCS Phosphate as required and that no additional public infrastructure would be required.

An estimated 94,000 square feet of additional storage space would be required to handle projected 2040 volumes at Morehead City.

Figure 93: Bulk Handling Facilities at Port of Morehead City



Source: NCSA

7.9 Infrastructure Needs for Military Cargo

Military cargo would benefit from investments made to support the various market scenarios evaluated as part of the *Maritime Strategy*. Because military cargo comprises containers, Ro/Ro, and oversize cargo, the maritime infrastructure needs to support military use are generally consistent with those cargos. Draft findings from the Governor's Military Task Force concluded that access to the North Carolina ports to military installations could be two days faster than Charleston is today with the implementation of select rail improvements including the Pembroke Rail Turn, the Fort Bragg Connector, and the Wallace to Castle Hayne Rail Improvements. In addition to these, investments in ITS and communications to permit secure monitoring and tracking, as well as seamless coordination among commercial providers with military logistics units would facilitate this movement as well. More specific evaluation of economic opportunities and infrastructure needs to support equipment reset has been performed under the Defense Logistics Initiative. Specific infrastructure needs cited by military stakeholders are summarized below.

For major military moves, significant open area comprising 1,000 to 2,000 acres is required for marshaling of equipment. This can be accomplished inland at a site that has good road and rail connection to the nearby port, such as at the Global TransPark.

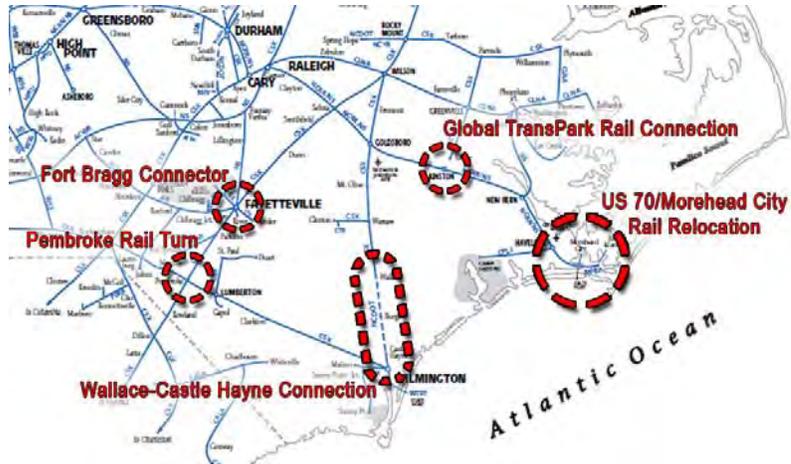
Infrastructure identified to support the Ro/Ro and Oversize market would be beneficial to the movement of military cargo. Enhanced Ro/Ro capabilities at Wilmington are desired.

The US Military uses containers where possible to transport supplies and equipment. Up to 200 TEU may be required to support a single move.

The availability of on-dock rail and inland rail facilities would minimize handling costs for military cargo. Several high-priority projects have been identified as illustrated in Figure 94.

Construction of the Wallace to Castle Hayne Rail Connection would provide an important direct link from military facilities at Fort Bragg to Port of Wilmington. The Wallace to Castle Hayne project is also mentioned in the Strategic Seaport Report to Congress (2007) as an important investment in line haul rail infrastructure to provide more direct routing of Camp Lejeune cargo and redundant rail access to Port of Wilmington.⁵²

Figure 94: Priority Railroad Improvements to Support Military Cargo



Source: North Carolina Logistics Village Initiative Transportation Needs and Priorities, Kimley-Horn & Associates (December 2011)

Figure 95: Priority Highway Improvements to Support Military Cargo



Source: North Carolina Defense Logistics Initiative Transportation Needs and Priorities, Kimley-Horn & Associates (December 2011)

The Military Growth Task Force has identified the Morehead City Rail Relocation has a high priority project to improve rail access to the Port of Morehead City; this alternate route, likely constructed to the north of Morehead City near NC 101, would connect the Port of Morehead City and Beaufort with Havelock and MCAS Cherry Point.

The Pembroke Rail Turn (already funded) will provide a new connection between two key rail lines – the CSX north-south mainline between Baltimore MD and Jacksonville FL and the CSX east-west mainline between Wilmington NC and Charlotte NC -- that now cross south of Fort Bragg. Wallace to Castle Hayne Connection, which would

⁵² US Department of Defense Report to Congress on Projected Requirements for Military Throughput at Strategic Ports, Undersecretary of Defense (Acquisition, Technology, & Logistics) (April 2007)

improve the rail access from the Port of Wilmington to surrounding military installations.

The Fort Bragg Connector includes three projects that will enhance access from the base to Port of Wilmington.

Global TransPark Rail Connection will link GTP with the existing rail network. The rail spur, providing a connection to the NCCR system, would introduce another mode for use in the GTP. A potential route for this rail spur has already been identified. Construction for this improvement is slated to begin in spring 2012.

Connection between seaports of entry (SPOE) and nearby airports of entry (APOE) is an important advantage to movement of military cargo. Improvement of road connections between Morehead City, Cherry Point, and GTP would enhance the military value of the Port of Morehead City.

The improvement of highway connections between North Carolina's military bases and strategic ports would facilitate military goods movements and deployments. The North Carteret Bypass, US 17 widening around Jacksonville and the Kinston, Greenville, and Wilmington Bypass projects have all been identified as priority highway projects by military stakeholders. Figure 95 illustrates the highway improvements recommended by the Military Growth Task Force and Defense Logistics Initiative.

8 ENVIRONMENTAL CONSIDERATIONS

Potential environmental impacts from construction and operation of the alternative port facilities to achieve one or more of the market scenarios are described in this section. These potential impacts and effects are based on existing literature and available Geographic Information System (GIS) data. This presentation is intended to provide insight into some of the issues anticipated to be encountered, but is not intended to be a comprehensive environmental assessment or review. If an alternative market and infrastructure scenario is selected subsequent to this *North Carolina Maritime Strategy*, additional environmental and engineering studies will be required to fully assess environmental impacts in accordance with the National Environmental Policy Act (NEPA).

8.1 Health Effects of Port Operations

Public health research in California has demonstrated that air emissions resulting from port activities can be tied to negative health impacts, including premature death. There are, however, no nationwide statistics. The most comprehensive statistical analysis of the health effects of port emissions currently available has been conducted by the California Air Resources Board (CARB). CARB has modeled concentrations of diesel particulate matter (PM) to assess the mortality effects of diesel particulate emissions statewide and also in the area near the Ports of Los Angeles and Long Beach. Based on modeled diesel PM concentrations for year 2002, premature deaths associated with the ports' emissions was estimated to be approximately 120. The mortality effects of poor air quality across California were estimated at 18,000 deaths for that same year.⁵³ In 2006, the Ports of Los Angeles and Long Beach adopted and implemented the San Pedro Bay Ports Clean Air Action Plan to address pollution from port operations and have since realized more than 70 percent reduction in diesel particulate matter emissions (between the baseline year 2005 and 2010).

8.2 Local Economic Effects

A correlation between the presence of a large container port and unemployment and poverty within the adjacent port community has been described in one study⁵⁴. While the researchers conclude in that report that the ports studied had a negative effect on employment and poverty rates in the nearby neighborhoods, the cause-and-effect basis is not clearly established. Empirical evidence surrounding many of the nation's largest ports indicates that those communities are attractive and desirable places to live. Despite their growing container ports, Savannah and Charleston continue to maintain vibrant economies in areas near the ports. Over the last decade, the Port of Long Beach has invested in waterfront facilities (aquarium, restaurants, pleasure boat marina, and other recreational uses) that have enhanced the

⁵³ More information on the CARB research is available at http://www.arb.ca.gov/research/health/pm-mort/pm-mort_final.pdf.

⁵⁴ The Economic Status of Areas Surrounding Major U.S. Container Ports: Evidence and Policy Issues, Lisa Grobar (September 2008)

surrounding neighborhoods with spillover effects that benefit the adjacent convention center, downtown shopping district, and newly-developed waterfront residential complexes. In 2011 alone, the Port of Long Beach invested \$80 million in community-related shoreline developments.

Regardless, this study suggests useful strategies -- many of which are regularly put into place in today's modern ports -- to balance the broad economic benefits of seaport activities with the potentially negative externalities of port operations. Example measures include:

- Reducing ship and truck emissions at the port,
- Investment in infrastructure to reduce congestion on local roads and freeways,
- Use of "satellite terminals" to reduce local congestion,
- Enhancing the aesthetic properties of port-adjacent neighborhoods, and
- Job training programs to reduce mismatch of skills in port districts to needs at ports.

8.3 Navigable Channel Changes and Potential Impacts to Fish and Wildlife

Many of the container terminal alternatives considered along the Cape Fear River (Port of Wilmington, River Road, and Southport sites) would require deepening and widening of the existing channel; scenarios identified for the Port of Morehead City – Radio Island would also require some dredging at the new berths and turning basins (see Section 7.5.2).

In a recent updated review of the USACE's Wilmington Channel project, which includes a study of the "S" turn at the lower reach of the Wilmington Harbor Navigation Channel, USFWS identified potential adverse impacts that would need to be addressed as part of a comprehensive environmental permitting process and mitigation plan.⁵⁵

- The new channel alignment may accelerate erosion on nearby beaches by disrupting the existing longshore sediment transport system at the mouth of the Cape Fear River and result in the loss of sea turtle nesting habitat;
- Sediment deposition on area beaches may diminish the habitat quality for nesting sea turtles and adversely affect populations of beach invertebrates;
- Sediment deposition on area beaches may result in turbidity and siltation in nearshore areas that adversely affect important hardbottom habitat;
- The increased extent of overflowing scows or barges carrying sediment may reduce water quality and adversely affect fish and other aquatic organisms as well as estuarine habitats such as primary nursery areas, and;
- The elimination of the bubble curtain around blast areas in the river would kill some fish.

Figure 71 on page 137 depicts sections of adjacent shorelines that could be impacted by deepening of the channel, which would result in a wider footprint. Affected shorelines could include areas of waterfront development, industrial areas, and undeveloped coastal habitats.

⁵⁵ Wilmington Harbor, North Carolina, Supplement to the Final Fish and Wildlife Coordination Act Report, US Fish & Wildlife Service, July 2010.

The White House Council on Environmental Quality proposed in 2009 a set of National Objectives and the supporting Planning Principles and Standards⁵⁶ that would formulate the national water resources planning policy and establish a framework for the planning process and decisions regarding the federal implementation of solutions to water resources problems, needs and opportunities. The development of guidelines has been initiated to allow each agency to develop its own procedures to apply the new principles and standards to their agency-specific missions; however, the proposed water resource planning guidelines have not yet been developed. Core recommendations in the planning principles include:

- Protect and restore natural ecosystems and the environment while encouraging sustainable economic development.
- Avoid adverse impacts to natural ecosystems wherever possible and fully mitigating any unavoidable impacts.
- Avoid the unwise use of flood plains, flood-prone areas and other ecologically valuable areas.

Archaeological sites that could be affected by dredging include 65 shipwrecks. Some of these are located within the Wilmington Historic District, National Register of Historic Places.

8.4 Aquifer Impacts

Previous USGS evaluation⁵⁷ of the Cape Fear shipping channel has indicated that the surficial, Castle Hayne and Peedee aquifers exhibit a discharge relationship to the Cape Fear River along the twenty-six mile length of the shipping channel. From north to south along the length of the channel, hydrogeologic data indicate that from Castle Street through the northern part of Brunswick channel the base of the shipping channel is within the Peedee aquifer. Five feet of deepening along this stretch would increase the surface area of the Peedee aquifer exposed to the channel. From the northern part of the Brunswick through the Lilliput channel the base is within the Castle Hayne aquifer. Thus, deepening along this stretch would increase the surface area of the Castle Hayne aquifer exposed to the channel. From south of Lilliput channel to the mouth of the Cape Fear River, maps and cross-sections indicate that deepening the existing channel may cause penetration, or increase penetration of the channel into the Castle Hayne confining unit.

A separate study⁵⁸ by NC Division of Water Resources (NC DWR) also identifies increased exposure the Peedee and Castle Hayne aquifers that would occur as a result of proposed deepening of the Cape Fear River shipping channel along certain channel segments; however, based on ground-water modeling efforts, DWR concluded that proposed channel deepening

⁵⁶ National Objectives, Principles, and Standards for Water and Related Resources Implementation Studies, White House Council on Environmental Quality, December 2009, <http://www.whitehouse.gov/sites/default/files/microsites/091203-ceq-revised-principlesguidelines-water-resources.pdf>

⁵⁷ USGS, Hydrogeology and Ground-Water Quality of Brunswick County, North Carolina, Stephen L. Harden, Jason M. Fine, and Timothy B. Spruill (2003)

⁵⁸ NC DENR DWR Hydrogeologic Assessment of the Proposed Deepening of the Wilmington Harbor Shipping Channel, New Hanover and Brunswick Counties, North Carolina, Jeff C. Lautier (February 1998)

would not adversely affect the aquifer system by changing water-level gradients or inducing saltwater intrusion from the Cape Fear River.

Numerical modeling and analysis combined with well data and geology data would be needed to confirm actual extents of impacts and impacts of Cape Fear channel deepening to regional drinking water systems.

8.5 Potential Site-Specific Environmental Impacts of Port Terminal Development

Potential environmental impacts were identified for the potential terminal developments at Radio Island, River Road, the Port of Wilmington, and Southport. The impacts were evaluated using an approximate landside footprint and an area of water immediately adjacent to the associated berths, considering properties listed in or known properties eligible for listing in the National Register of Historic Places, conservation easements, significant natural heritage areas, known submerged aquatic vegetation areas, fish nursery areas, shellfish growing areas, wetlands, shell-bottom areas, known threatened and endangered species occurrences, and hazardous materials sites. Figure 96 through Figure 99 present the potential environmental impacts of each port site.

Figure 96: Potential Environmental Impacts – Radio Island

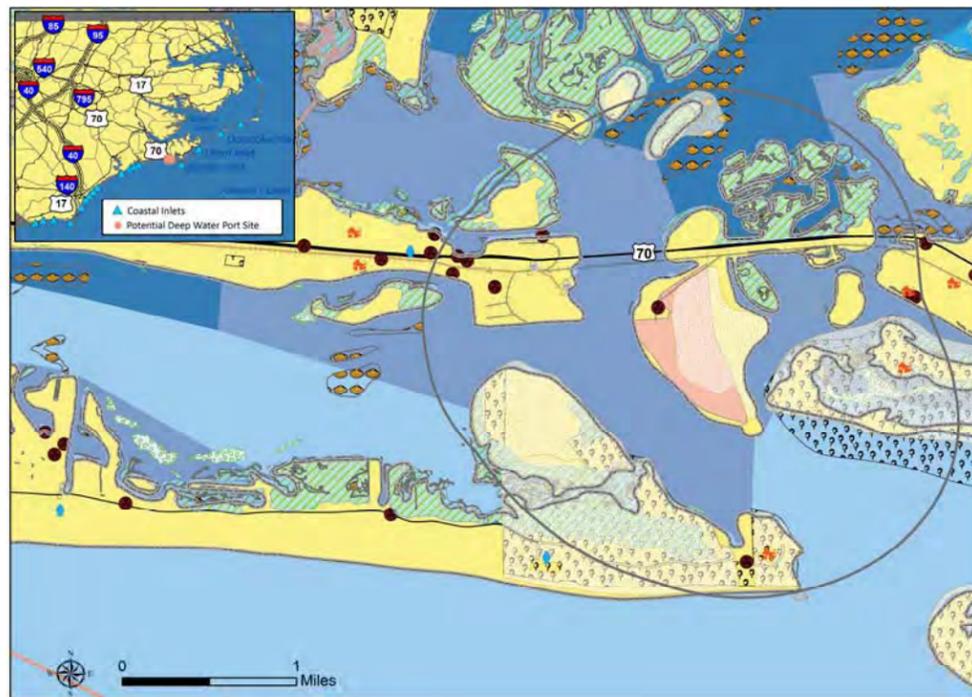


Figure 98: Potential Environmental Impacts – River Road

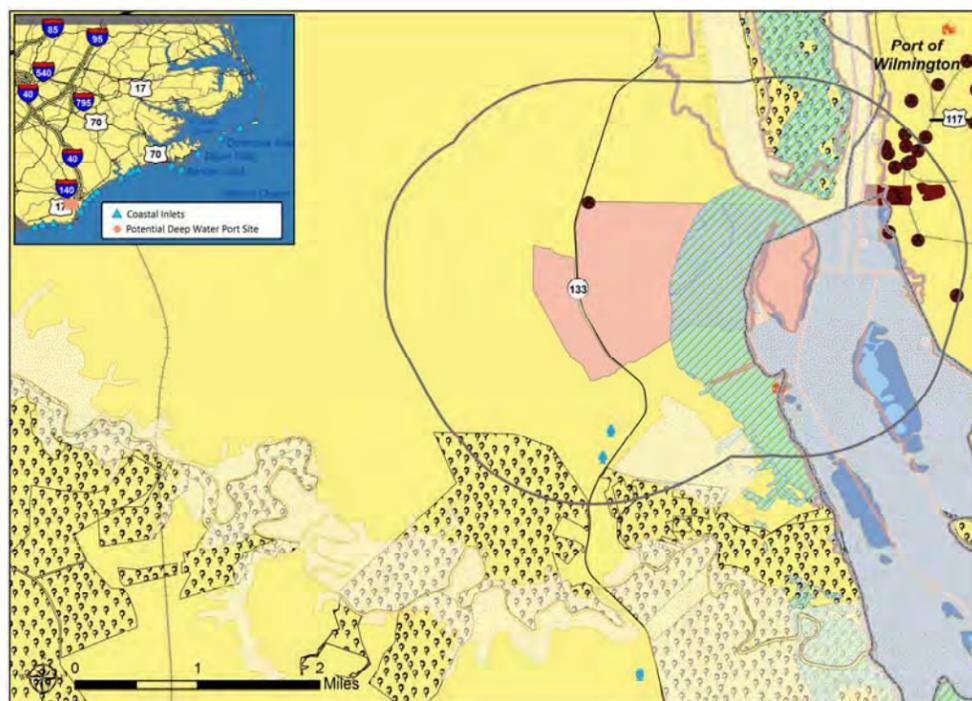


Figure 97: Potential Environmental Impacts – Port of Wilmington

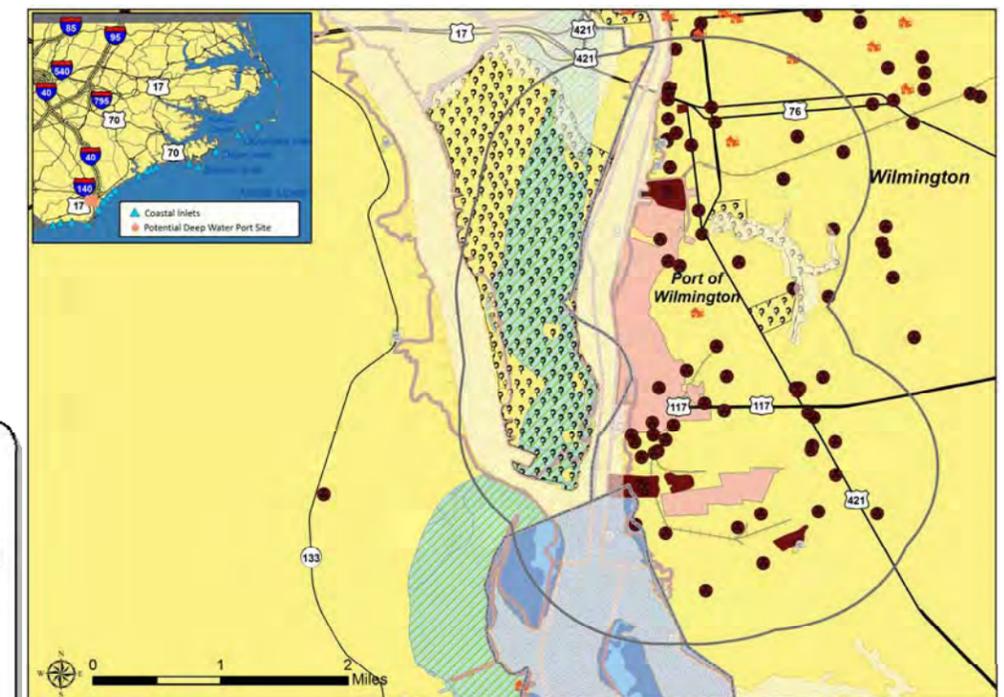
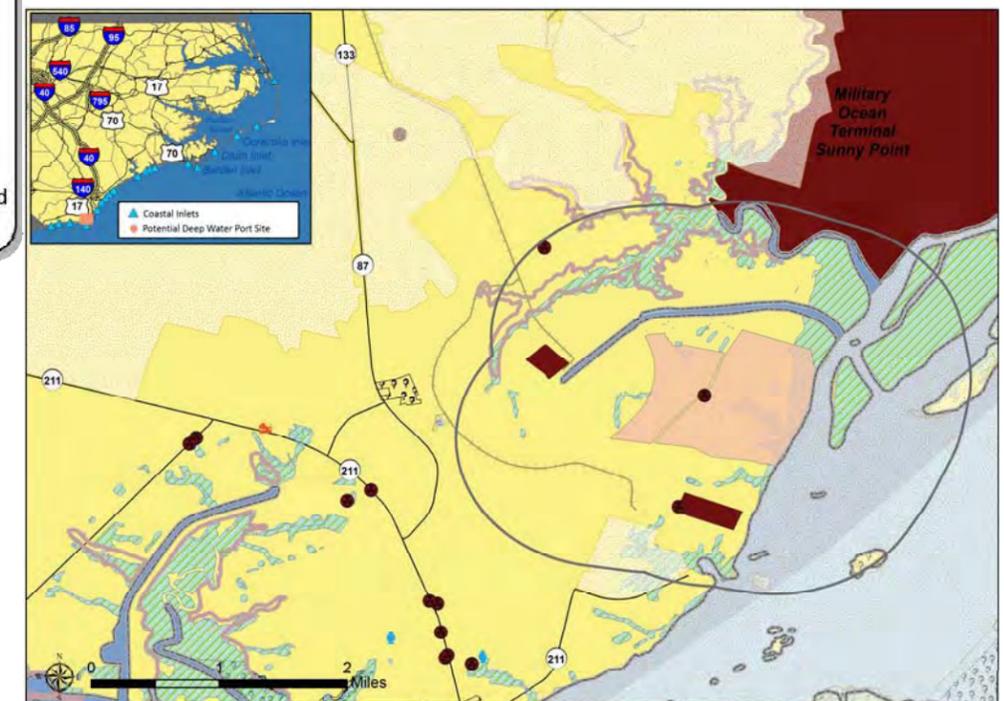


Figure 99: Potential Environmental Impacts at Container Site 6 – Southport



Source: AECOM/URS from ESRI, NCDOT, FAF 3.1, USGS ThematicMapping with world borders dataset, Seamap-SA 2001, and Moser and Taylor, 1995

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Much of the Port of Wilmington is already developed, but expansion onto the North Property could impact access to public trust waters. Development of the North Property would also require a remediation plan, approved by NC DENR, to remediate contamination from historic creosote operations. Capping of the site may be an appropriate remediation alternative; however, contaminated groundwater or sediments could be encountered during berth dredging or the construction of deep foundations. Further investigation is required.

Other impacts that may be encountered at the Radio Island site include potential impacts to public trust waters, access to the East Beach recreation area, and potential impacts to marina and condominium communities located on the north and east portions of the island. An Environmental Impact Statement was published in 2001 and described more detailed impacts that would result from a potential project on Radio Island. Although each of these potential impacts would require mitigation, costs associated with that mitigation is difficult to predict without more detail.

8.6 Environmental Impacts of Highway and Rail System Infrastructure

Connecting infrastructure will also have associated environmental impacts. Projects such as the Cape Fear Skyway, I-140 Wilmington Bypass / Loop, US 70 North Carteret Bypass, NCRR Havelock to Morehead City Railroad Relocation, US 70 Kinston Bypass have been or are currently being studied in detail. Many of these projects will benefit more users than just those traveling to and from the Port of Morehead City. As such, their impacts are not wholly attributable to the maritime industry in North Carolina.

Environmental documents that comply with the National Environmental Policy Act are either underway or have been completed for the Cape Fear Skyway, I-140 Wilmington Bypass / Loop, and US 70 Kinston Bypass. These projects are located in close proximity to the Ports of Morehead City and Wilmington. Ongoing planning studies provide or will provide more in depth information on the impacts of these projects.

Feasibility studies have been prepared for both the North Carteret Bypass and NCRR Railroad Relocation. These documents identified several environmental issues that will have to be mitigated. Beyond typical impacts to streams, wetlands, potential historic resources, and communities, both of these projects traverse the Croatan National Forest. These potential impacts will require extensive coordination with the Nation Forest Service to assuage concerns.

8.7 Green Ports Strategies

Port authorities are among entities that increasingly are turning to “green” initiatives that bring about improved health for those who live and work in and around ports, while also encouraging goodwill essential to advancement of development projects that bring about well-paying employment and facilitate the flow of global trade. In addition, ports are finding that sustainability efforts also may yield fiscal savings.

Project Energy was initiated by NCSPA in October 2007, as part of a “Green Port” initiative developed in conjunction with the American Association of Port Authorities’ hemispheric push for cleaner, greener port operations. The NCSPA’s Project Energy covers such areas of concentration as electricity, utilities, fuel usage, emissions, alternative energies, recycling,

hybrid technologies and communications and draws upon numerous outside resources, including the North Carolina State Energy Office, North Carolina Environmental Management Commission, North Carolina Department of Environmental and Natural Resources' Clean Air Division, US Environmental Protection Agency, North Carolina State Solar Center, Progress Energy/Electric Power Research Institute, North Carolina State University, along with manufacturer representatives and vendors. North Carolina's tax incentives for solar energy have encouraged such firms as Advanced Green Technologies (AGT) to embark upon North Carolina projects.

NCSPA has already realized tangible results from its sustainability efforts, from its use of \$150,000 from the State Energy Efficiency Reserve Fund to purchase 1,100 T5 high-efficiency light fixtures, qualifying for some \$62,000 in additional Progress Energy rebates, reducing electricity usage by some 80 percent in installed warehouse locations and significantly reducing maintenance costs; to more than \$250,000 in 2007 and 2008 Emission Reduction Fund projects for biodiesel tanks at Wilmington and Morehead City and emission control devices for diesel-powered equipment; to the favorable attention received by its September 22, 2009 "Go Green" event. It was estimated at that time that, by the end of 2011, potential NCSPA electricity demand would be reduced by approximately 730,000 watts with completion of significant lighting replacement projects at Wilmington and Morehead City ports, including the replacement of 470 high-mast pole fixtures and installation of more than 2,700 indoor energy-efficient light fixtures.

While NCSPA officials continue to pursue green initiatives, including expanded use of hybrid technologies, solar energy and various emissions reductions measures, they are by no means alone in the port industry in demonstrating such commitment. North Carolina-based Lowes Companies Inc. for example, is a founding member of the industry-based Coalition for Responsible Transportation that is advancing national efforts to implement practical and sustainable solutions to reduce port truck pollution.

Ports across North America, including those in neighbor states to North Carolina, are proactively implementing environmental programs to enhance their triple bottom line. Whereas west coast ports, especially those in California, have traditionally been at the forefront in advancement of green initiatives – arguably largely because stricter environmental mandates have gone into place there before most of the rest of the nation – sustainability has become a crucial consideration in virtually all port-related development, policies and procedures. By continuing and even expanding upon its leadership role in the environmental arena – including through broadened partnerships and pursuit of additional grant funding – North Carolina can further the long-term competitive advantages it offers to present and future port facility users.

8.7.1 Protection and Restoration of Water Habitats and Water Resources

Habitat Development

Ports that require ongoing maintenance dredging have opportunities to reuse clean dredge material in ways that benefit the environment and community users. As part of previous deepening of the Cape Fear navigation channel, NCSPA partnered with USACE to use large rocks encountered during dredging to form a large underwater marine habitat. The Wilmington Offshore Fisheries Enhancement Structure (WOFES), constructed using rock removed during

deepening of the adjacent ship channel, has created a 165-acre fish habitat recognized by local fishermen for consistently good catches.⁵⁹

The Port of Houston Authority (PHA) has developed an off-shore island called Redfish Island from dredge materials. This island is now a well established bird habitat and rookery as well as a productive oyster reef. The website betterbay.org has this to say about PHA's habitat preservation and enhancement efforts:

“As the deepening and widening of the Houston-Galveston Navigation Channels (HGNC) continues, the silt, sand, shell and clay dredged during the expansion and subsequent channel maintenance are being creatively utilized as an environmental resource to enhance Galveston Bay. This project is the largest wetland creation effort of its kind in the nation and, possibly, one of the largest environmental initiatives to date.”

Stormwater Pollution Prevention

Ports are governed by federal and local regulations with regard to stormwater discharge. These vary from place to place, but typically do not allow direct discharge of untreated storm water into the ocean or river on which a port is located. Interceptor devices are used to retain some amount of storm water so that some of the pollution that may be carried by storm water settles out in the system as opposed to being swept directly into the sea.

Terminals in areas that receive heavy rainfall may install retention ponds adjacent to the terminal in order to achieve a higher level of preliminary treatment of stormwater. Port of Houston's Bayport terminal has effectively used a linear stormwater retention pond to eliminate direct runoff into the channel.

Container terminals can store a great deal of water through the use of gravel pavement for container stacks. These stacks are only compatible with overhead cranes for container handling. The pavement at the Pusan Newport Terminal in Korea, for example, has been developed to be permeable with container stored directly on the gravel surface.

The Georgia Ports Authority's wide-reaching Green Initiative, like efforts of many ports, ranges from monitoring of wetlands that support protected bird, aquatic species and mammal habitats.

Figure 100: Wilmington Offshore Fisheries Enhancement Structure



Source: FLW Fishing News

⁵⁹ FLW Fishing News, *Wilmington Offshore Fisheries Enhancement Structure: The secret is out about North Carolina's largest artificial reef*, Captain Jerry Dilsaver (July 2, 2007).

8.7.2 Beach Nourishment and Shoreline Protection

High-quality sand from harbor maintenance dredging can provide material for beach nourishment and shoreline stabilization. The USACE Carolina Beach Coastal Storm Damage Reduction project, for example, provides for regular placement of dredged sand on 2.7 miles of Carolina Beach to protect the area from storm erosion and hurricane events. In all, 112 miles of North Carolina coastline have benefited from placement of sand dredged from the Cape Fear Channel and the Beaufort Inlet.

8.7.3 Air Quality Initiatives

Clean Truck Technologies

The Green Operators (GO) program of the Virginia Port Authority is providing rebates to retrofit older drayage trucks with more emissions-efficient engines while recognizing partners for setting and achieving goals for reducing air pollution and greenhouse gases associated with the transport of goods – using matching funds from the Virginia Department of Environmental Quality made possible by the US Environmental Protection Agency’s National Clean Diesel Program.

The Clean Air Action Plan (CAAP) implemented jointly by the Port of Los Angeles and the Port of Long Beach includes a comprehensive Clean Trucks Program, which bans drayage trucks not meeting 2007 EPA on-road engine standards from visiting the port starting in 2012. In order to help offset the cost to trucking companies to upgrade their fleets, the ports spent \$44 million on incentives for purchases of new diesel trucks, with another \$12.5 million going towards LNG-fueled truck purchases⁶⁰. The ports have realized a 70 percent measured reduction in diesel emissions compared to baseline 2005 levels as a result of the program.⁶¹

Low and Zero Emissions Cargo Handling Equipment

Several efforts have been made by ports to meet the highest EPA emissions standards for existing and replacement cargo handling equipment:

- Minimum Tier 4 engine performance standards for all new cargo handling equipment; Tier 4 standards are set by the EPA and have the strictest requirements for acceptable levels of particulate matter and NOx emissions.
- Replacement or retrofitting of engines in existing cargo handling equipment with Best Available Control Technology (BACT).

Modernization of container yards to incorporate the latest cargo handling strategies and technologies yields even more air quality benefits. The automated container operation at APMT Virginia results in drastically reduced diesel emissions through the use of electric automated stack cranes (ASC) in the container yard, rather than diesel-fueled rubber-tired gantry (RTG) cranes typical in traditional operations. In addition, the use of end-loaded yard cranes allows

⁶⁰ www.portoflosangeles.org/ctp/CTP_Fact_Sheet.pdf

⁶¹ www.cleanairactionplan.org/

street trucks to back into an ASC row and turn off their engines while waiting for service, resulting in significantly reduced emissions from drayage trucks while on the terminal.

The newest mobile harbor crane at South Florida's Port Everglades is capable of operating on biodiesel fuel, and, moreover, Port Everglades officials stated in October 2011 that the port's \$1.32 million investment in new clean diesel equipment, stemming from a Diesel Emissions Reduction Act (DERA) grant from the Florida Department of Environmental Protection, has resulted in the replacement of heavy equipment and service vehicles, as well as pilot boats being repowered with clean diesel technology, that is translating into as much as \$17 million in environmental and health benefit for the port community. That projection is based upon a US Environmental Protection Agency statement that DERA activities return a minimum of \$13 for every \$1 invested, and by some estimates as high as \$20 for every \$1 invested, through environmental and public health benefits.

The Port of Savannah has also deployed reduced-emissions technology on its container-handling equipment (most recently with January 2012 approval of purchase of four electric-powered rubber-tired gantry cranes, with a commitment to have 169 ERTGs by 2022).

Shore-to-Ship Power

CAAP also includes a comprehensive shore-power initiative to meet and exceed the requirements set by CARB. Installing shore-to-ship power infrastructure allows vessels to turn off engines completely while at berth. Switching ships to electric power at berth will always result in massive reductions in local pollutants such as NO_x and particulate matter (PM), regardless of the fuel source used to generate electricity. Even coal fired power plants are equipped with fairly robust equipment to remove pollutants from the exhaust gas whereas cargo ships feature little or no exhaust filtering technology.

Ultra-Low Sulfur Fuels

VPA's GO program is being expanded in 2012 to provide an incentive to ocean carriers to burn ultra-low-sulfur marine gas oil or use alternative power technology while their vessels are moored at VPA-owned terminals. Also, the Port of Virginia, the first major east coast port to receive ISO certification for terminal operations, has proceeded with development and implementation of an Environmental Management System. Meanwhile, the South Carolina State Ports Authority is being joined by the South Carolina Department of Health and Environmental Control in funding a program replacing some 200 pre-1994 trucks serving South Carolina port facilities.

The LA and Long Beach ports' CAAP requires that low sulfur fuels be used in all vessel engines and boilers within a defined "green flag" zone near the coast (within 40 nautical miles).

The MARPOL Annex VI agreement, to which the US is a signatory, establishes the North American Environmental Control Area that extends 200 miles off the coast of US and Canada. Within these limits and by 2015, ocean going vessels are required to use low-sulfur fuels that will reduce SO₂ emissions from ship operations by 80 percent. NO_x emissions would be subject to similar reductions by 2016.

Vessel Speed Reduction

Vessel speed reduction programs, such as included in CAAP, require ships to operate at reduced speeds within 24 nautical miles of the coast. Slower speeds result in lower levels of emissions from marine engines, allowing reductions in air emissions for communities near the port.

Landside Mode Shifts

Significant reduction to greenhouse gas (GHG) air emissions can be achieved by shifting landside transport of waterborne cargo from trucks to either rail or barge. A vast majority of GHG are composed of CO₂.

Rail is far more efficient from an energy consumption and air emissions perspective than trucking. To take advantage of this, ports have been trending toward implementing large on-terminal rail yards to encourage consumers to use rail over trucking whenever possible.

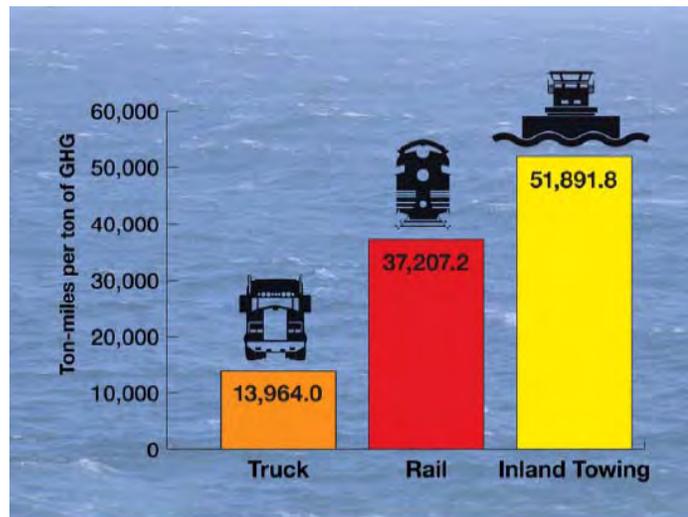
Inland towing (barging) is even more efficient than rail. Several American ports are considering implementing barge shipping programs in order to eliminate truck or rail trips. For instance, VPA's 2040 Master Plan includes plans for a barge service to reduce the carbon footprint and remove 580,000 trucks from Virginia roads.

The Port of Oakland is starting a barge service to Stockton along the inland corridor designated M580 (the marine highway parallel to I-580 in California). This service involves transferring containers from the terminal in Oakland onto a barge, which would then be towed via M580 to the Port of Stockton. At Stockton, containers are offloaded from the barges onto a terminal where they can be picked up by trucks for transportation to their final destination. This reduces the distance cargo must be transported via less energy-efficient trucks, and has the added benefit of allowing more cost-effective shipment of containers too heavy for highways.

Emissions Reduction for Trains and Harbor Craft

Several standards have also been developed to address and reduce air emissions from trains and harbor craft; however, initial surveys of traditional operations find that, as compared to ocean going vessels, trucks, and in-terminal cargo handling equipment, trains and harbor craft are not the main sources of air pollution.

Figure 101: Ton-miles per Ton of GHG by Mode of Transport



Source: A Modal Comparison of Domestic Freight Transportation Effects on the General Public, Texas Transportation Institute, March 2009

8.7.4 Congestion Reduction

Gate Hours of Service and Appointment Systems

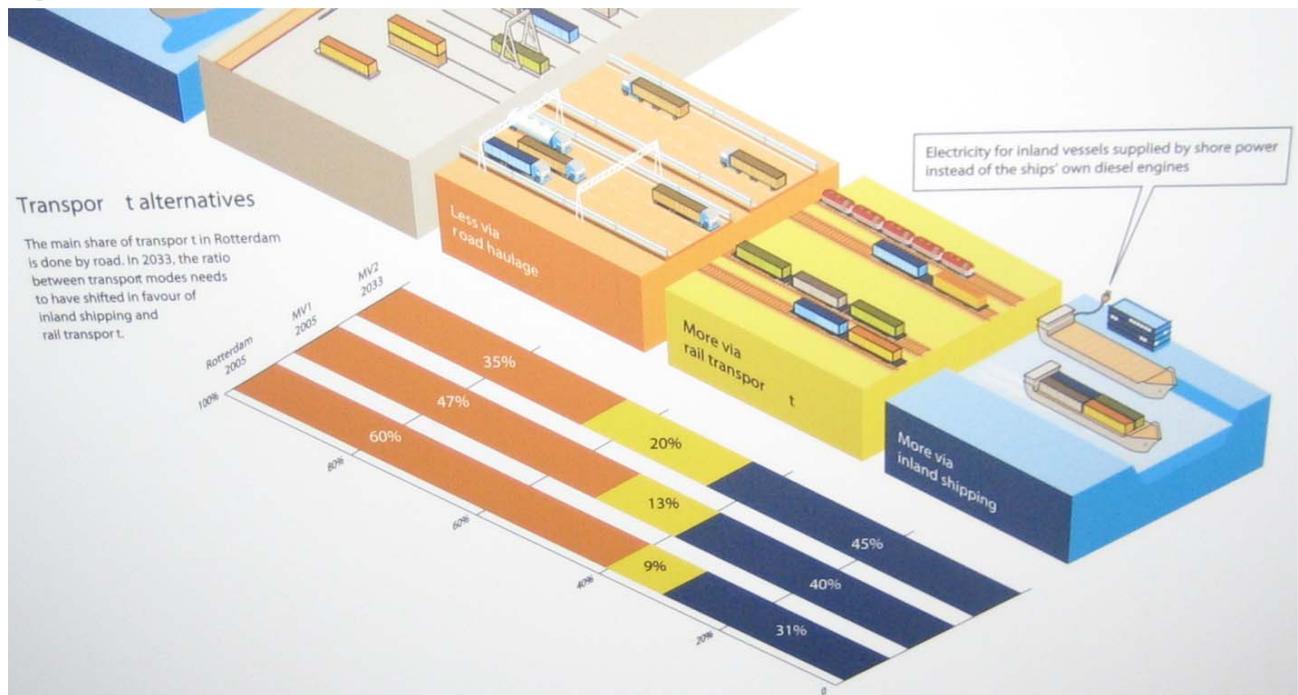
Reduction of daytime truck queuing and peak hour traffic impacts of truck movements can be achieved through longer gate hours and the use of gate appointment systems. This has been one of the primary motivating factors behind the implementation of the PierPass system, a measure first implemented at the ports of Los Angeles and Long Beach. PierPass is a system developed by terminal operators at the ports of Los Angeles and Long Beach to address truck congestion issues at the Ports. In the PierPass system, there are two 8-hour gate shifts operated per weekday at container terminals. During the dayshift (the 'busy' shift), there is an additional fee to access the terminal. Customers who are willing to use the off-peak shift are not required to pay this fee, thereby creating a financial incentive to shift traffic to lighter hours. This has the added benefit of reducing peaking in truck arrivals (i.e. resulting in more uniform truck arrivals), which yields higher terminal gate capacity.

Shortly after the implementation of PierPass, 40 percent of the gate transactions shifted from the busy shift to the off-peak shift. This smoother flow of truck arrivals over the course of each day significantly reduced congestion and truck idle time both on the terminals, and on major freeways serving the port.

Rail and Barge Transport

In addition to the air quality benefits described above, increased usage of rail and inland waterways have the added benefit of easing road congestion through elimination of truck trips. Some ports have begun to mandate reductions in truck moves as part of all new terminal leases, particularly the Port of Rotterdam. Figure 102 shows the modal shift being implemented by the port via lease requirements.

Figure 102: Port of Rotterdam Mandated Modal Shifts



Source: Photograph of display at the Port of Rotterdam, photo by Mark Sisson, October 2011.

In Figure 102, the orange bar represents containers moved via truck, which occurred in 60 percent of all container moves at the port in 2005. As the chart shows, Rotterdam is attempting to reduce this to 35 percent by 2033 via lease mandates.

8.7.5 Community Compatibility

Some of the benefits generated by sustainability efforts may be more difficult to measure in dollar terms. This may particularly be the case when such efforts generate significant community support for dredging and other port-related development.

Waterfront Development

The Maryland Port Administration's Masonville Dredged Material Containment Facility project, will, over the next 20 years, put to productive use more than 15 million cubic yards of material from harbor deepening and maintenance projects while restoring a derelict brownfield site and creating waterfront access, new parklands and environmental and community facilities for an economically challenged neighborhood. The AAPA-award-winning Baltimore project evolved from extensive discussions with dozens of stakeholder groups.

As part of their Vision 2000 expansion, the Port of Oakland created a Middle Harbor Shoreline Park, a new park that provides shallow water habitat for marine life as well as open space for the public to enjoy the waterfront adjacent to operating marine terminals. The following description of the park is taken from the port of Oakland website:

Since World War II, military use has restricted public access to the shoreline of the Middle Harbor. As part of the Port's Vision 2000 seaport program, the public will regain access to the former naval ship basin. Agencies, community representatives and scientists worked together to design the habitat restoration for the more than 150-acre water area of the harbor and the integration of the park with the habitat. Middle Harbor will become an ecological reserve of shallow bay and shoreline habitats for many species, such as Dungeness crab, flatfish, anchovy, herring and perch.

Efficient Land Use

The increased resistance to physical expansion of ports onto undeveloped land combined with better automation technology has made high density terminals more feasible in the US. A good example of the type of terminal that will become more typical due to the increasing importance of environmental issues is APMT Virginia, which maximizes the density of terminal operation to reduce acreage requirements for the same level of annual throughput. This allows the environment around the terminal to stay undeveloped, and reduces the amount of damaging ocean fill required.

Buffer Areas

Ports strive to block light and noise from operations from impacting nearby residences, while allowing public access to the waterfront as much as possible. The ports in Los Angeles and Houston have built soil berms at the perimeter of some terminals to minimize light and noise.

8.7.6 Green Building Practices

Most of port areas are open spaces or special materials handling structures. However, ports still feature a number of traditional buildings for administration and maintenance functions. The Leadership in Energy and Environmental Design (LEED) rankings can be used to help improve the sustainability of terminal buildings. The LEED evaluation process scores buildings on the following categories:

- Site sustainability
- Water efficiency
- Energy use
- Materials and resources
- Indoor environmental quality

Figure 103: Middle Harbor Shoreline Park in Oakland



Source: AECOM

Many ports are now specifying LEED building certification as part of new building projects. Green strategies implemented under Georgia Port Authority's Green Initiative include installation of an energy management system, featuring a Web-based remote control system projected to yield \$78,000 in annual energy bill savings, to monitor and control HVAC and lighting at seven Port of Savannah buildings (with funding for this latter project provided by the Georgia Environmental Finance Authority through the American Recovery and Reinvestment Act of 2009).

8.7.7 Clean and Renewable Energy

Ports provide great opportunities for the generation of clean power on port property. Solar and wind are the primary energy sources for green power on ports, and their applicability depends considerably on the local climate. The Dutch have been building windmills for hundreds of years, and the trend continues today at the Port of Rotterdam which has over 100 large wind turbines on port property. Each of these turbines can generate over a megawatt of power under peak conditions.

Many ports are installing solar photovoltaic (PV) panels on terminal buildings. In March 2011, Progress Energy signed a contract to install an 800 kilowatt PV system on a warehouse at the Port of Morehead City. Renewable energy not only reduces the carbon emissions from Port operations but provides a reliably priced long term source of energy and often generates considerable positive public relations for ports in the process.

8.8 Assessment of Proposed Port Uses for Potential Incompatibility with Predominant Economic Sectors of Surrounding Community

Executive Order 99 directs the *Maritime Strategy* study "to identify activities at and uses of the Wilmington and Morehead City ports that are not incompatible with the underlying economic base and existing predominant economic sectors supported by the surrounding community." Such a determination first requires an assessment of the surrounding community and identification of the predominant economic sectors.

8.8.1 Surrounding Port Communities

For the purposes of this analysis, the team used statistical data and definitions developed and maintained by the Office of Management and Budget (OMB). OMB is charged with providing standard definitions of the geographies for which federal agencies collect, tabulate and publish statistical data as the value of the data is much greater if it can be compared and combined across programs, requiring a uniform definition of each place⁶². The OMB definition was selected to define each port's surrounding community because this area incorporates nearby areas that are linked to the port community through economic and social ties; is an established

⁶² The current standards and the geographic delineations for metropolitan and micropolitan areas are provided in Office of Management and Budget, 2010 Standards for Delineating Metropolitan and Micropolitan Statistical Areas, Federal Register, Vol. 75, No. 123, Monday, June 28, 2010, Notices, and OMB Bulletin No. 10-02, Update of Statistical Area Definitions and Guidance on Their Uses, December 1, 2009.

and recognized definition used for planning purposes; and delineates an area that is used for statistical data collection and thus facilitates the identification of predominant economic sectors.

The central county of a metropolitan or micropolitan area is associated with the urbanized area or urban cluster that accounts for the largest portion of the county's population and must either:

- Have at least 50 percent of their population in urban areas of at least 10,000 population; or
- Have within their boundaries a population of at least 5,000 located in a single urban area of at least 10,000 population.

A county is considered an outlying county of a central county if it meets the following commuting requirements:

- At least 25 percent of the workers living in the county work in the central county or counties of the CBSA; or
- At least 25 percent of the employment in the county is accounted for by workers who reside in the central county or counties of the metropolitan or micropolitan area.
- A county may be included in only one metropolitan/micropolitan area.

Metropolitan Statistical Areas have at least one urbanized area of 50,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties. Micropolitan Statistical Areas – a new set of statistical areas – have at least one urban cluster of at least 10,000 but less than 50,000 population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties.

For the Port of Wilmington, the surrounding community is defined as the Wilmington MSA, which includes Brunswick, New Hanover, and Pender Counties. For the Port of Morehead City, the surrounding community is defined as the Morehead City Micropolitan Area, comprising Carteret County.

The area defined by this approach is much larger than the radius used in documents reviewed for this study. "The Economic Status of Areas Surrounding Major US Container Ports: Evidence and Policy Issues," by Lisa Grobar, published in *Growth and Change*, September 2008, used a much tighter 7.5 mile radius.

8.8.2 Predominant Economic Sectors in the Surrounding Communities

The predominant economic sectors of the port communities were defined with a three-pronged approach:

- Identification of the community's leading industrial sectors based upon employment as a share of the total community employment and relative to US employment as a whole from 2001 to 2009.
- Examination of agricultural industry cash receipts
- Review of community demographics

Employment

Based upon analysis of employment base and trends, economic strengths in each of the Morehead City and Wilmington communities are (in descending order):

- Construction
- Retail Trade
- Information
- Real estate and rental and leasing
- Arts, entertainment, and recreation
- Accommodation and food services
- US military
- Other government and government enterprises (including federal, state, and local)
- Nonfarm proprietors
- Administrative and waste management services

Annual Cash Receipts

While employment is a reliable barometer of an economy's industrial composition and means to assess which are its main economic drivers, there are a few industries that may be underrepresented by such a method. These are industries such as mining and agriculture, where the ratio of product to employee is very high; mining is very capital intensive, for example, as one employee can extract a lot of coal or aggregate. Recognizing this possibility, other data sources were reviewed as well.

The North Carolina Department of Agriculture reports on the annual cash receipts for agricultural activities for each of the state's 100 counties. By this measure, the port communities identified above rank in the following way:

- Brunswick County (Wilmington MSA): 63rd in terms of cash receipts out of 100 counties
- New Hanover County (Wilmington MSA): 96th in terms of cash receipts out of 100 counties
- Pender County (Wilmington MSA): 20th in terms of cash receipts out of 100 counties
- Carteret County (Morehead City MA): 75th in terms of cash receipts out of 100 counties

The data above shows that Pender County has an active agriculture sector, while agriculture is a secondary activity for Brunswick and Carteret.

Tourism and Retiree-Focused Industries

Tourism and retiree-focused industries are not identified directly in the statistical data describing economic activity. Rather, both are typically described as a cluster of retail, recreation, lodging, and amusement activities (retiree locations also often have elevated real estate concentrations) in combination with locations with high degrees of cultural or natural amenities. Thus, there is a lot of overlap between the two industry clusters. Both regions have healthy tourist industries. An assessment of the communities' demographics finds each has a higher than average concentration of retiree-aged residents, as shown in Table 47.

Table 47: Concentration of Retiree-aged Population in Port Communities

Region	Population	Population Age 65+	% 65+
United States	308,745,538	40,267,984	13.0%
North Carolina	9,535,483	1,234,079	12.9%
Wilmington MSA			
Brunswick County	107,431	23,026	21.4%
New Hanover County	202,667	28,092	13.9%
Pender County	52,217	7,886	15.1%
3-County Total	362,315	59,004	16.3%
Morehead City Micropolitan			
Carteret County	66,469	12,659	19.0%

Source: US Census Bureau, Census 2010

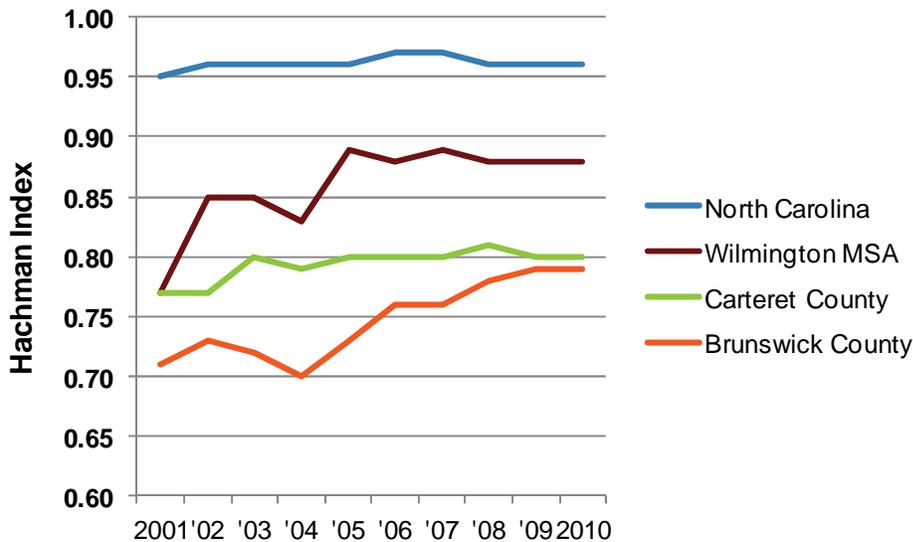
8.8.3 Economic Diversity of Port Communities

Seaports support a variety of industries, which supports a diverse economy within their regions and the state. The attraction of complementary and job-supportive industries through the State’s ports can serve to enhance the industrial diversity and economic resiliency of port communities.

Industry diversity can be defined by a measure known as the Hachman Index, which compares the employment mix of one or more subregions within a broader economic region. The index value ranges between 0 and 1, with a value of 1 indicating that the distribution of industries in the subregion is equivalent to the larger reference region—it is the most diverse that is empirically observed. By contrast, as a local economy is increasingly dominated by one industry, the index value falls closer to 0. Greater industrial diversity can protect an economic region from downturns or cycles in singular industries.

Analysis of industrial diversity over the period from 2001 to 2010 for North Carolina and for its port communities is illustrated in Figure 104. For North Carolina, the 2010 Hachman Index is 0.96, meaning that the state’s economy is nearly as diverse as the national economy as a whole. The Wilmington MSA, comprising New Hanover, Brunswick, and Pender Counties, follows at 0.88, and then Carteret and Brunswick Counties at 0.80 and 0.79 respectively. These values indicate that Brunswick and Carteret Counties are less diversified than the Wilmington MSA and the State, meaning that their economies are more dependent on fewer industries. The industrial mix within Brunswick County is less diverse than the larger Wilmington MSA of which it is a part.

Figure 104: Industrial Diversity of Port Communities



Source: AECOM, from NC Department of Commerce data

8.8.4 Compatibility of Port Uses

Benefits of Maritime-Focused Infrastructure Investments to Tourism and Other Economic Sectors

Several of the infrastructure investments developed to facilitate freight movement in the state will have spillover effects for the general traveling public. In particular, travel improvements would be expected to benefit the state’s tourism industry. Travelers value their vacation time highly and will not return to locations that waste their time in traffic congestion. Moreover, in-state residents will be more likely to visit the state’s coastal communities if it is an easy trip, increasing the potential for off-season tourism. Projects such as the North Carteret Bypass, with the potential to shorten the travel time to Morehead City, for example, would benefit the community’s tourist industry even as it supports freight activity.

Grain and Wood Products

Support for the grain and wood products industry is directly consistent with the structure of the port communities, supporting a complementary industry to the region’s dominant tourism and retiree-focused economy. In addition, the two sectors are increasingly merging in some communities to create agritourism. Agritourism combines leisure and recreation with farm-based activities such as farm stands or shops, U-pick farms, tours, on-farm classes, fairs, festivals, pumpkin patches, Christmas tree farms, winery weddings, orchard dinners, hunting or fishing, and guest ranches. Public stakeholder input identified an opportunity to have a local fish market to provide local fishermen with a means to sell their catch locally, or to support the branding of North Carolina seafood.

Ro-Ro/Oversize Cargo and Wind

The movement of large and oversize cargos is not incompatible with the industrial base of the surrounding communities, though the truck traffic can create bottlenecks as the cargo moves through the community. This can be mitigated by directing such traffic to specific routes and to communicating with the public about when and where such loads will be moving in order to permit the general public to avoid these routes when possible.

There is also an opportunity for the Wind Power opportunity to support the port communities. If the state moves forward with offshore wind farms, the jobs and earnings associated with maintaining that offshore asset will likely reside in the port communities, offering diversification from the tourist and amenity-based economic activities. The potential of this opportunity is strengthened if local community colleges develop a curriculum that develops the requisite skills in the local labor force, permitting local residents to find jobs outside the tourist industry without leaving their home community. Because these economies are amenity-driven, their focus is on consumption activities—tourism, recreation, dining out. The introduction of wind power maintenance offers a complementary production-oriented activity.

Containers and Refrigerated Cargo

Containers and refrigerated cargo, by their projected volume would introduce significant traffic to these communities. The impact of this traffic, however, can be mitigated by dedicating specific truck routes to separate port traffic from local residents' daily traffic and tourist activity. Noise walls and investments to enhancing the aesthetic properties of port-adjacent neighborhoods can also reduce the impact of port operations on adjacent neighborhoods. The continued adoption of green technologies such as low emission and hybrid port vehicles can reduce the emissions impact on the local area; such vehicles tend to be quieter than equipment using other forms of power.

Handling of Chemicals

As evidenced by community reaction to the proposed sulfur processing in Morehead City, there is little local support for on-port chemical manufacturing processes. The safe handling of chemicals, such as dry bulk phosphates and liquid sulfur transported through the Port of Morehead City, can be wholly consistent with the local economy. Moreover, these products include import of fertilizer components that are important to local agriculture production. In 2010, chemicals comprised 86 percent of the total tonnage handled by the Port of Morehead City. Most of this volume was transported to the port via barge, so has no impact on local traffic. The handling of chemical products through North Carolina's ports can readily coexist with adjacent non-port uses by continuing many of the port's current practices: employing bulk storage and handling methods that minimize dust and odors and using lower profile storage domes and buildings that limit visual intrusion of on-site storage.

Advancing Common Interests

The proposed market opportunities identified in the *Maritime Strategy*, if properly implemented, would not be incompatible with the predominant economic drivers of the port communities, including New Hanover, Brunswick, and Pender Counties that comprise the Wilmington MSA as well as Carteret County surrounding the Morehead City port. Investments in maritime

infrastructure to support the import and export of wood and grain would directly support local growers, while refrigerated container facilities would enhance the competitiveness of nearby sweet potato, poultry, and hog farms. Efforts by the Brunswick County Economic Development Commission to attract port-dependent uses to the US 74/ US 76 corridor would be enhanced by maritime investments in either Brunswick or New Hanover County. In Carteret County, improved capability for handling Ro/Ro and oversize cargo is important to nearby military bases. NC Port operations also support and complement the activities of private marine terminals along the Cape Fear River. Ongoing port operations support continued maintenance of North Carolina's harbors and channels, which, in turn, supports recreational, tourism, and uses of these shared waterways.

Each of the North Carolina's port communities also includes industries and uses that are unrelated to the port. Non-port stakeholders have communicated certain common interests: the need for a strong local economy and for the protection of North Carolina's coastal environment that supports the local lifestyle and attracts tourists to local businesses. Advancement of maritime market opportunities can and should be realized in a manner that recognizes these interests and minimizes the potential impacts of port operations. An overview of port best practices for economic, social, and environmental stewardship is provided in Section 8.7 of this report.

In order to coexist with and support the broader community needs, maritime investments should incorporate sufficient landside road and rail infrastructure to avoid undue impact of truck and rail traffic on local streets and roads. Port operations that include industrial processing are not well-supported by the surrounding community because of the potential for unpleasant odors and unsightly industrial facilities. Security is a priority to both the ports and the general public; plans to advance North Carolina's maritime interests should include also communicate to the public the role of and actions taken by ports, US Customs, US Coast Guard, and others in ensuring the safe movement of goods through US port facilities. Development of the Southport property, which is immediately adjacent to the nuclear power plant, would require collaboration with Progress Energy to update the plant's evacuation plan and to avoid adverse impacts to the plant's intake channel.

9 POTENTIAL ECONOMIC BENEFITS & IMPACTS

The purpose of this chapter is to assess the economic impacts and benefits associated with implementation of the market and infrastructure scenarios described in this report.⁶³ The proposed investments have the potential to generate economic impacts and benefits through their construction, operation, and subsequent market response to the new freight capability. Impacts and benefits are estimated for the state as a whole, with consideration for compatibility with the surrounding port community’s economic structure.

9.1 Overview of Candidate Maritime Investments

A series of potential infrastructure investments, as described in Chapter 7, have been identified to support North Carolina in its realization of the candidate market opportunities presented in Chapter 5. In most cases, multiple investment alternatives are considered to support a given market opportunity. The team investigated, for example, the infrastructure that would be required to meet maritime market needs at either Morehead City including Radio Island, or along the Cape Fear channel at the Port of Wilmington or one of two potential alternative sites identified for container operations. Evaluation of the economic benefits and costs of these alternative strategies considers the nature, timing, and expected impact of proposed investments. For the purposes of this analysis, candidate investments have been identified as “immediate,” “near term” or “long term” infrastructure needs to support each market opportunity.

Table 48: Timing and Characterization of Candidate Maritime Investments

Immediate Investments	Certain infrastructure elements are prerequisites to North Carolina’s entry into new maritime markets. In these cases, North Carolina shippers currently transport their goods to or from port facilities in neighboring states because in-state import or export facilities do not exist. Examples include a bulk export terminal for the grain market and a cold storage warehouse for the refrigerated cargo market. Immediate investment in new infrastructure would be required to meet the market needs.
Near Term Investments	North Carolina’s existing maritime infrastructure offers the capability and capacity to meet the immediate needs of some market opportunities identified. Market focus and expansion could potentially be initiated right away with limited capital investment; however, near-term investments would be required to realize anticipated market growth.
Long Term Investments	Additional maritime infrastructure investments are proposed to meet demands of long-term market growth. Continued investment in highway capacity, for example, will maintain the mobility of North Carolina’s import and export goods even as ambient congestion is forecasted to increase through 2040.

⁶³ In this chapter, the terms impact and benefit are used deliberately to distinguish between those outcomes that are associated with economic impact analysis and benefit cost analysis. Impacts are positive and/or negative outcomes experienced as a result of a transportation investment. Generally, impacts are not included in a benefit cost analysis; they include outcomes such as jobs, earnings and tax revenues. Benefits (or disbenefits) are positive (or negative) outcomes that are included in benefit cost analysis, including user, non-user, community, and wider economic gains (or losses) experienced as a result of a transportation investment.

9.1.1 Grain

Support for the North Carolina grain market includes the following proposed infrastructure investments:

Port and Terminals

Whether at Morehead City (Radio Island) or at Port of Wilmington (on the north property), a new grain terminal is proposed to realize the market opportunities for grain and soybeans. This is an immediate need since North Carolina does not currently have any facilities to support the export of bulk grain.

Local Highway Access

Based on the distance from North Carolina's primary soybean growing regions, trucking is expected to be the primary mode of transport to North Carolina port facilities.

At Radio Island, a new diamond interchange will provide access from US70. This immediate investment would support anticipated truck volumes to the Radio Island development.

A new grain terminal at Port of Wilmington would not require any immediate investment in truck access.

Local Rail Access

Upgraded rail connection is proposed to support rail deliveries of grain to Radio Island.

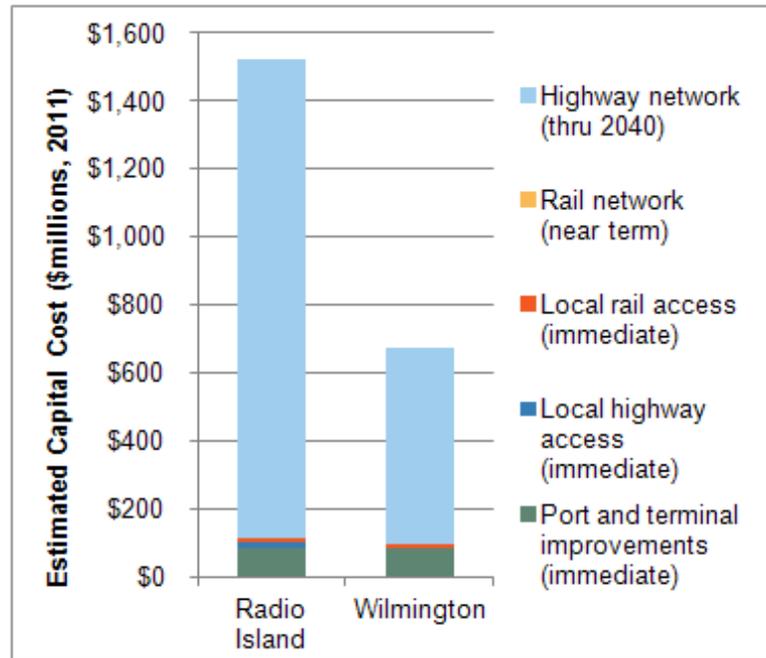
A rail connection to the CSX mainline is required to provide rail access to the north property at Port of Wilmington.

Highway Network Improvements

Various projects currently identified in North Carolina's long-range transportation plan, but not yet funded, would provide continued competitive landside trucking costs to NC port facilities.

For grain exports from Radio Island, various improvements along US 70 including the North Carteret Bypass and Havelock Bypass as well as proposed upgrades to NC 11, NC 24, US 17, US 421, and US 74 would ease congestion and support freight mobility.

Figure 105: Cost and Timing of Candidate Maritime Infrastructure Investments for Grain



Source: AECOM/URS capital cost estimates

A grain export terminal at Port of Wilmington would benefit from currently unfunded investments to add capacity and eliminate gaps along the US 17, US 74/76, NC 24 and US 421 highway corridors. The planned Cape Fear Skyway and Wilmington Bypass are assumed to be in place and funded by toll revenues to further enhance local truck access to the port.

9.1.2 Wood Pellets

Realization of the opportunity presented by the North Carolina wood pellet market includes the following proposed infrastructure investments:

Port and Terminals

Whether at Morehead City (Radio Island) or at Port of Wilmington (on north property), a new wood pellet terminal is proposed. This is an immediate need since North Carolina does not currently have any facilities to support the export of wood pellets.

Local Highway Access

At Radio Island, a new diamond interchange will provide access from US70. This immediate investment would support anticipated truck volumes to the Radio Island development.

A new wood pellet terminal at Port of Wilmington would not require any immediate investment in truck access.

Local Rail Access

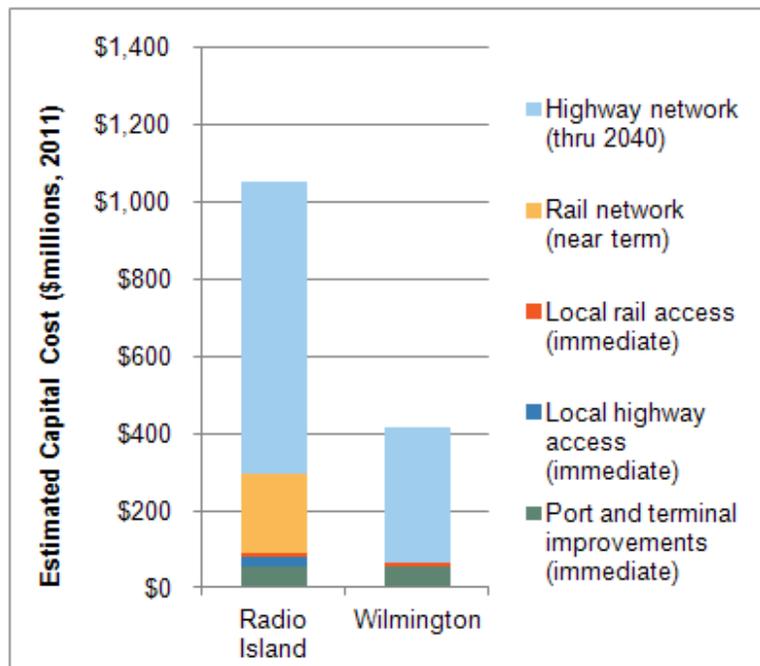
An upgraded rail connection is required to Radio Island.

For the Port of Wilmington site, a rail connection would be required to the CSX mainline.

Highway Network Improvements

Various projects currently identified in North Carolina's long-range transportation plan, but not yet funded, would provide continued competitive landside trucking costs to NC port facilities.

Figure 106: Cost and Timing of Candidate Maritime Infrastructure Investments for Wood Pellets



Source: AECOM/URS capital cost estimates

Access from North Carolina’s easterly timber production areas to the Port of Wilmington would benefit from upgrades to US17 and US74 to provide continued freight mobility as corridor congestion grows over time.

Funding of targeted capacity and speed improvements along I-95, NC 24, US 17, US 421, US 70 and US 74 is proposed to provide long-term competitive truck access to Radio Island.

Rail Network Improvements

Rail is anticipated to be a primary mode of transport for wood pellets from growing regions in the western part of the state. While the addition of two trains a week is not anticipated to have a significant impact on rail capacity, relocation of the rail corridor running through Morehead City would minimize community impacts of a wood pellet facility at Radio Island.

9.1.3 Other Wood Products

Beyond wood pellets, the anticipated growth and opportunity for wood, including wood chips, wood pulp, and other bulk and breakbulk wood products can be accommodated within the available capacity within existing general cargo terminals at Morehead City or at Wilmington. Support for the North Carolina market for these wood products, includes the same proposed highway and rail network improvements as described for the wood pellet market above.

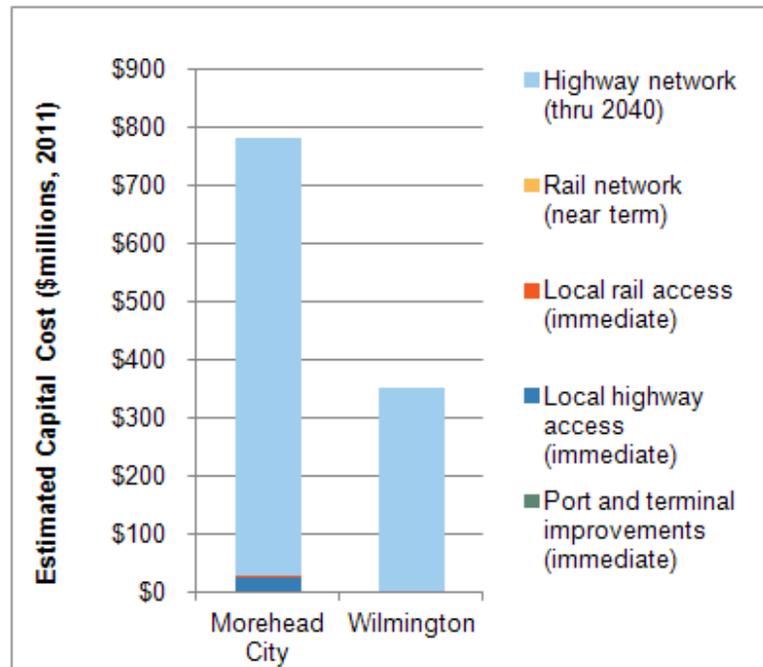
9.1.4 Containers

To meet North Carolina-based demand for the import and export of containerized goods, a comprehensive set of infrastructure investments is proposed. The nature, cost, and timing of container infrastructure needs vary by container port location.

Port and Terminals

North Carolina’s immediate container demand can be met at the existing Port of Wilmington terminal. Realization of the projected container market opportunity, however, would require near-term investment to expand capacity through construction of an additional premium berth, increased container storage area, and upgrade of existing reach-stacker cargo handling operations to the use of rubber-tired gantry (RTG) cranes.

Figure 107: Cost and Timing of Candidate Maritime Infrastructure Investments for Other Wood Products



Source: AECOM/URS capital cost estimates

The handling of containers at Radio Island, River Road, or Southport would require immediate investment in a new container terminal, including new wharf, berths and container yard and associated handling equipment. Based on efficiency analysis presented in Section 7.5.8, RTG-based operation is proposed for Radio Island and automated stacking crane (ASC) operation for River Road or Southport.

Water Access

One of the greatest challenges to maintaining the viability and attractiveness of North Carolina ports to regular and frequent calls by container lines is water depth. Depth of 51 ft would offer unrestricted access to containerships expected to call on regional ports.

While immediate container operations can be provided at Port of Wilmington with the existing 42 ft channel, near term investment in Cape Fear channel deepening to 45 ft, 47 ft, or 51 ft is proposed to meet North Carolina's container demand.

At Radio Island, the existing 45 ft channel could support immediate water access to a new container terminal. Dredging of the Beaufort Inlet to 51 ft is proposed to meet forecasted demand at this location.

Development of a new greenfield container terminal at either River Road or Southport would require new channel access to the site and deepening of the Cape Fear channel to that location.

Local Highway Access

Currently programmed or funded projects would provide needed local highway connection to an expanded container terminal at Wilmington.

"Last mile" access to potential container terminals at Radio Island, River Road, or Southport would require new highway connections as immediate investments. For Radio Island, this would include a new access road and interchange connection to US70. Truck access to the River Road site would require a new highway connection to NC 133. The Southport site would require a new roadway from NC 87 to the terminal.

Local Rail Access

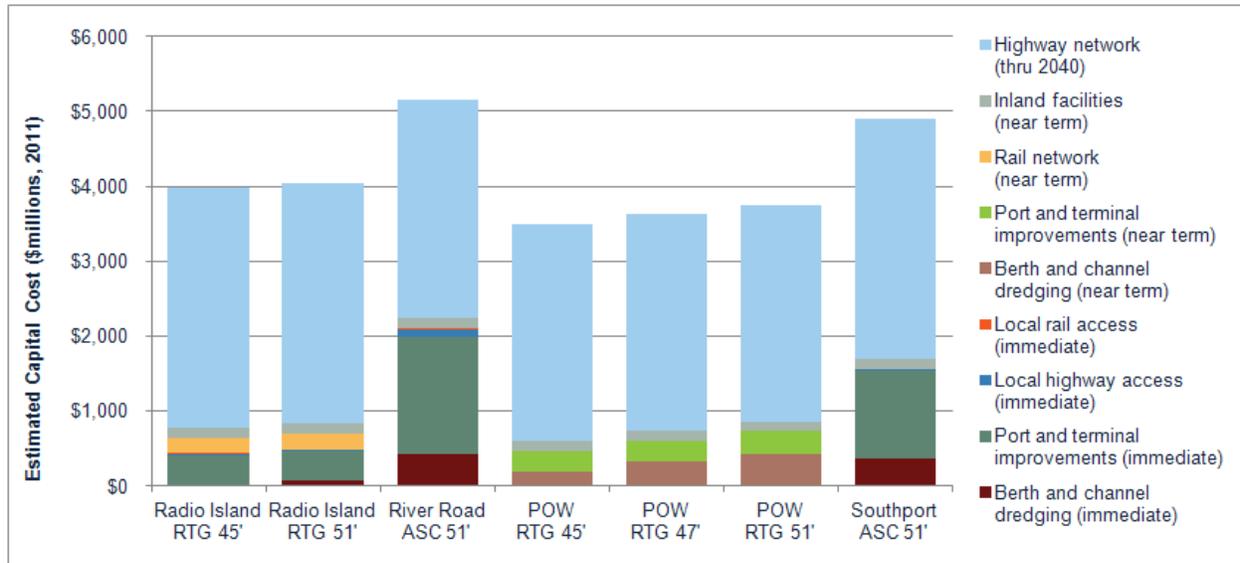
The proposed expanded container yard at Wilmington lies immediately adjacent to the existing CSX mainline. A new yard lead is proposed as an immediate investment to provide on-dock rail access for loading and unloading of intermodal containers.

Rail access to Radio Island would require immediate investment in rail access to the terminal from the existing the track operated by the Carolina Coastal Railway, which provides switching service within the port.

For the River Road container alternative, a new 22,000 ft lead track is proposed off of the existing US Military track that runs from Sunny Point Junction to MOTSU.

A new 5400 ft lead track and connection to the existing US Military track, upgraded from Sunny Point Junction, would provide rail access to the Southport container terminal. Upgrade of the military rail line is also assumed.

Figure 108: Cost and Timing of Candidate Maritime Infrastructure Investments for Containerized Cargo



Source: AECOM/URS capital cost estimates

Highway Network Improvements

Long-term investments include significant proposed improvements to the highway network between the proposed container ports and inland terminals and distribution centers. Improvements to highway capacity and elimination of gaps will maintain competitive trucking costs from the port sites to North Carolina's population centers in Charlotte, Raleigh, and Greensboro. Many of these projects have been identified in the State's long-range transportation plan, but extend beyond the timeframe of the current seven-year STIP.

For the Port of Wilmington, upgrades to US 74, NC 540, I-40, I-73, and US 17 are proposed to maintain freight mobility as highway congestion is projected to increase through 2040.

To enhance container access to Radio Island, proposed highway investments through 2040 include completion of NC 540 and improvements to I-40 in the Triangle Region as well as targeted widening of I-95 and NC 24.

Proposed highway system improvements for the River Road and Southport sites are similar to those identified for Wilmington, including upgrades to US 74, NC 540, I-40, I-73, and US 17. Additional investments are also proposed along I-77, US 74/76, NC 133 for future competitive access to River Road and along NC 87, US 71, US 74/76 for Southport.

Rail Network Improvements

The existing rail network, including planned and funded operational improvements, provides sufficient capacity to support the projected container access to the Port of Wilmington, River Road, and Southport sites.

For the Radio Island site, construction of the Havelock to Morehead City Rail Relocation project is proposed as a near-term investment to avoid impacts or traffic delays resulting from anticipated 18 to 20 weekly intermodal trains through Morehead City.

Inland Facilities

The relocation of the existing CSX Charlotte Intermodal Terminal to a site on the east side of Charlotte is proposed to improve the efficient movement of containers from North Carolina ports.

9.1.5 Refrigerated Cargo

Support for the refrigerated cargo market would require immediate investment in a cold storage warehouse, where refrigerated goods would be flash-frozen, stored and stuffed into refrigerated containers. Such a facility could be scalable to meet needs over time. A cold storage warehouse could be provided at or near the port terminal.

9.1.6 Ro/Ro and Oversize

The movement of heavy and oversize goods benefits from direct road and rail connections and sufficient laydown area at the terminal.

Port and Terminal

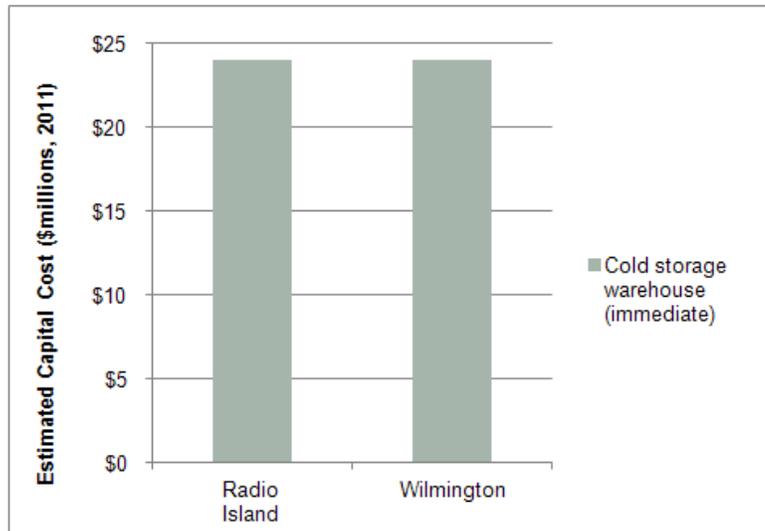
A new Ro/Ro and Oversize terminal is proposed at either Radio Island or at the Port of Wilmington north property. While North Carolina has limited capability to handle large manufactured goods and military equipment, this near-term investment would support the state in realizing the market opportunity and in-state demand for Ro/Ro and oversize goods.

Local Highway Access

A new diamond interchange at Radio Island would provide access from the new Ro/Ro and Oversize terminal to US 70.

At Wilmington, currently programmed and funded projects would provide access for Ro/Ro and oversize cargo.

Figure 109: Cost and Timing of Candidate Maritime Infrastructure Investments for Refrigerated Cargo



Source: AECOM

Local Rail Access

An upgraded rail connection is required to Radio Island. For the Port of Wilmington site, a rail connection would be required to the CSX mainline.

Rail Network Improvements

For the Radio Island site, construction of the Havelock to Morehead City Rail Relocation project is proposed. While the addition of

one or two trains a week is not anticipated to require additional rail capacity, relocation of the rail corridor running through Morehead City would minimize community impacts of the new terminal at Radio Island.

Highway Network Improvements

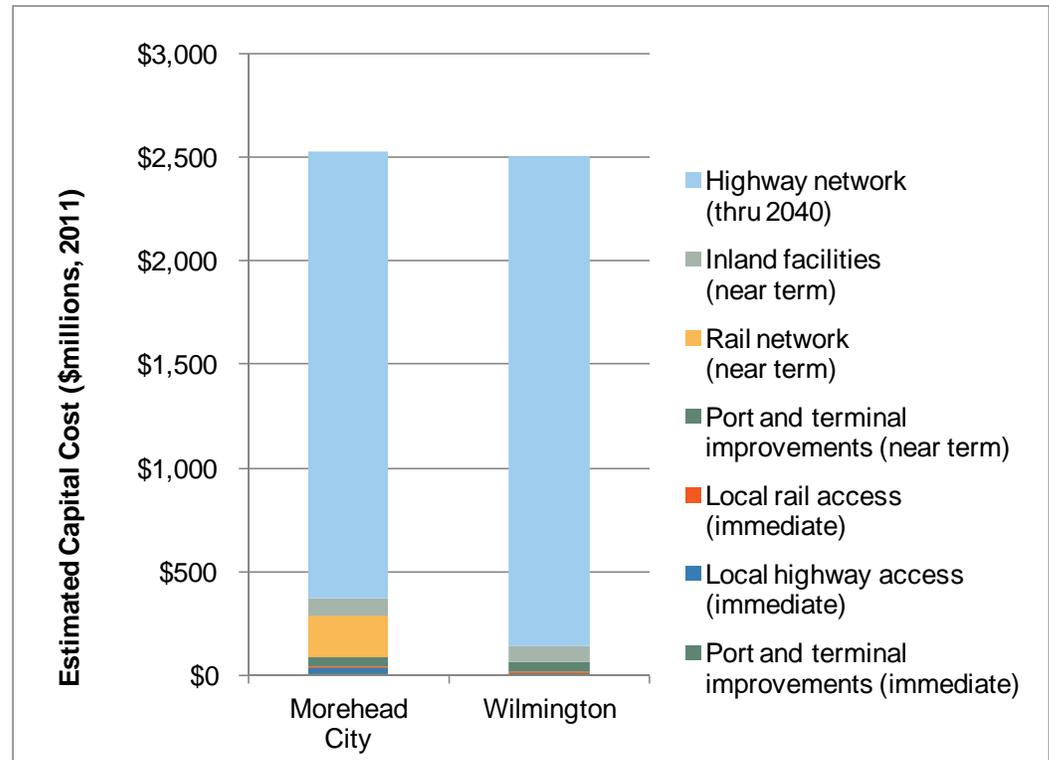
Key unfunded improvements to enhance access to Radio Island include the North Carteret Bypass and Kinston Bypass. Through 2040, additional improvements to US 70, I-40, NC 42, US 401 and US 421 are also proposed to enhance truck connections to manufacturing centers across the state.

For a Ro/Ro and oversize access to the Port of Wilmington site, corridor improvements to US 74/76, I-40, US 17 are proposed to counter anticipated highway congestion through 2040.

Inland Facilities

The development of two inland Ro/Ro – Lo/Lo ramps are proposed, at locations to be identified in collaboration with in-state manufacturing and economic development interests.

Figure 110: Cost and Timing of Candidate Maritime Infrastructure Investments for Ro/Ro and Oversize Cargo



Source: AECOM/URS capital cost estimates

9.2 Economic Impacts

The economic impacts focus on the elements such as construction jobs created and sustained, operations and maintenance jobs created and sustained, potential economic development, and fiscal impacts. Economic impact analysis examines what changes would occur due to of a project's construction and implementation and who would be affected by this change, regardless of whether the change is a transfer or net incremental change. By contrast, the benefit/cost analysis (as presented in Chapter 9) considers the potential net benefits attributable to the project, i.e. those differences between an improvement case (with project) and base case (no build, or without project) adjusted for any transfers. These economic benefits include transportation and operational (travel time, travel cost, and accident reductions), environmental sustainability (emissions reduction), productivity gains (shipper savings), benefits to other modes (additional rail capacity and grade crossing benefits), residual value of the investment, and investments avoided (if any).

For the economic analysis, the base case is that the proposed improvement is not constructed and operated, included existing and planned infrastructure supporting maritime trade as described in Chapter 6. The improvement case is that one or more of the proposed investments summarized in Table 48 is built and used by shippers. The "benefits" or "impacts" of the improvement case are then the differences in various measures between the base case and the improvement case.

The proposed *Maritime Strategy* investments would generate economic impacts through its construction and daily operation for the State of North Carolina. These economic impacts include:

- Construction impacts. Construction of the project would create jobs and expand payrolls for the duration of the project's construction cycle.
- Operating impacts. Since the project adds new services, there would be hiring associated with the operation of the project and local purchases of goods and services necessary to operate the project. Unlike the one-time construction impacts, these new operations jobs and local purchases required to operate the project would be recurring impacts.
- Tax base impacts. The additional earnings generated by the construction and operations activity would yield personal income tax revenues and sales tax revenues for the state.

The construction, local operating purchases, and new hiring for operations associated with the proposed projects represent the direct effects of the investments on the state's economy. The purchases associated with construction and operation would stimulate demand for support industries. As a result, a further increase of new employment across a variety of industrial sectors and occupational categories is expected as employers hire to meet this increase in local consumer demand. Additionally, the earnings of these newly-hired construction and operations and maintenance workers would translate into a proportional increase in consumer demand as these workers purchase goods and services in the state. This latter hiring represents the project's indirect and induced impacts.

The direct, indirect, and induced economic impacts associated with the construction and operation of the proposed maritime investments are measured using regional multipliers from the Bureau of Economic Analysis (BEA) within the US Department of Commerce. Derived from the Regional Input-Output Modeling System (RIMS II), the RIMS II multipliers measure the total

change (direct + indirect + induced effects) in employment and earnings that result from an incremental change to a particular industry. Since the focus of the study is on the state's competitiveness, state level economic multipliers are used. The multipliers are tailored by BEA to reflect the industrial structure of the state's economy. The multipliers are based on the 2002 Input-Output Table for the nation and 2008 regional accounts data; they represent the most up to date version available at the time this analysis was prepared.

9.2.1 Construction

Construction Expenditures

Construction of the proposed maritime improvements would have a substantial impact on the state's economy due to the direct and indirect employment supported by the construction expenditures. The number of construction jobs generated by the candidate investments is based on construction cost estimates developed and described in Chapter 7. The total gross capital expenditures are divided into four major categories. These include:

- General construction: waterway, port and terminal, roadway, railroad and inland facilities and contingencies;
- Right-of-way (ROW): all rights-of-way, land and existing improvements;
- Equipment: equipment manufacturing, installation and assembly; and
- Soft costs: professional engineering and related services.

Table 49 summarizes the capital costs by expenditure activity for candidate investments.

Table 49: Summary of Capital Costs by Major Cost Category (\$ Millions, 2011)

	Total Construction Cost	Construction	Professional Services	ROW
Grain	1,523	777	305	442
Wood Pellets	417	213	83	121
Wood Products	351	179	70	102
Containers	3,752	1,914	750	1,088
Refrigerated	24	--	--	--
Ro/Ro	2,524	1,287	505	732

Source: AECOM/URS capital cost estimates

The economic impact of these expenditures varies by expenditure type and depends on the amount of locally-produced goods and services embodied in the purchases. Construction goods and services would be purchased in the local economy. Although every building material required for the project is not produced locally, the RIMS II multipliers reflect the supplier linkages for the construction industry, and thus account for this leakage from the local economy.

Specialized equipment, financing, and land purchases, by contrast, would not be purchased from the local economy or generate jobs. The North Carolina regional economy does not produce all of the requisite equipment needed for the improvements, tempering the potential local impact this purchase can have. Although there is likely to be some assembly required upon delivery of the equipment, and it is possible that a component of the equipment might be made by a local supplier, these possibilities represent a negligible share of the total equipment cost and are, therefore, excluded from this analysis. Similarly, ROW expenditures shown above are for real property only and financing costs reflect the debt service payments only; therefore, the transaction costs associated with these expenditures are included in the Soft Cost category.

As there is no labor associated with the ROW and financing expenditures, there is no economic impact to the pure land or financing costs.

In sum, there are two types of capital expenditures that are expected to impact the economy: general construction and soft costs.

Construction Impacts

The economic impacts from the construction of the candidate maritime investments are estimated for the State of North Carolina based on the construction and professional services expenditures and the construction RIMS II multipliers for the state. The results are summarized in Table 50 below. Additionally, the impacts shown in the table are one-time impacts that last for the duration of the project's construction. One job is defined as a full- or part-time job for one person of one year's duration. As an example, a job for one person that had a duration of two years would be defined as two job-years.

Table 50: Total Employment (job years), Earnings and Fiscal Impacts Associated with Construction (2014–2040)

	Employment Impacts (job years)			Earnings Impacts (millions, 2011\$)			Fiscal Impacts (millions, 2011\$)		
	Total Jobs	Construction	Professional Services	Total Earnings	Construction	Professional Services	Total Tax Collected	Personal Income	Sales
Grain	21,194	15,821	5,374	771.4	545.9	225.5	39.42	23.65	15.76
Wood Pellets	5,803	4,332	1,471	211.2	149.5	61.7	10.79	6.48	4.32
Wood Products	4,885	3,646	1,238	177.8	125.8	52.0	9.08	5.45	3.63
Containers	52,214	38,975	13,239	1900.3	1344.8	555.4	97.11	58.27	38.84
Refrigerated	--	--	--	--	--	--	--	--	--
Ro/Ro	35,125	26,219	8,906	1278.3	904.7	373.7	65.33	39.20	26.13

Source: AECOM/URS capital cost estimates and BEA RIMS II multipliers

Note: The cost of the refrigerated market scenario is primarily for the warehouse equipment. As a result, while there may be a few construction jobs associated with its installation, these are likely to be minimal.

In the case of economic impacts generated by capital expenditures for the maritime investments, there are no long-term effects. Construction-related impacts last for the duration of the project's construction cycle. In order to isolate the potential economic effects of the project on the local economy, it is necessary to distinguish those resources that are new to the state's economy and that would not be invested in North Carolina **but for** the project from those that would still be spent in the state with similar economic effects (for example, funds that would be allocated to other transportation construction projects in the state). As no project has been selected or a finance plan developed, it is not possible to be definitive here. As an illustration, if 75 percent of the candidate project costs would be funded with federal money that would not necessarily be spent in North Carolina but for the project, 75 percent of the project impacts presented in the table above for each of the candidate investments would be net gains to the state.

9.2.2 Operations

The operation and maintenance (O&M) of the proposed maritime investments will support the state's economy through the creation of direct O&M employment and purchases. The economic impact of these expenditures will vary by the scale of activity and depends on the amount of locally-produced goods and services embodied in the purchases. Employment associated with the on-dock improvements will be slight; the employment associated with highway maintenance

for the additional lane-miles will be more significant. Although every material required for these activities is not produced locally, the RIMS II multipliers reflect the supplier linkages for the transit industry, and thus account for this leakage from the local economy. Additionally, the impacts shown reflect job-years. In other words, one job is defined as a full- or part-time job for one person of one year's duration. As an example, a job for one person that had a duration of twenty years would be defined as twenty job-years. The economic impacts generated by O&M expenditures are long-term, recurring impacts that occur as long as the project is in operation. The impacts are summarized in Table 51.

Table 51: Summary of Operating Impacts of Proposed Infrastructure Investments

Market Scenario	Grain	Wood Pellets	Other Wood Products	Containers	Refrigerated Cargo	Ro/Ro
Employment Impacts (average annual job years)						
Total Jobs						
At Port and Highway (includes multiplier)	90	40	290	2720	175	100
Earnings Impacts (millions, 2011\$)						
Total Earnings	70	34	240	2285	145	70
Fiscal Impacts (millions, 2011\$)						
Tax Collected						
Personal Income	2.2	1.1	7.4	70	4.0	2.2
Sales	1.4	0.7	5.0	47	3.0	1.4

Source: AECOM/URS operating estimates and BEA RIMS II multipliers

9.2.3 Economic Development

Once a candidate maritime investment is constructed and in operation, the state's economy will begin to respond to the accessibility, mobility and reliability provided by the investment. This response varies across the market scenarios. In the instance of grain, shippers will save transportation costs and may receive higher prices for crops. Collectively this increases margins, with the potential for greater spending in agricultural communities. By contrast, the Wind Power part of the Ro-Ro and Oversize Market Scenario introduces a new industry opportunity to the state either as a service in maintaining an offshore wind farm or in manufacturing if the state is successful in attracting a firm to the state. Unlike the construction impacts, these are long-term job impacts that recur each year, as long as the industry operates in the state. The following sections provide an estimate of the jobs and earnings potential associated with the market's response to the investments.

Grain

The primary benefit of the grain scenario is the improvement of profitability for growers. This will permit them to improve margins and expand production for a larger international market. Direct employment gains associated with grain farming are not anticipated; farm sector employment

has been declining for decades as the industry has become increasingly capital intensive. Because of the perishable quality of crops, farm production, is a critical anchor for the food processing industry—an important industry for North Carolina. Investments that benefit the continued health of the farm sector thus support the long-term economic health of food processing. While it is not possible to project how many new food processing plants might open or expand in the state over the coming decades, it is possible to describe the economic impact of a “typical plant,” with the understanding that the food processing industry is likely to benefit from growers’ improved access to foreign markets and long-term health.

Table 52: Summary of Recurring Economic Development Impacts Associated with Investments to Support Grain Exports

Jobs (annual average)	Earnings (millions, 2011\$)	Personal Income Tax (millions, 2011\$)	Sales Tax (millions, 2011\$)
135	3.1	0.096	0.064

Note: Jobs estimate assumes 50 direct jobs and includes the multiplier effect that includes both indirect and induced employment. Source: BEA RIMS II multipliers, industry sources, and AECOM analysis

Wood Pellets

The wood products industry is an anchor of the North Carolina state economy, particularly in the state’s large rural regions. The wood pellets opportunity diversifies this industry by introducing the ability to ship a new type of wood product from the state’s local ports. This opens up new markets for the state’s large forest resources—supporting revenues--and shields producers from cyclical downturns in other segments of the industry. The state already has one wood pellet facility; it ships from Norfolk because of the land side costs. Wood pellets manufacturing facilities locate where they have good access to the raw resource and good shipping access.

The industry is still evolving; the opportunity below assumes a typical wood pellet plant employs 62 workers. There are numerous regions in the state that could support a pellet facility, but here the number of total facilities is limited by the need to avoid competition with each other and other wood products producers for the raw resource. Thus, it is likely the state will attract more than one facility, but unlikely that it will attract more than 10, based on information from the forest products industry and stakeholder interviews. The economic development outcomes associated with a typical wood pellet plant are provided next.

Table 53: Summary of Recurring Economic Development Impacts Associated with Investments to Support Wood Pellets

Jobs (annual average)	Earnings (millions, 2011\$)	Personal Income Tax (millions, 2011\$)	Sales Tax (millions, 2011\$)
132	4.3	0.131	0.087

Note: Jobs estimate assumes 62 direct jobs and includes the multiplier effect that includes both indirect and induced employment. Source: BEA RIMS II multipliers, industry sources, and AECOM analysis

Other Wood Products

Increased export of wood products through North Carolina ports, including wood chips and wood pulp, would support an important existing industry in the state. Ensuring that the state’s

economic anchors can continue to thrive in the state is essential to growing the state's economy over time; allowing new opportunities to expand and diversify the state's economy as opposed to replacing losses. These opportunities are particularly vital for the state's large rural areas.

Table 54: Summary of Recurring Economic Development Impacts Associated with Investments to Support Other Wood Products

Jobs (annual average)	Earnings (millions, 2011\$)	Personal Income Tax (millions, 2011\$)	Sales Tax (millions, 2011\$)
436	14.1	0.433	0.289

Note: Jobs estimate assumes 204 direct jobs and includes the multiplier effect that includes both indirect and induced employment. Source: BEA RIMS II multipliers, industry sources, and AECOM analysis

Containers

Goods are increasingly shipped by container; improvements to the state's ability to handle containers efficiently offer opportunities on both the import and export sides of the market—benefitting retailers, distribution centers, and manufacturers. This improvement scenario benefits the largest variety of industries of all the scenarios considered in the strategy. Not all will be able to capitalize on the opportunity; the infrastructure is available to them if needed. Competitor ports are having economic development success in attracting users of container services to their state, in part, because of the efficiency of their operations and marketing efforts. The table below presents the economic development outcome associated with a distribution center, based on similar developments at the Port of Savannah.

Table 55: Summary of Recurring Economic Development Impacts Associated with Investments to Support Containers

Jobs (average annual)	Earnings (millions, 2011\$)	Personal Income Tax (millions, 2011\$)	Sales Tax (millions, 2011\$)
175	5.7	0.173	0.115

Source: BEA RIMS II multipliers, industry sources, and AECOM analysis

Refrigerated Cargo

The ability to handle refrigerated cargo supports the state's large animal production and food processing industry, in much the same way that grain handling investments support the industry. While this is the most likely industrial beneficiary of the investment, the ability to handle refrigerated cargo opens up additional opportunities in other industries that use specialized inputs such as textiles that need to be kept in a temperature-controlled environment. Grocery distribution facilities are another opportunity on the import side. The example below describes the impact of a one percent gain in the state's existing animal processing industry.

Table 56: Summary of Recurring Economic Development Impacts Associated with Investments to Support Refrigerated Cargo

Jobs (average annual)	Earnings (millions, 2011\$)	Personal Income Tax (millions, 2011\$)	Sales Tax (millions, 2011\$)
932	34.5	1.058	0.705

Source: BEA RIMS II multipliers, industry sources, and AECOM analysis

Ro/Ro and Oversize

Investments to handle heavy roll on/roll off cargo and oversize cargo support both the state's existing producers of large capital goods and the needs of the military installations located in the state, but it also supports expansion of capital goods manufacturing in the state. Although the state has not attracted the auto industry as other southeastern states have, it has had success with aerospace and heavy equipment manufacturers. The state's placement on several short-lists for major expansions of capital goods producers attests to the viability of this opportunity. The example below depicts the economic development outcome associated with the relocation of a new equipment manufacturing plant with 400 direct jobs.

Table 57: Summary of Recurring Economic Development Impacts Associated with Investments to Support Ro/Ro and Oversize Cargo

Jobs (annual average)	Earnings (millions, 2011\$)	Personal Income Tax (millions, 2011\$)	Sales Tax (millions, 2011\$)
1,536	40.4	1.239	0.825

Source: BEA RIMS II multipliers, industry sources, and AECOM analysis

Wind Power

There are several dimensions to the wind power opportunity from an economic development perspective—the possibility of low-cost energy to support the state's economy and help keep business costs low, the jobs and earnings associated with maintenance of an offshore facility, and the potential for the state to capture wind power manufacturers. While low energy costs certainly support the economy, it is a benefit considered by the Governor's commission on wind power and outside this freight study scope except to note its benefit. The potential outcomes associated with wind power manufacturing are the same as for Ro/Ro and oversize as described in the section above. The blade and turbine are oversize goods and based on the industry's expansion in other states, facilities are similar in size to other capital goods manufacturers. The remaining opportunity is thus the maintenance jobs associated with an offshore wind farm. These jobs would be located near the port, unlike some of the other economic development opportunities which would likely be located throughout the state rather than on the coast. The employment impact of such a facility depends on the size of the turbines used and the size of the facility constructed. Long-term prospects are also affected by the evolution of the industry over time as technology improves and turbines improve their generating efficiency. As no current plans are in place to construct a facility offshore, the facility is sized on current industry specifications for equipment generating capacity and the state's goal of meeting 15 percent of its retail electrical usage through renewable sources. The economic development outcome depicted below is sized to meet that goal based on current industry norms.

Table 58: Summary of Recurring Economic Development Impacts Associated with Investments to Support Wind Power (maintenance of offshore facility)

Jobs (annual average)	Earnings (millions, 2011\$)	Personal Income Tax (millions, 2011\$)	Sales Tax (millions, 2011\$)
215	5.4	0.166	0.111

Source: BEA RIMS II multipliers, industry sources, and AECOM analysis

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10 BENEFIT-COST ANALYSIS OF ALTERNATIVE MARKET POSITIONS

The proposed port-related investments will generate economic benefits through their use and the subsequent market response. A description of each benefit type is provided below; estimates are provided in the table below. The costs and benefits shown are discounted to a net present value to account for the fact that a dollar today is worth more than a dollar 20 years from now. The difference in value is the opportunity cost associated with waiting to receive the dollar (or dollar of benefits) because the dollar today could be invested and return more than a dollar in the future. The Office of Management and Budget (OMB) guidance (OMB circular No. A-94) requires the use of a seven percent real discount rate for any project receiving federal dollars. However, recent guidance from the USDOT (in its Notice of Funding Availability for Transportation Investment Generating Economic Recovery (“TIGER”) Discretionary Grants) has also allowed the inclusion of a lower discount rate due to the current interest rate market. As a result, the analysis also includes the use of a three percent real discount rate.

Benefit Cost Analysis (BCA) is used to determine whether a project or program (or multiples of them) yields a positive return on investment by comparing the quantifiable direct benefits to the direct costs for a defined period of time (often the useful life of the project or program). As a result, it focuses on the net changes attributable to the project or program, i.e. those differences between an Improvement Case (with project or program) and a Base Case (no build, or without the project or program). In addition, the BCA only considers direct impacts; it does not include any multiplier effects (i.e. indirect and induced impacts). The BCA does not include multiplier effects because the multipliers describe the aggregate outcome of a series of transactions across the economy. Because each transaction—a purchase of on-dock workers’ services for example—is a cost to the employer but a benefit to the wage-earner. The two sides of the transaction offset one another in the BCA.

While every freight scenario has its own unique characteristics, the outcomes typically included in a BCA can be broadly classified as follows:

Direct transportation benefits that result from project operation: As shippers and non-freight travelers divert to the new/improved transportation investment, travel time, travel cost, and accidents avoided savings are likely to accrue to users and non-users, due to increased mobility, reduced congestion, and reduced VMT in the region.

Economic benefits that occur in North Carolina as the market responds to the improved level of service and accessibility: As the transportation investment creates additional freight-handling capability and improves mobility and access to the port, there is an opportunity to improve the productivity of logistics operations.

Environmental and community benefits: Transportation investments improve mobility and potentially reduce VMT for autos and trucks as traffic shifts to more efficient routes or from highway to rail in some of the scenarios. As highway VMT are reduced, there are gains from reduced emissions and the reduction of grade crossing conflicts (associated with rail improvements in Morehead City).

Residual value of the project assets: Many transportation project assets will have a useful life that extends beyond the BCA period specified by the federal and state grant programs US DOT

guidance indicates that this residual project value (beyond the analysis period) is a benefit and should be included in a BCA, as long as the expectation is the asset will be in service for its full useful life.

Investments avoided: As travelers divert to the new/improved transportation investment, VMT are likely to be reduced on parallel facilities, resulting in a decline in the wear and tear on other parallel assets. As a result of this reduced wear and tear, transportation investments required to maintain a state of good repair or improve these parallel assets may be avoided or deferred.

It is also important to note that the costs included in the BCA go beyond the initial capital cost investment for the project or program. These costs should reflect life cycle costs, including capital costs (design/engineering, land, vehicles, construction, contingencies, and mitigation expenses), ongoing operations and maintenance costs, minor rehabilitation costs, and any major rehabilitation/replacement costs if the analysis period extends beyond the useful life of the assets.

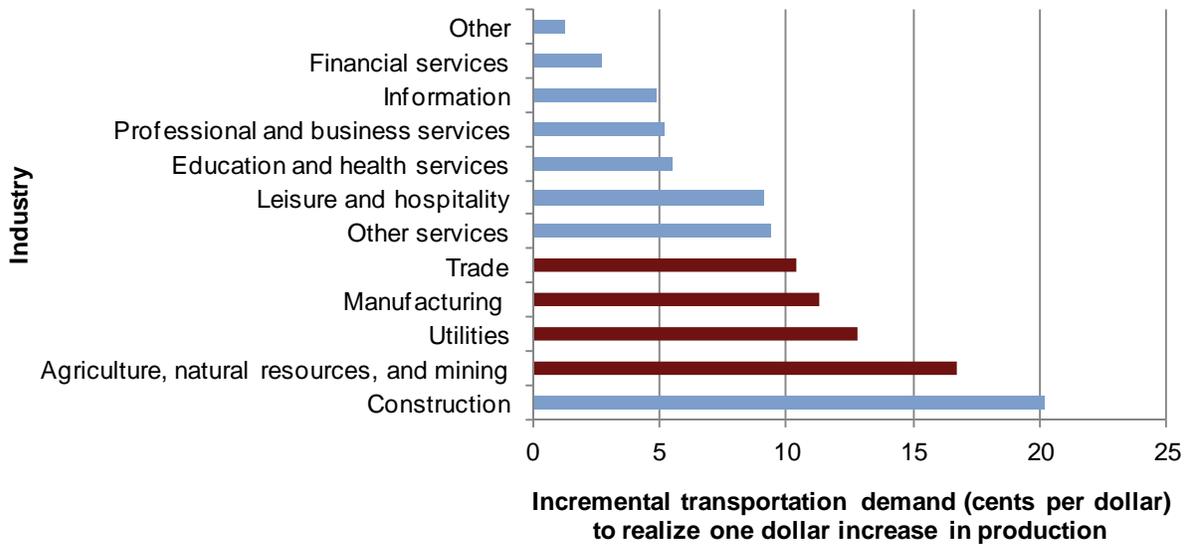
As part of a BCA, benefits and costs (both capital and operating) are monetized (or estimated as a dollar amount), discounted, and then compared to each other to develop a benefit cost ratio (BCR). The benefits are monetized so that they can be compared appropriately to the project costs. Additionally, the monetized benefits and costs are discounted to a present value (PV) in a BCA. Discounting accounts for the fact that a dollar today usually is greater than a dollar expected 10 years from now—because the dollar today could be invested and return more than a dollar in benefits 10 years from now (excluding inflationary impacts). As a result, benefits that are experienced today are more valuable than the benefits expected in future years.

10.1 Direct Shipper Benefits

Several of the proposed maritime improvements would provide shippers with a closer or faster port alternative, reducing the transportation cost associated with delivering the product to market. The figure below shows the total cost (direct and indirect) of transportation needed to deliver a dollar increase in product to final demand. For instance, a \$1 increase in the final demand for construction sector commodities requires an increase of 20.2¢ in total transportation services output. Of this 20.2¢ increase, 14.8¢ of in-house transportation; 3.9¢ of for-hire air, rail, truck, and water; and 1.5¢ of other for-hire transportation services would be required⁶⁴. As the figure illustrates, agricultural, forest products and manufacturing industries are large users of transportation. A reduction in these costs improves profitability or allows the firm to reach a larger market for the same transportation cost.

⁶⁴ Example provided by BTS.

Figure 111: Industry Demand for Transportation Services: Incremental Increase in Transportation Cost (cents per dollar) to Realize One Dollar Increase in Production



Source: US Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, Transportation Satellite Accounts: A Look at Transportation's Role in the Economy, Washington, DC: 2011, page 35.

The shipper benefits are estimated based on the output of the delivered cost model (described in 7.1.5). In order to avoid bias, the estimates assume that all production nodes are equally likely to deliver product to the port. In instances where the expectation is that the availability of specialized equipment, such as a grain terminal or cold storage will permit freight to travel to the closer and less costly in-state port, the cost differential with the next lowest cost out-of-state alternative is used in order to be conservative.

10.2 Logistics Benefits

The availability of faster and more reliable freight deliveries offers firms savings beyond just the direct shipper savings, as they can operate and restructure in a more productive way. These benefits can take a variety of forms. Shippers use lower transportation costs to search for and purchase from less expensive suppliers, which improves their profit margins. Firms also deliver at lower costs per shipment—this either reduces the cost to the final customer making the firm more competitive or improves the industry's profit margin (or a combined effect). Greater landside travel capacity improves reliability and speed of delivery; participants in the shippers' workshop reported that they favored reliability. In the words of one shipper, "I can plan for a longer deliver time; I just place the order sooner. I need reliability so that I can plan." Greater certainty on delivery times allows producers/shippers to keep lower inventory and maintain smaller warehousing costs, reducing their production costs. Those that use an in-house transportation fleet can reduce the size of that fleet because they need fewer vehicles for congested periods. The improvements proposed here will affect a variety of producers and industries, which vary in their sensitivity to such logistics costs. In order to capture the benefit of these improvements, the supply chain benefit was estimated as 6.8 percent of the transportation cost savings, based on research prepared for the USDOT on quantifying the economic impact

of freight transportation projects⁶⁵. The research relates a 10 percent improvement in transportation costs to a 6.8 percent change in logistics benefits. This is a conservative approach as many of the estimated cost reductions are closer to 20 percent, but this approach is taken as there is no way to model how the shipper will utilize the cost savings in the broader production process.

10.3 Non-Freight Traveler Benefits

A number of the improvements will yield benefits for the non-freight traveling public. Road improvements will yield travel time savings, the avoidance of vehicle crashes and the associated loss of life and injury. Each is quantified according to federal guidance for the value of travel time and the valuation of a statistical life⁶⁶. The number of hours saved is generated from the FAF model and applies only to savings for those segments of road that are improved. The reduction in accident costs is assessed using crash rate data from the NCDOT, applied to roads that will install a median as part of the project.

10.4 Highway Maintenance Costs Avoided

The reduction of truck vehicle miles traveled reduces the wear and tear on the state's highway, reducing the need for highway maintenance. The economic benefit of highway maintenance cost avoided is estimated by applying a per mile estimate of truck damage to highways to the volume of truck VMT avoided. The amount of truck VMT avoided is estimated for 2040 using data from the FAF model and then backcast to the present using an assumed one percent change in VMT.

10.5 Emissions

The reduction of truck vehicle miles traveled in those market scenarios where truck travel less with an in-state option will reduce the amount of emissions, providing a public benefit of cleaner air. The economic benefit of the decreased emissions is estimated by applying the economic cost of air emissions to the reduction of CO, NOx, and VOC as specified by the National Highway Traffic Safety Administration (NHTSA), which currently does not include a value for the economic cost of CO.⁶⁷ The amount of truck VMT avoided is estimated for 2040 using data

⁶⁵ Guide to Quantifying the Economic Impacts of Federal Investments in Large-Scale Freight Transportation Projects, prepared for the Office of the Secretary of Transportation, US Department of Transportation, August 2006.

⁶⁶ USDOT Office of the Secretary, "Treatment of the Economic Value of a Statistical Life in Departmental Analyses – 2011 Interim Adjustment" and "Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis" September 2011.

⁶⁷ The economic costs of air emissions are taken from Chapter VIII of the Final Regulatory Impact Analysis of the National Highway Traffic Safety Administration's rulemaking on Corporate Average Fuel Economy for MY 2011 Passenger Cars and Light Trucks.
http://www.nhtsa.gov/DOT/NHTSA/Rulemaking/Rules/Associated%20Files/CAFE_Final_Rule_MY2011_FRIA.pdf

from the FAF model and then backcast to the present using an assumed one percent change in VMT.

10.6 Grade Crossing Benefits

The construction and operation of rail improvements included in some of the market scenarios would affect grade crossings in two ways: 1) introduction of a number of grade crossing improvements (safety upgrades – including those for Quiet Zones, separation, closure, and relocation) and 2) increase in the number of trains operating along the tracks. These improvements and operating changes have the potential to affect delay times at crossings, vehicle operating cost savings, emissions avoided, and accidents avoided. To quantify these effects at grade crossings requires a means to estimate the queuing at crossings and the potential for accidents and injury, which differs from the risk while driving. Developed by the Federal Railroad Administration (FRA), GradeDec estimates both safety and other transportation outcomes associated with the additional service on the corridor and the grade crossing improvements or elimination.

10.7 Residual Value

The useful life of highways constructed in many of these market scenarios exceeds the 30-year analysis period specified for this benefits analysis. According to the Bureau of Economic Analysis, highways and streets have a 60 year life⁶⁸. Thus, many of the assets would have a residual value (sometimes referred to as salvage value) beyond the 30-year analysis period applied. In order to estimate the residual value of the project, the highway capital investment in each of the major categories noted above was depreciated (straight-line) over the full length of its asset life. The years included in the analysis period (the first 30) were excluded from the residual estimation because these years are the basis of the other benefits estimation. The value of the depreciated asset in years 31 to 60 was discounted back at seven percent and three percent and summed.

The table below summarizes the benefit-cost ratio (BCR) for each of the market scenarios described in this report. Because of the large landside investments included in a number of the scenarios, two BCR are presented. The first concentrates on a comparison of freight benefits to freight costs, where freight costs are defined as any capital or maintenance cost directly related to the port or port access, plus a fraction of the larger landside network improvements which serve both the freight and non-freight economy. Freight benefits are those benefits that are directly freight related such as shipper and logistics benefits, plus a share of the user benefits generated on the larger landside network improvements. The freight share is assigned in each scenario by the share of projected freight traffic applied in the freight scenario of total traffic using the facility. The second BCR is a comprehensive comparison of benefits to costs that spans all users and costs—freight and non-freight.

In interpreting a BCR, a value of 1.0 indicates that each dollar of investment yields a dollar of benefit. A value higher than 1.0 indicates that more than a dollar of benefits are received for

⁶⁸ BEA Rates of Depreciation, Service Lives, Declining-Balance Rates, and Hulten-Wyckoff categories.

each dollar spent. A value lower than 1.0 indicates that less than a dollar's worth of benefits are returned for each dollar of expenditure—not a favorable investment. Values close to 1.0 such as 0.98 or 1.02 are essentially yielding the same result as 1.0—the magnitude of the difference is not a meaningful one in the larger freight strategy context.

As the table shows, the grain, wood products, wood pellets, Ro/Ro and oversize, and container (refrigerated and non-refrigerated) market scenarios all yield a positive return on investment at the 3 percent discount rate and most at the more stringent 7 percent discount rate. Of special note, the Ro/Ro & oversize scenario also benefits the state's military facilities significantly. While an adjustment was made to capture this important benefit, a long-term projection of the full benefits cannot be captured in the BCR because a 30-year projection of military equipment movements is not available. That said, the Eastern Region Defense Logistics Initiative concluded that the US military could realize significant savings by utilizing North Carolina's ports and that the state of North Carolina would realize significant economic development benefits from such a strategy. In short, the Ro/Ro & oversize scenario understates the benefits to the state and the nation, but a more precise estimate cannot be developed.

Table 59: NC Maritime Benefit/Cost Analysis of Alternative Market Scenarios

2017 - 2046	Grain		Wood Pellets		Other Wood Products		Containers with Inland Port		Refrigerated Cargo		Ro/Ro & Oversize (Note 4)	
	7%	3%	7%	3%	7%	3%	7%	3%	7%	3%	7%	3%
BENEFITS (\$ millions)												
Shipper Savings (Note 3)	\$ 50	\$ 92	\$ 55	\$ 125	\$ 31	\$ 60	\$ 511	\$ 1,334	\$ 65	\$ 127	\$ 33	\$ 64
Logistics Benefits	\$ 3	\$ 5	\$ 4	\$ 8	\$ 2	\$ 4	\$ 35	\$ 91	\$ 4	\$ 9	\$ 2	\$ 4
Accident Savings	\$ 13	\$ 30	--	--	--	--	\$ 43	\$ 99	--	--	\$ 22	\$ 51
Travel Time Savings (net of shipper savings)	\$ 871	\$ 2,103	\$ 260	\$ 628	\$ 284	\$ 693	\$ 1,301	\$ 2,998	--	--	\$ 2,032	\$ 4,872
Highway Maintenance Avoided	\$ 6	\$ 12	\$ 7	\$ 14	\$ 7	\$ 14	\$ 60	\$ 115	\$ 3	\$ 5	\$ 2	\$ 5
Emissions Reduction	\$ 6	\$ 14	\$ 8	\$ 17	\$ 8	\$ 17	\$ 61	\$ 138	\$ 3	\$ 6	\$ 1	\$ 3
Grade Crossing Benefits	\$ 20	\$ 49	--	--	--	--	--	--	--	--	\$ 11	\$ 27
Residual Value of Infrastructure	\$ 36	\$ 132	\$ 9	\$ 32	\$ 9	\$ 32	\$ 78	\$ 285	--	--	\$ 60	\$ 218
Total Benefits	\$ 1,004	\$ 2,437	\$ 342	\$ 825	\$ 341	\$ 820	\$ 2,088	\$ 5,060	\$ 74	\$ 147	\$ 2,164	\$ 5,245
COSTS (\$ millions)												
Operating Costs	\$ 8	\$ 19	\$ 1	\$ 2	\$ 1	\$ 2	\$ 29	\$ 67	--	--	\$ 22	\$ 52
Capital Costs	\$ 534	\$ 902	\$ 167	\$ 262	\$ 113	\$ 201	\$ 1,499	\$ 2,356	\$ 20	\$ 22	\$ 889	\$ 1,498
Total Costs	\$ 542	\$ 921	\$ 168	\$ 263	\$ 114	\$ 203	\$ 1,528	\$ 2,423	\$ 20	\$ 22	\$ 912	\$ 1,550
Direct Freight Costs	\$ 75	\$ 86	\$ 55	\$ 62	\$ 6	\$ 7	\$ 528	\$ 627	\$ 20	\$ 22	\$ 129	\$ 145
Freight Benefits/ Freight Costs BCR	1.12	2.01	1.32	2.64	7.49	13.71	1.27	2.69	3.79	6.69	0.40	0.75
Total BCR	1.85	2.64	2.04	3.13	2.99	4.04	1.37	2.09	3.79	6.69	2.37	3.38

Notes:

1. Costs and benefits are shown discounted from year of occurrence to 2011 at seven percent and three percent rates.
2. Accident savings reflects savings related to the addition of medians or the upgrade of a highway to interstate quality.
3. Grain shipper savings includes five cent price per bushel gain for export price.
4. Underestimates benefits to NC's military facilities.

Source: AECOM analysis

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11 FUNDING STRATEGIES

Port improvement projects are capital-intensive, increasingly requiring project sponsors to assemble funding from multiple sources as maintenance and expansion needs outstrip the growth in program revenues. This chapter examines the options for federal and state and local participation. Additionally, private investment opportunities and benefit capture strategies are explored so that non-governmental revenues can be identified and leveraged to demonstrate local commitment and support the case for federal and state participation.

11.1 Federal Funding Programs

There are several federal funding programs under which maritime infrastructure could be funded, including FEMA/Homeland Security, USDA, Military, USDOT (including FHWA and FRA and MARAD), TIFIA, GARVEE Bonds, and tax-exempt financing.

At the time of completion of the *Maritime Strategy*, the authorization of a new multiyear Surface Transportation Bill is being drafted by Congress. No specifics are known except that a number of surface transportation programs are being consolidated. As a result, in some cases, the following discussion provides an overview of the program type rather than the program specifics.

11.1.1 FEMA/Homeland Security Grants

Port Security Grant Program (PSGP)

PSGP provides funding for transportation infrastructure security activities to implement area maritime transportation security plans and facility security plans among port authorities, facility operators, and state and local government agencies required to provide port security services. The purpose of the FY 2011 PSGP is to support increased port-wide risk management; enhanced domain awareness; training and exercises; expansion of port recovery and resiliency capabilities; and further capabilities to prevent, detect, respond to, and recover from attacks involving improvised explosive devices (IEDs) and other non-conventional weapons. Port applicants are sorted into three groups, depending on their assessed risk. The seven members of Group I have the highest assessed risk; the 48 members of Group II have the next level of risk; all remaining ports (35) are in Group III. For 2012, North Carolina ports are in Group II.

Total funding available under this program in FY 2011 was \$235,029,000. Annual funding for this program is determined as part of the US Department of Defense Appropriations process. The most recent funding allocation is found in Department of Defense and Full-Year Continuing Appropriations Act, 2011 (Public Law 112-10).

The general security issues related to rising cargo volumes, exposure to hurricanes, concerns about climate change's impact on coastal facilities, and the North Carolina ports' status as Strategic Military Ports are all issues that are eligible for this program.

Freight Rail Security Grant Program (FRSGP)

The program provides funding to freight railroad carriers, owners and offerors of railroad cars, and owners of rail bridges to protect critical surface transportation infrastructure from acts of terrorism and to increase the resilience of the freight rail system. The funding priorities for the FY 2011 FRSGP reflect the Department's overall investment strategy as well as requirements of the 9/11 Act. The key goals of the FY 2011 FRSGP are to establish the basis for capital security improvements by funding vulnerability assessments and security plans, training to frontline personnel, security related exercises, global positioning system (GPS) tracking on railroad cars, and infrastructure hardening on rail bridges.

Total funding available in this program for FY 2011 was \$7,745,544. Funds were allocated competitively based on their ability to deliver protection to rail bridges and other high-risk assets, provide counter-terrorism training, or develop security plans and vulnerability assessments. There is a 75 percent (75%) federal and 25 percent (25%) grantee cost match (cash- or in-kind) requirement. Vulnerability assessments and security plans were exempt from this cost match requirement.

Rail service from the port runs through a number of North Carolina communities. Vulnerability assessments and planning can help to develop coordination and collaboration with the surrounding communities.

11.1.2 USDOT Grants and Loans

Highway Trust Fund

The Highway Trust Fund (HTF) is the primary source used to fund federal spending on roads, highways and transit. It is funded by the federal gas tax, currently set at 18.4 cents for gasoline and 24.2 cents for diesel. There are two accounts—one for roads and highways and a second for transit. Recent projections from the Congressional Budget Office find that both accounts will become insolvent in the next two years; the highway account will be unable to meet projected expenses in 2013 and the transit account will face the same challenge in 2014. From 2008 to 2010, the trust fund received transfers from the Treasury of \$35 billion to prevent it from becoming exhausted.

HTF primarily supports four surface transportation agencies within the Department of Transportation. The Highway Account funds the Federal Highway Administration (FHWA), the Federal Motor Carrier Safety Administration (FMCSA), and the National Highway Traffic Safety Administration (NHTSA) and the programs they administer. The Mass Transit Account funds the Federal Transit Administration (FTA). For example, the CMAQ program described elsewhere in this chapter is funded by the Highway Trust Fund.

The insolvency of the HTF for future needs creates significant uncertainty for the types of surface transportation program and their structure in the current authorization in light of Congressional reluctance to increase the gas tax. Although the form of the final legislation is not yet known, program consolidation, restructuring, and elimination are anticipated. Freight and passenger rail issues have also gained in importance in recent years and are anticipated to play a greater role in this authorization debate.

TIGER Discretionary Grants (USDOT)

The TIGER program grew out of the American Recovery and Reinvestment Act of 2009 (the “Recovery Act”) which included the program known as the Transportation Investment Generating Economic Recovery, or “TIGER Discretionary Grant.” Highly popular and heavily oversubscribed, subsequent rounds of discretionary grants for National Infrastructure Investments under the annual Appropriations Act as “TIGER Discretionary Grants”. As with the original TIGER program, funds for the TIGER II, II and IV program are to be awarded on a competitive basis for projects that will have a significant impact on the Nation, a metropolitan area or a region. Projects are evaluated according to five long-term outcomes: State of Good Repair, Economic Competitiveness, Livability, Environmental Sustainability, and Safety. In addition, support for job creation and near-term economic activity, innovation and partnership with other jurisdictions and the private sector are considered.

As this report is drafted, TIGER IV is underway. The FY 2012 appropriation for this round is \$500 million. FY 2012 Consolidated and Further Continuing Appropriations Act specifies that TIGER Discretionary Grants may be not less than \$10 million (except in rural areas) and not greater than \$200 million. For projects located in rural areas, the minimum TIGER Discretionary Grant size is \$1 million. In reality, program requirements for geographic and modal diversity among awards (up to \$100 million in TIGER IV funds will be made available for high speed and intercity passenger rail projects according to program guidance) strongly suggest that the maximum award will be less than \$200 million. The largest award in the prior TIGER III round was \$20 million.

Highway Safety Improvement Program (HSIP) (formerly Section 130 (Highway-Railroad Grade Crossings Program) and Section 152 Hazard Elimination Program)

The Rail-Highway Crossings Program was established in 1913 through the Highway Safety Act, later codified as Section 130 in Title 23 of the United States Code. Section 152 Hazard Elimination Program is similarly codified in Title 23. Section 130 provides Federal money to states to fund projects aimed at reducing the incidence of accidents, injuries, and fatalities at railroad crossings.

H.R. 3 amended these programs in several important ways. The Section 130 program is maintained; it is funded as an annual set-aside of Section 148 funds (p. 88, H.R. 3). The Hazard Elimination Program under Section 152 is eliminated and is incorporated into 23 USC 148, the new Highway Safety Improvement Program (HSIP). All states must develop a strategic highway safety plan by October 1, 2007. If a state certifies that it has met all of its needs for installation of protective devices at railway-highway crossings, the State may use funds set-aside for section 130 Railway-Highway Crossings to pay for other safety projects eligible under the HSIP (p. 864, H.R. 3).

Level of funding under this program going forward will be defined in the new transportation bill.

Last authorization was \$220,000,000 of Section 148 funds that set aside in each fiscal year for Section 130 program activities across the US. Of these funds, ½ of the funds will be apportioned based on a formula set forth in Section 104(b)(3)(A) and ½ of the funds are apportioned based on each State’s percentage of railway-highway crossings. The minimum apportionment is one half of one percent (p. 88, H.R. 3). The Federal share of a project’s cost is set at 90 percent.

Table 60: Historic Level of Highway Safety Improvement Program Funds

2006	2007	2008	2009
1,236,810,000	1,255,709,322	1,275,929,067	1,296,474,396

Source: H.R. 3

HSIP funding is specifically available for grade crossing improvements and removal of high-risk at grade crossings. Although the program's status is currently part of ongoing congressional transportation bill

authorization, safety is projected to be one of the programs carried forward in the new bill.

Railroad Rehabilitation and Improvement Financing Program (RRIF)

TEA-21 (Section 7203) authorized a new Railroad Rehabilitation and Improvement Financing program to provide credit assistance, in the form of direct loans and loan guarantees for railroad capital improvements. The USDOT may provide direct loans and loan guarantees to state and local governments, government sponsored authorities and corporations, railroads, and joint ventures that include at least one railroad. Direct loans and loan guarantees are to be used to acquire, improve, develop or rehabilitate intermodal or rail equipment or facilities, including track, bridges, yards, buildings and shops.

The Program has not been well used to date as RRIF loans have taken a long time to process and there have been significant obstacles to participation. SAFETEA-LU amended the program to increase participation. "Congress seeks to encourage, not discourage, major rail investment in the U.S." (p. 1094, Conference Report on H.R. 3).

Key modifications included the following:

- There is a time limit of 90 days for the Secretary's approval or disapproval of an application.
- The Secretary may not require an applicant for a direct loan or loan guarantee to provide collateral.
- Conference substitute language indicates that the bill retains Senate language overruling both the memorandum and DOT regulations requiring rejection by a private lender before an applicant may obtain a RRIF loan.
- The Secretary is required to give priority to projects that have a national impact. "RRIF should be used to help improve service and capacity in the national rail system wherever feasible." (p.1095, Conference Report on H.R. 3).

Level of funding under this program going forward will be defined in the new transportation bill. This program may be expanded. Prior transportation bill reauthorization included \$35 billion in funding.

Applies to projects that may alleviate a choke point in the landside network serving the port.

STP (Surface Transportation Program) for Rail Purposes

The Surface Transportation Program (STP) provides flexible funding that may be used by states and localities for projects on any Federal-aid highway (includes the NHS), bridge projects on any public road, and projects on rural minor collectors.

Funding Levels: TBD in current reauthorization

The Federal government, for fiscal years 2005 through 2009, has placed over \$32 billion in the Surface Transportation Program and then distributes those funds to each State's Department of Transportation based on a formula.

The North Carolina landside improvements would be eligible for limited STP funding to fund requisite construction on highway structures in the corridor such as those a grade crossings/separations.

Table 61: Historic Level of STP Funds (in millions)

2005	2006	2007	2008	2009
6,860	6,270	6,370	6,473	6,577

Source: H.R. 3

Congestion Mitigation and Air Quality Improvement Program

The Congestion Mitigation and Air Quality Improvement Program (CMAQ) funds are provided to state DOTs, MPOs and transit agencies to invest in projects that reduce transportation-related pollutants.

The CMAQ provisions recognize ozone and carbon monoxide (CO) as the primary transportation pollutants. CMAQ funds can be used on projects to improve the air quality within or in close proximity to nonattainment or maintenance areas. The Federal government issues CMAQ funds to each State based on population and the severity of the area's air quality problems. The State is then responsible for allocating the money to various projects throughout the year. Freight projects are eligible for CMAQ funding if they show an air quality benefit.

For those States that do not have classified non-attainment areas, they may use their CMAQ funding to aid programs that qualify for their STP program. Generally speaking, the CMAQ program was created to provide States with flexibility in which programs receive funding from this source.

Level of funding under this program going forward will be defined in the new transportation bill.

In the last reauthorization, the Federal government has appropriated over \$8.6 billion dollars in CMAQ funds between 2005 and 2009.

CMAQ funding is a candidate-funding source for port projects, particularly those where truck traffic is projected to be highly congested in the future. The limiting factor, however, is that relatively few counties in North Carolina are in non-attainment.

Transportation Infrastructure Finance and Innovation Act (TIFIA)

The Transportation Infrastructure Finance and Innovation Act (TIFIA) established a Federal credit program for major transportation investments. As TIFIA is a credit program, not a grant program, projects must be capable of generating their own revenue streams through user charges or other dedicated funding sources in order to use this program.

The TIFIA credit program provides for the following three types of financial assistance:

- Direct Federal loans to project sponsors;

- Loan guarantees provide full-faith-and-credit guarantees by the Federal government to institutional investors; and
- Lines of credit represent standby secondary sources of funding that may be drawn upon to supplement project revenues.

Eligible project sponsors include state departments of transportation, local governments, public private partnerships, or any legal entity undertaking the project and authorized by the Secretary. The Reauthorization Bill expanded the definition of freight-related projects eligible for TIFIA assistance to allow private rail facilities that serve a public benefit for highway users. Public freight rail facilities, intermodal freight transfer facilities, and projects providing access to freight rail or intermodal freight transfer facilities are also eligible.

TIFIA assistance improves access to capital markets, offers flexible repayment terms, and potentially more favorable interest rates than can be found in private capital markets for similar instruments. The project must be reasonably anticipated to total at least \$50 million. For ITS projects, the minimum cost is \$15 million. Project financing may be repaid in whole or in part from toll, user fees or other dedicated revenues; other dedicated revenues include: tolls, user fees, special assessments, tax increment financing and any portion of a tax or fee that produces revenues that are pledged for the purpose of retiring project debt.

SAFETEA-LU authorized a budget of \$122 million in each fiscal year between 2005 and 2009 for a total of \$610 million. This budget translates into lending authority of about \$2 billion per year. As of July 2004, over \$3.5 billion in TIFIA credit assistance has been approved for 11 projects with a construction value of \$15.4 billion. The TIFIA program is likely to be expanded in the next transportation bill.

TIFIA is a candidate financing source for port projects that ease landside bottlenecks in the network serving a port. There is precedent for using TIFIA for rail projects. The Reno Transportation Rail Access Corridor (included in case studies) received TIFIA funding support. The Alameda Corridor project was the predecessor and model for TIFIA, bringing together several funding sources from federal, state, and port programs, along with a user fee applied to shipments either using, or capable of using the corridor

GARVEE Bonds

Grant Anticipation Revenue Vehicles (GARVEE) are debt financing instruments that permit an issuer to pledge future Federal highway funds to repay investors. Prior to 1995, states could use their Federal highway grants to repay only the principal component of debt service on most projects. Section 311 of the National Highway System Designation Act of 1995 changed the rules by conferring Federal-aid eligibility on a wide array of bond-related costs. Specifically, a state may use future obligations of Federal-aid funds to retire principal, interest payments, issuance and insurance costs, and other expenses incidental to the sale of an eligible debt financing instrument.

To be eligible, the project must be eligible for Federal-aid funding under one or more program categories as set forth in Title 23, section 115 such as NHS or STP. Reimbursements of debt-related costs must be made with obligations of eligible categories of Federal-aid funds. GARVEEs can be issued by a state, a political subdivision of a state, or a public authority.

GARVEE financing mechanism generates up-front capital for major highway projects at tax-exempt rates and enables a state to construct a project sooner than it would using traditional pay-as-you-go funding sources. By accelerating projects, costs are lower due to inflation savings and the public realizes safety and economic benefits.

As GARVEE instruments are secured against future federal monies, they carry appropriation risk and can carry authorization risk.

The amount of funding provided under GARVEE varies with program use. FHWA considers GARVEEs to be debt instruments backed directly by federal-aid funds. Other forms of indebtedness where the debt is repaid indirectly by federal project reimbursements are very similar to GARVEEs, but do not appear in FHWA tallies of GARVEE issuances. North Carolina has experience using this program. This program is expected to carry forward in the next reauthorization bill.

GARVEE bonds are a financing vehicle and not a new revenue source. GARVEE bonds primarily help by adding flexibility to a financing plan and by accelerating the construction process. The primary challenge with respect to the port projects is to first find a federal funding program that is applicable and can be secured against.

Capital Grants for Rail Line Relocation Projects (SEC. 9002, H.R. 3, p. 770)

This was a new program created in SAFETEA-LU. It is a grant program to provide capital assistance for local rail line relocation and improvement projects. Eligible projects include those that improve safety, motor vehicle traffic flow, community quality of life or foster economic development. Selection criteria include the capability of the State to fund the rail line relocation without Federal grant funding, equitable treatment of various regions of the US, the effects of the proposed rail line on the region to which it will be relocated, the effects of the relocated rail line on freight and passenger rail operations. Two or more states may combine any part of the amounts provided through grants for a project under this section if the project will benefit each state and it is not a violation of the states' laws. The Secretary shall require a state to submit a description of the anticipated public and private benefits associated with the rail line relocation and will consider the feasibility of seeking financial contributions or commitments from private entities involved with the project in proportion to the expected benefits.

Level of funding under this program going forward will be defined in the new transportation bill.

In the past, annual appropriations were \$350 million for the period from fiscal year 2006 to fiscal year 2009 for a total of \$1.4 billion. Allocation requirements reduce the possible support for any single project. At least half of all grant funds awarded under this program in each fiscal year will have a maximum value of \$20 million. Thus, the maximum amount that a project could receive in any one year is \$175 million and it would likely be less as there will be many requests for funding.

A state or other non-Federal entity must pay at least 10 percent of the project costs. In-kind contributions count against the non-Federal share and may include real or tangible personal property or the services of employees of the State or other non-Federal entity.

Tax-Exempt Financing of Highway Projects and Rail-Truck Transfer Facilities (H.R. 3, p. 1143)

The interest on state and local bond issues is typically excluded from Federal income taxation. By contrast, the interest on state or local bonds issued to finance the activities of entities other than state and local governments (including the Federal government) is typically taxed, unless the bond was issued for a particular purpose that is eligible for tax-exemption. Among the current exempt purposes for these so-called Private Activity Bonds are bonds issued for certain transportation facilities (airports, ports, mass commuting and high-speed intercity rail facilities). SAFETEA-LU creates a new type of exempt facility—the “qualified highway or surface freight transfer facility.” This new exempt facility includes (1) an surface transportation project receiving Title 23 funds; (2) a project for an international bridge or tunnel which receives Title 23 funds and for which an international entity authorized under Federal or State law is responsible; and (3) facilities for the transfer of freight from truck to rail or rail to truck (including facilities for temporary storage during such transfers) state receives Title 23 or Title 49 funding.

Level of funding under this program going forward will be defined in the new transportation bill.

Past funding levels included \$15 billion of issuance authority between 2005 and 2015. There were no caps on the annual amount that could be issued.

Government must issue the bond, but this program largely aids private parties to financially support the project reducing the cost of financing private parties’ share of freight intermodal projects.

Freight Intermodal Distribution Pilot Grant Program (SEC. 1306, H.R. 3, p. 77)

This was a new pilot program in the last reauthorization to make grants to states to facilitate and support intermodal freight transportation initiatives at the state and local levels to relieve congestion and improve safety. Grants should provide capital funding to address infrastructure and freight distribution needs at inland ports and intermodal freight facilities.

In the past, the grant program included \$6 million in each fiscal year from 2005 to 2009 for a total of \$30 million. Six projects were named in the legislation and received \$5 million each for a total designated project cost of \$30 million.

This funding source would not be available at this time since the projects for the pilot program are already designated. This program would be applicable if the pilot program were extended to all states in this round of reauthorization.

Water Resources Development Act (Section 401)

The Water Resources Development Act (WRDA) of 1986 provides for Federal cost-sharing for “general navigation features” as shown in Table 62. The program also covers 100 percent of costs

Table 62: Cost-Sharing Requirements for USACE Harbor Projects and Source of Funds

Channel Depth	Operation & Maintenance (HMTF)	Construction (General Treasury)
< 20 feet	80 percent	80 percent
20 to 45 feet	65 percent	65 percent
> 45 feet	40 percent	40 percent

Source: United States Code, Title 33-Navigation and Navigable Waters, Chapter 36-Water Resources Development.

of maintenance dredging from deposits of the Harbor Maintenance Tax (HMT) to the Harbor Maintenance Trust Fund (HMTF). For projects greater than 45 feet, the Federal share of dredging cost is reduced to 50 percent of project cost. Up to 10 percent of the non-Federal share of project costs can be offset by a credit for land, easements, rights of way and relocations.

HMTF expenditures are prioritized by military need, by total tonnage, and potential economic benefit.

Despite a surplus of nearly \$6 billion, outlays from the HMTF have been limited to an average of \$832 million annually during the years FY2006 to FY2011. This is significantly less than the collections and interest which averaged \$1,409 million during the same period.

America's Marine Highways Capital Construction Funds

The America's Marine Highway (AMH) was established in 2010 to expand freight uses of the country's inland and coastal waterways to mitigate landside congestion, and reduce greenhouse gas emissions. MARAD made available \$7 million to fund planning projects on a competitive basis through a Notice of Funding Availability.

North Carolina's position on the M-95 Corridor creates a potential avenue to support opportunities for expansion of port activities associated with the AMH program. This may be exploited as part of assessing North Carolina's future market expansion potential. Any future market assessment should investigate opportunities associated with or resulting from MARAD's implementation of the Energy Act, including possible technical and funding support for regional transportation plans; establishment of agreements with other US agencies to use AMH services; consultation with shippers on methods to incentivize the use of AMH services, and qualification of AMH services to participate in the Capital Construction Funds program.

MARAD, the administrative agency for the Marine Highways Grant program, awarded the initial \$7 million to three projects and provided funding for further study for three promising initiative, offering an indication for the programs early priorities. In total the program received 35 applications for the first round of funding. Of these, a number were identified as initiatives that show promise—creating a pipeline of projects for future funding and federal support. Projects that received direct funding in the first round included:

- \$3.34 million for the Ports of Brownsville, TX and Manatee, FL to modify two barges and purchase equipment,
- \$1.1 million for the James River container Expansion Project sponsored by the Virginia Port Authority to purchase two barges to increase and expand service, and
- \$1.76 million to buy and modify nine barges for the Tennessee-Tombigbee Waterway Pilot Project, sponsored by the Port of Itawamba, MS

Projects to receive funding for further study include:

- An initiative among the ports of Baltimore, MD, New Bedford, MA and Canaveral FL to use divert traffic from I-95. Of note for North Carolina, there is the option to add additional ports to this initiative as it advances and the state is well located between the existing Florida and Maryland stops.

- The West Coast Hub-Feeder and Golden State Marine Highway, a service connecting 13 ports on the west coast, and
- The Illinois-Gulf Marine Highway that would support Midwest industrial production with service between Peoria, IL and Gulf Coast seaports.

Future funding allocations to the program are uncertain at this time. The FY2011 and FY2012 budget request did not include money for the Marine Highway Program.

11.1.3 US Economic Development Administration (US EDA)

Public Works and Development Facilities Program

This program provides assistance to help distressed communities attract new industry, encourage business expansion, diversify local economies, and generate long-term, private sector jobs. Among the types of projects funded are access roads to industrial parks or sites; port improvements; business incubator facilities; technology infrastructure; sustainable development activities; export programs; brownfield redevelopment; aquaculture facilities; and other infrastructure projects. EDA has established the following investment priorities:

- **Collaborative Regional Innovation:** Initiatives that support the development and growth of innovation clusters based on existing regional competitive strengths.
- **Public/Private Partnerships:** Investments that use both public and private sector resources and leverage complementary investments by other government/public entities and/or non-profits.
- **National Strategic Priorities:** Initiatives that encourage job growth and business expansion in clean energy; green technologies; sustainable manufacturing; information technology (e.g., broadband, smart grid) infrastructure; communities severely impacted by automotive industry restructuring; natural disaster mitigation and resiliency; access to capital for small and medium sized and ethnically diverse enterprises; and, innovations in science, health care and alternative fuel technologies.
- **Global Competitiveness:** Investments that support high-growth businesses and innovation-based entrepreneurs to expand and compete in global markets.
- **Environmentally-Sustainable Development:** Investments that encompass best practices in “environmentally sustainable development,” broadly defined, to include projects that enhance environmental quality and develop and implement green products, processes, places and buildings.
- **Economically Distressed and Underserved Communities:** Investments that strengthen diverse communities that have suffered disproportionate economic and job losses and/or are rebuilding to become more competitive in the global economy.

The funding amount for FY2012 has not yet been announced, but \$158 million was awarded in FY2011.

Economic distress is defined as the area in which the project is located having an unemployment rate at least one percentage point higher than the United States, or the per capita income in the area is less than 80 percent of the per capita income of the United States.

11.1.4 Programs for Specific Complementary Uses (e.g. agriculture, military)

A final option for consideration is that many of the market scenarios require industry specific equipment. As individual projects develop, there may be opportunities to apply funds from the US Department of Agriculture such as those for rural development or for funds from the military.

11.2 North Carolina State and Local Funding Options

There are several state and local funding and financing options available for port and related improvements.

11.2.1 State Infrastructure Banks

SAFETEA-LU expands the State Infrastructure Bank (SIB) pilot program to all states. Two or more states can enter into a cooperative agreement with the Secretary to establish a multi-state SIB (p. 875, H.R. 3). SIBs may be used for rail projects. SIB loans are revolving loans that are capitalized by federal monies. North Carolina has a State Infrastructure Bank that is capitalized with federal funds. As of 2008 (most recent data available), the state's IB had supported six transactions worth \$1.2 billion⁶⁹. The state's bank does not appear to have been active in recent years.

11.2.2 Tax Exemptions

North Carolina has the option of offering tax incentives to the railroads (or other project beneficiaries that pay taxes) that in turn could support the project. The revenue yield from this type of arrangement depends on tax bill paid by the railroad. An example of this type of arrangement is described in AASHTO's Freight-Rail Bottom Line Report as quoted below.

As the railroad owns and maintains its own right-of-way, most of the railroad's tax burden is fixed, based on assets, rather than based on traffic. In the case of CSX, about 31 percent of the corporation's tax bill (\$20M, 1999 figure) goes to the State of New York even though only seven percent of CSX's track is located in New York. The New York State Legislature passed a bill (was awaiting Governor's signature when report was written) that would reduce the tax bill for Class I railroads by about 45 percent. In return, CSX would invest \$26 million in NY infrastructure projects—upgrades for both freight and passenger service. (p. 97)

11.2.3 Local Option Fuel, Sales or Property Tax

Counties and cities have limited financial resources for making capital improvements, but still may be able to contribute modestly to the Project's funding. North Carolina allows counties (but not cities) to levy four local option sales tax (LOST) upon the approval of public referendum. The four LOST are the Article 39 one-cent tax, the Article 40 half-cent tax, the Article 42 half-cent tax, and the Article 44 half-cent tax. The 100 NC counties now levy the full amount -- 2.5 percent. As the state levies a 4.5 percent sales tax, the total sales tax rate is now seven

⁶⁹ AASHTO Center for Excellence, Transportation Funding and Financing, chapter on State Infrastructure Banks available at http://www.transportation-finance.org/funding_financing/financing/credit_assistance/state_infrastructure_banks.aspx

percent statewide (except in Mecklenburg County which levies an additional 0.5 percent LOST for mass transit only). The local option fuel tax has a transportation nexus and the advantage that a portion of the tax burden can be exported to tourists and visitors to the coastal counties. As other transportation needs are ongoing in these counties, one possibility would be to dedicate a portion of the tax to the ports for a period of time. An alternative option would be to raise the tax and dedicate all or part of the additional tax to the ports. Depending on the size of the increase, the additional revenues could be split among other needs in the counties such as education, in order to gain broader support for the project. Legislative action would be required to raise the tax. North Carolina's fuel tax is a combination of a fixed and variable rate. The fixed portion is 17.5 cents; the remainder is variable – indexed to 7 percent of the wholesale rate of fuel with a minimum yield of 3.5 cents. There is similarly a ceiling on the top rate—the combined total fixed and variable rate is 38.9 cents (January 1, 2012). Given that fuel prices are expected to hold at a rate that maxes out the top variable rate, North Carolina's fuel taxes are effectively flat going forward.

11.2.4 Special Development District

The port operations and trade activities create development opportunities. The creation of a special development district in either or both port locations would generate a source of revenue for the project and permit the project to capture some of the value that it creates.

11.3 Opportunities for Private Sector Investment

This section describes options for obtaining private sector funding for the port projects.

11.3.1 Direct Investment by Railroads

There are three considerations when negotiating funding shares for port-related improvements: ability to contribute, receipt of benefits in return for contribution, and willingness to pay.

In terms of ability to contribute, both of the Class I railroads that operate in the state have large capital investment budgets and have partnered nationally with public sponsors to secure federal funding, such as for TIGER funding. In terms of willingness to pay, this is a matter of negotiation rather than analysis. There may be instances where a project yields operational savings to the railroad; in these instances it may be possible for the railroad to participate.

11.3.2 User Fees

As the port is owned publicly, then fees can be charged to the users. These fees are used to cover the cost of operating and maintaining the facility, with the balance applied to repaying construction debt. An advantage of the user fee approach is that port users (or railroads) can transfer at least some of this cost to shippers, who are also beneficiaries of the improved rail service afforded by the relocated line. User charges are applied in the Alameda Corridor and the Shellpot Bridge Project.

11.3.3 Sale/Leaseback of Rail Assets

The railroads own numerous assets within the state. Some of these assets may become obsolete if rail lines are relocated. Aside from the abandoned right-of-way, there may be offices

or other parcels that would no longer be used. These assets could be sold with the understanding that some percentage of the proceeds would be applied to port and freight improvements that benefit the railroad. The sale of assets need not wait until the new project is built. The railroad could sell the asset and lease back the right to use it, providing a revenue stream to the state.

11.3.4 Public-Private Partnerships

Public-Private Partnerships (P3s) have gained acceptance over the past decade as another tool in the project development and delivery toolbox. North Carolina allows P3s under certain circumstances. For example, SB 243 Public-Private Partnerships for Schools is a 2011 bill to extend the sunset on the law allowing capital lease financing for public schools. The North Carolina Turnpike Authority also has the ability to enter into P3 agreements. Additional applications are possible; HB 320/SB 278 extends legislative study committee examining use of public private partnerships for social and utility infrastructure (bill is in committee). The Department of Transportation does not currently have authorization to enter into P3 agreements, limiting this approach for port financing in the near term. North Carolina's law authorizing Department of Transportation-administered P3 projects expired on December 31, 2011. The North Carolina House created an 11-member Select Committee on Public Private Partnerships In September 2011. The committee is examining P3-related issues, including the appropriate oversight authority and regulatory framework, and will submit a final report before the start of North Carolina's 2013 legislative session.

In implementing a P3, framing the concession agreement is essential to having a successful project. A concern for the public and for public agencies, for example, is that the public authority or agency will lose control over pricing policy once the asset is operated by a private concessionaire. This can be prevented by including an escalation formula in the agreement. For example, in Indiana, the formula set by the Governor is the greater of 4.5 percent, CPI, or GDP. For the Pennsylvania Turnpike, the proposed toll escalation formula is the greater of 2.5 percent or CPI.

The concession agreement can cover details of how the facility will be operated as well. For example it can include Operating Standards that describe minimum levels of service, minimum asset condition, and intervention times for snow removal, accidents and other events. The public agency can retain the ability to resume full control in the event of default.

Public private partnerships can offer project sponsors several benefits when administered carefully. Key potential benefits are summarized below.

Value for Money

The P3 project provides value to facility users and taxpayers. This determination is typically evaluated using a public sector comparator as a benchmark. A Value for Money analysis will assess whether P3 delivery offers tangible benefits to the public. Value for Money is calculated as the net present value of project costs as delivered through P3 as compared to an equivalent quality project delivered through traditional public processes. Quantitative measures included in the Value for Money assessment may include design, construction, finance, operation and maintenance costs as well as value of earlier operation that may be realized through P3 delivery.

Risk Transfer

The P3 arrangement can be structured to transfer risk from the public sector to the private sector. Risks include revenue shortfall, construction cost overruns, greater than expected growth in O&M costs. This risk transfer can be accomplished because the private sector has the flexibility and reactivity to manage complex risks. Also, the multiparty transaction (banks, concessionaire, public sponsor) all work to identify, quantify and mitigate risk—ensuring a disciplined financial risk approach and a comprehensive review.

Timely Delivery of Projects

Data from the UK National Audit Office found that a higher percentage of privately financed projects were delivered early or on-time at the agreed upon price, compared with pure public projects.

Preservation of Public Borrowing Capacity

By privately financing a project, the public sector can leverage its finite bonding capacity and apply this bonding capacity to other projects.

P3 Examples

The following two examples outline P3 arrangements in the context of port projects.

Port of Miami Tunnel

The project will construct a tunnel connection, widen the McArthur Causeway and provide access improvements in the Port of Miami. The project is not tolled. It is procured by the Florida Department of Transportation as a Design, Build, Finance, Maintain, and Operate project offering an availability payment over 35 years. An availability payment takes the place of a toll, is made by a public project sponsor (a state DOT or authority, for example) based on particular project milestones or facility performance standards. Deductions are made if the facility is not operational (available) for a time. The winning concessionaire is responsible for all routine and heavy maintenance and has performance metrics to meet, as well as at handback of the asset to DOT. FDOT received three bids for this project. One was 94 percent of the engineer's estimate (the grantor's estimate/public sector comparator). The second was 56 percent of the engineer's estimate and the third was 49 percent of the estimate. The approach yielded significant cost savings and transferred risk to the private sector.

Maryland Port Authority Seagirt Terminal

The transaction allows Ports America to lease the Seagirt Terminal at the Port of Baltimore. It is a 50 year lease with no option for renewal. The Seagirt facility is a 183-acre container facility. The Canton property is an adjacent breakbulk facility of 18 acres. The two main customers are Evergreen and MSC. Ports America provided the Port of Baltimore with an upfront payment of \$100 million and a commitment to build an additional berth at \$105 million. The firm also pays an annual rent of \$3.2 million and there is a variable assessment of \$15/per container over 500,000.

On the public side, the Maryland Economic Development Corporation issued \$170 million in bonds to pay for the transfer of land to the port and \$89 million in bonds to lend to Ports America to help construct the berth. Ports America is providing a \$75 million match. Both bonds are secured by a lien on Ports America's Concession, which requires that all container business at the Port of Baltimore flow through the Ports America terminal.

11.4 Case Studies of Traditional Funding and Financing Approaches

The following case studies are presented because they are representative of landside freight projects throughout the country, and/or because their funding sources and financing mechanisms used are strategies that may be relevant to the port improvements. Taken as a group, they illustrate the variety of innovative approaches that are being pursued across the US to address freight problems. Each of the case studies presented are outlined in terms of Project Description, Capital Cost, Funding Sources, Financing Mechanisms, and Institutional Arrangements.

The Alameda Corridor

Project Description⁷⁰

The \$2.4 billion Alameda Corridor project provides the efficient and cost effective transportation capacity necessary for the United States to capitalize on the economic expansion in the Pacific Rim. The Alameda Corridor dramatically improved railroad and highway access to the Ports of Los Angeles and Long Beach (The San Pedro Bay Ports). The project travels along Alameda Street and consolidates over 90 miles of rail with 200 at-grade roadway crossing into a single 20-mile high-capacity and fully grade-separated facility linking the San Pedro Bay Ports with the national rail system. It also widens and improves the local truck route paralleling the rail facility to expedite port truck traffic.

Capital Cost

\$2.5 billion

Funding Sources

- \$400 million loan from the US Department of Transportation
- \$394 million contribution from the Ports of Los Angeles and Long Beach
- \$347 million administered by the Los Angeles County Metropolitan Transportation Authority (LACMTA)
- \$160 million in other State, Federal, and interest income sources
- \$1.2 billion in bond proceeds

⁷⁰ FHWA Innovative Finance web site.

Financing Mechanisms

The \$400 million loan from the USDOT was generated through the Direct Loan Financing Program under the Omnibus Consolidated Appropriations for Fiscal Year 1997. Minor adjustments were made to fulfill all requirements of section 505. The source of payment for the loans is the revenue generated by port wharfage surcharges and the rail corridor use fee. The revenue base has upside risk, since volume builds as container throughput increases thereby increasing surcharges and corridor use fees. The ports acquired the right-of-way with cash payment.

The \$394 million in funding from the ports were used to acquire the railroad right-of-way with cash payment. The repayment schedule is tied to volume, and is not considered a priority to debt service. Originally the grants were not expected to be repaid, but further negotiations stipulated that repayment be through yearly excess revenues after the debt is paid off.

All \$347 million administered by LACMTA is from grant funds that stem from federal sources such as STP, ISTEA, and some state involvement. Nearly \$208 million came directly from ISTEA.

The repayment schedule is through a revenue stream from corridor use. Rail cars are charged per container. The money generated from this fee will be used to pay back the bonds that were originally issued to finance the project.

Institutional Arrangements

The Southern California Association of Governments formed the Alameda corridor Task Force in 1985. The group worked on institutional arrangements, funding and project development. In 1989, the San Pedro Ports provided seed funding for design and environmental studies. They also led the creation of an agency to oversee the project. Originally known as the Consolidated Transportation Corridor Joint Powers Authority, this group became the Alameda Corridor Transportation Authority (ACTA). ACTA members include: two representatives from each of the San Pedro Bay Ports, one representative each from the Los Angeles and Long Beach City Councils, and a delegate from the Los Angeles County MTA. Corridor cities were permitted detailed review and approval of changes to each city's facilities.

Chicago Region Environmental and Transportation Efficiency Program (CREATE)

Project Description⁷¹

The Chicago Region Environmental and Transportation Efficiency Program (CREATE) is a package of capital investments in the Chicago area that will increase the efficiency of the region's rail infrastructure and reduce train delays and vehicle congestion throughout the Chicago area. The capital improvements will focus on grade crossing improvements and extensive upgrades of tracks, switches and signaling systems. Select rail lines along the lakefront will be eliminated as rail operations are reconfigured in the region. The vacated land will be redeveloped for public uses. Improvements will require six to 10 years to complete, depending on the availability of funding.

⁷¹ Chicago Create web site. www.createprogram.org/faq.aspx

Capital Cost

\$1.5 billion

Funding Sources

The six railroad partners will provide \$212 million, which is the amount equal to the potential economic benefits estimated for the rail industry. The remaining funds will come from federal, state and local governments over time. The total amount of funding required for this project has not yet been secured.

Financing Mechanisms

None yet identified.

Institutional Arrangements

Mayor Daley of Chicago requested the help of the Surface Transportation Board to convene a task force to address the rail network problem in the Chicago area. The CREATE project grew out of this task force. CREATE is supported by a public-private partnership between the State of Illinois, the City of Chicago, Metra and the six railroads with operations in the area. They are: BNSF Railway, Canadian Pacific Railway, CN, CSX Transportation, Norfolk Southern Corporation and Union Pacific Railroad.

Reno Transportation Rail Access Corridor (ReTRAC)

Project Description

The Reno Transportation Rail Access Corridor (ReTRAC) depressed the railroad tracks that run through downtown Reno between West Second and Sutro Streets. The project involved construction of a below-grade trench with two mainline tracks and replacement of 10 grade crossings with bridges. The Project will increase safety, reduce traffic congestion and air pollution from idling vehicles and speed up rail freight operations. The project was sponsored by the City of Reno, with cooperation from Union Pacific. The project permitted UP to increase train lengths to 8,000 feet and transport double-stacked containers, eventually increasing freight capacity when the rest of the corridor is improved. The City of Reno will own Union Pacific's current right-of-way along the 2.3 mile corridor.

Capital Cost

Total project cost was \$280 million for the 2.25 mile long trench, two mainline tracks, an access road adjacent to the tracks, and replacement of the grade crossings with bridges. The \$280 million total cost combines \$264 million in construction cost with \$18 million in bonding costs.

Funding Sources

Funding sources included: a one-eighth cent countywide sales tax, a one percent hotel tax on downtown properties, lease income on 77 properties transferred from the UP railroad to the City of Reno, revenues from a downtown assessment district. A 1998 settlement negotiated with the

UP railroad was valued at over \$58 million in 1998. The settlement included all property owned by the UP in the City of Reno equal to 77 parcels, generating \$1.1 million per year in lease income, air rights over the trench, the trench right-of-way itself, and \$17 million in track ballast and ties. Overall, the UP provides 12 percent of the funding, the sales and room tax accounts for 71 percent, the assessment district accounts for eight percent and TEA-21 grants passed through the state account for nine percent.

Financing Mechanisms

The project received a \$50.5 million TIFIA direct loan agreement and senior lien bonds (approx \$114 million). These were both secured by the county sales tax and City of Reno Hotel room taxes. Two additional loans included \$17 million to be repaid from tax revenues from a special assessment district and \$5 million to be repaid from lease income from UP properties. Overall, municipal bonds provide 41 percent of the financing, a federal loan provides 26 percent and the balance is pay-as-you go.

Institutional Arrangements

The project was triggered by the merger of the UP and Southern Pacific. With the merger and the Port of Oakland Expansion, it was anticipated that the number of daily trains running through Reno would increase from 12 to 40. Reno filed several lawsuits to stop the merger. Appealed to the STB, the result did not favor the City. The City of Reno negotiated settlement with UP.

Mid-Atlantic Rail Operations Study (MAROps)

Project Description⁷²

The Mid-Atlantic Rail Operations Study (MAROps) is an on-going initiative to improve the region's rail network. The MAROps project is being implemented in stages. The first stage comprised a study to assess the performance of the region's network and identify strategies that would better utilize existing rail assets and formulate a program of investments to improve the network. The study identified 71 projects to reduce or eliminate choke points. The second stage examined various approaches to organizing and financing the rail improvements. Based on this initial work, the Mid-Atlantic states and the railroads agreed to advance a regional rail improvement program. The program builds on the MAROps work, but is extending the analysis to included results of the Northeast Rail Operations Study (NEROps), and will reflect the results of subsequent MAROps work. The next stage of the MAROps study quantified the benefits of the regional strategy formulated in the first phase of the MAROps work.

Capital Cost

The initial order-of-magnitude estimate of the cost for the 71 projects identified in the MAROps study was \$6.2 billion over 20 years. The projects were prioritized into three phases, a near-term program costing \$2.4 billion over five years, a medium-term program costing \$1.9 billion over the subsequent five years and a long-term program costing \$1.9 billion to be implemented between years 10 and 20.

⁷² Mid-Atlantic Rail Operations Study (MAROps) reports available on I-95 Coalition web site.

Funding Sources

A detailed funding plan has not yet been developed. The project, however has determined that a private-public partnership is needed to fund the program. The following options have been identified as the best initial options to pursue:

- Direct funding by railroads, state and local government and Congressional earmarks
- Existing federal rail assistance programs
- CMAQ or other formula funds
- Highway and rail safety programs
- Federal tax credit bond programs
- Toll or user charges
- Sale of freight assets
- State-based approaches such as property tax relief

Financing Mechanisms

Not yet determined.

Institutional Arrangements

The MAROps Study is a cooperative initiative of the I-95 Corridor Coalition, the five Mid-Atlantic states of Delaware, Maryland, New Jersey, Pennsylvania and Virginia, and three railroads comprised of Amtrak, CSX Transportation and Norfolk Southern. The group has committed to addressing the region's rail problems in a system-wide, regional approach recognizing that choke points in one state affect service performance in the other states and that the costs, benefits and risks of network investments are not distributed neatly within state boundaries.

Shellpot Bridge Project

Project Description⁷³

The 115 year old Shellpot Bridge had been taken out of service in 1995 by Conrail. In June 1999, Norfolk Southern took over Conrail's Delaware assets. The State of Delaware wanted to restore the bridge to service to support both freight and intercity passenger rail service. Doing so would improve passenger and freight capacity between Wilmington and Dover, improve access to the Port of Wilmington and improve service for the region's industrial shippers. The bridge has been reopened. Norfolk Southern reports new business due to line opening. There is an upward trend in car counts.

⁷³ AASHTO Freight Bottom Line Report, 2003, p. 107. Also presentation by Michael Kirkpatrick of Delaware DOT entitled, "Shellpot Bridge Agreement: A Case for Public-Private Cooperation." FHWA Talking Freight Seminars, July 20, 2005

Capital Cost

\$13 million.

Funding Sources

\$5 million in grant appropriations from the State of Delaware. The balance of the project cost was funded from a bond issued by the state to be repaid by user charges collected from Norfolk Southern on the bridge over the next 20 years. Charges are on a sliding scale. They start at \$35 per car and fall to a minimum of \$5 with volume.

Financing Mechanisms

See above.

Institutional Arrangements

Public-private partnership between railroad and the state.

11.5 Project Beneficiaries and Related Funding Sources

As detailed in the case studies, several funding sources and financing mechanisms are available for freight/rail transportation projects. Direct support from the railroads and states is common. The most commonly used method of financing was the issuance of general obligation and revenue bonds. Bonds are a desirable financing mechanism, but require a strong, reliable source of financing to secure the debt and receive favorable terms and ratings. Other financing mechanisms included were Federal grants and program funding. Each of these financing mechanisms is case-by-case sensitive, and should be thoroughly examined as a candidate-funding source.

An essential step in building momentum and broad-based support for port improvements is demonstrating how the project can be funded and relating those funding sources to the Project's beneficiaries. A credible, multiparty approach to funding the Project provides several advantages:

- A workable funding plan establishes the project as a realistic and achievable means to address the state's transportation, community and economic development objectives and permits serious and thoughtful engagement by stakeholders such as the railroads.
- The inclusion of multiple contributors:
 - Demonstrates commitment and belief in the Project's merits by multiple parties;
 - Makes the project more robust from a financial perspective;
 - Reduces reliance on federal sources, advancing the Project in programs where funds are competitively awarded.

12 RECOMMENDATIONS FOR FURTHER CONSIDERATION & ACTION

12.1 Decision Matrix of Alternatives

A summary of maritime market investment alternatives is presented in Table 75 at the end of this Chapter. This matrix presents an overview of promising maritime development opportunities identified for North Carolina. Relative benefits, effectiveness and costs associated with each individual market position and associated infrastructure are provided to support the State's decision-making process in advancing economic opportunities and prioritizing the use of public funding.

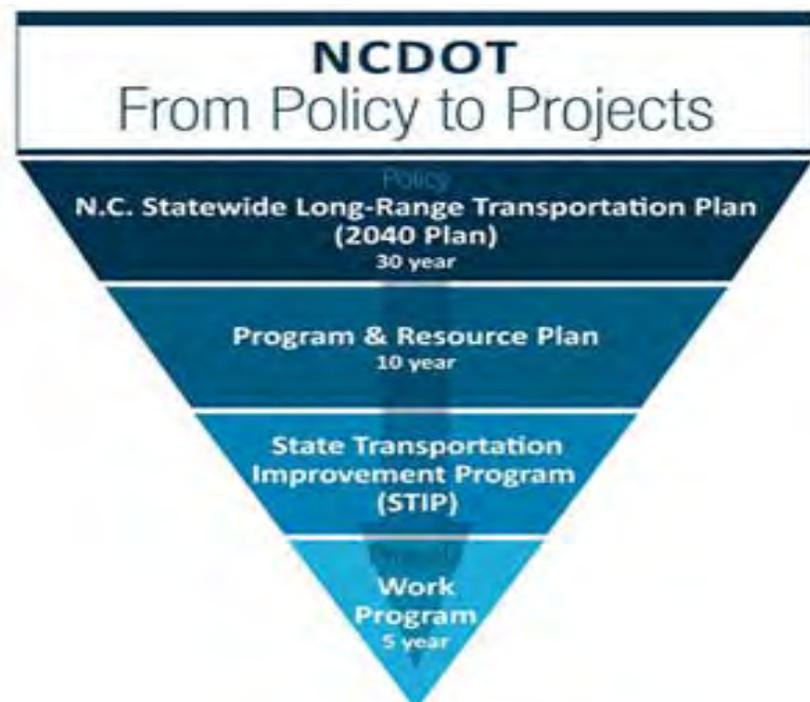
Maritime Strategy alternatives are presented as stand-alone market scenarios that could be individually pursued; however, certain synergistic benefits and shared costs exist across these market opportunities. The advancement of a market strategy that includes containerized goods, for example, could be complemented by investments in refrigerated cargo. Ro/Ro and oversize cargo and bulk grain, which share certain needs for landside access and wharfside infrastructure, could be implemented side-by-side on Radio Island or at the Port of Wilmington North Property. Examples for integration of proposed maritime market scenarios at the Port of Morehead City and at the Port of Wilmington are presented in Section 12.3 below.

12.2 Feasibility Studies and Environmental Analysis

The *North Carolina Maritime Strategy* identifies potential infrastructure projects that help goods move to and from North Carolina markets. Prior to these projects being programmed and subsequently planned, designed, and constructed, several additional steps must occur. These steps are explained in full detail on NCDOT's website and illustrated in Figure 112 (<http://www.ncdot.gov/performance/reform/>).

The first step in the development of a project is its inclusion in a statewide long-range transportation plan. NCDOT has published the *Draft 2040 Plan* that provides a 30-year vision for transportation planning and investment. The *Draft 2040 Plan*, dated March 2012, has

Figure 112: NCDOT From Policy to Projects



Source: <http://www.ncdot.gov/performance/reform/>

been published for comments and notes that NCDOT will continue to consider information provided by the *Maritime Strategy* in setting goals, objectives, and priorities for maritime trade-related investments. To date, the 2040 Plan has not included performance measures for specific port / terminal investments in its annual system performance assessment. Thus, the two seaports and two inland ports have not been graded as part of the project prioritization process that was completed as part of the plan. It should be noted, however, that many of the highway projects recommended in the *Maritime Strategy* have been and will again be assessed through this prioritization process. NCDOT has always funded highway infrastructure projects that have had benefits to ports by enhancing landside access; but, with the transition of the North Carolina State Ports Authority (NCSPA) from the North Carolina Department of Commerce to the North Carolina Department of Transportation, specific port projects will be graded in the next NCDOT Project Prioritization Process, which is anticipated to begin in 2013.

Once a project is included in the statewide long-range transportation plan, it must rank high enough in the prioritization process as compared to other statewide transportation needs to be included in the fiscally-constrained State Transportation Improvement Program (STIP). It is anticipated that criteria specific to infrastructure that supports maritime trade will be established by NCDOT for use in this prioritization process. Prior to and during this phase of the process is when more project-specific feasibility studies are prepared to more fully identify project scopes, describe initial environmental impacts based on existing, known information, and provide program level cost estimates.

Specific project alignments, limits, and configurations cannot be finalized until an environmental document is prepared in accordance with the National Environmental Policy Act (NEPA). After a project is included in the STIP, the NEPA process is initiated to fully define the project's purpose and need, reasonable alternatives, direct, indirect, and cumulative impacts to the natural and human environments, and identify a preferred alternative. Specialized environmental studies are conducted during this process and input is solicited from environmental review and regulatory agencies, the public, and other stakeholder to help identify potential concerns. Only after the NEPA process is completed can a project advance to right-of-way acquisition and final design.

12.3 Combination or Aggregation of Market-Focused Maritime Investments

The aggregation of multiple maritime market scenarios at the Port of Morehead City and at the Port of Wilmington is presented here as illustrative land use master plans for each port site. Site layouts were developed at each location to make optimal use of available land and, to the extent possible, to accommodate all current and proposed market commodities. Two alternative options were developed for the Port of Morehead City, while a single alternative is presented for the Port of Wilmington.

By bringing these multiple uses together, certain project costs and associated investment impacts related to construction and operations of the aggregated market scenarios have shared elements. As a result, economic impacts are not additive; any "duplicates" were removed prior to assessing the construction and long-term operating impact associated with the aggregated master plans. Similarly, the benefit cost ratios are not a simple addition of the individual components.

As with the baseline market scenarios that underpin each master plan, both a freight-focused and comprehensive benefit-cost ratio were estimated in recognition that many of the improvements suggested as part of the *Maritime Strategy* would benefit non-freight travelers as well.

Each of the illustrative port plans, along with associated landside and waterside infrastructure to support its effective operation, represents a large capital investment that will support the construction trades for the duration of the building activity. Construction employment estimates are presented in job years—that is a job for one person for one year. The estimates include the direct jobs and earnings associated with the building activity, as well as the indirect and induced impacts associated with workers' spending and purchases made for the project.

Operating impacts of potential integrated port developments include ongoing jobs that last for the duration of the facility's operation. They include those who work directly on the port properties, those who work to maintain the landside improvements such as highway maintenance, and the indirect and induced employment supported by those activities. The volume of employment rises over time as additional investment is made and needs to be maintained. The employment figures represent an average level of employment over the analysis period.

12.3.1 Morehead City Option 1

This option proposes to develop Radio Island to meet forecasted 2040 needs for the Ro/Ro and oversize cargo, grain, and wood pellets cargo and also to support organic growth of many of the port's existing commodities. Since the rail enters the island at the northern end, that space is well suited for a rail loop to service both the grain and wood pellet operation and storage buildings. Existing chemical facilities on Radio Island, including the fertilizer and sulfur terminals, have enough land immediately adjacent for their anticipated growth through the forecast year. A steel pellet operation, which has been proposed by a potential port user, can be accommodated within land adjacent to the fertilizer operation. The remaining area between the wood pellets and the Ro/Ro locations is more than adequate to accommodate other existing commodities currently handled at the Morehead City general cargo terminal, including breakbulk lumber, ore/mica/ schist, and natural rubber.

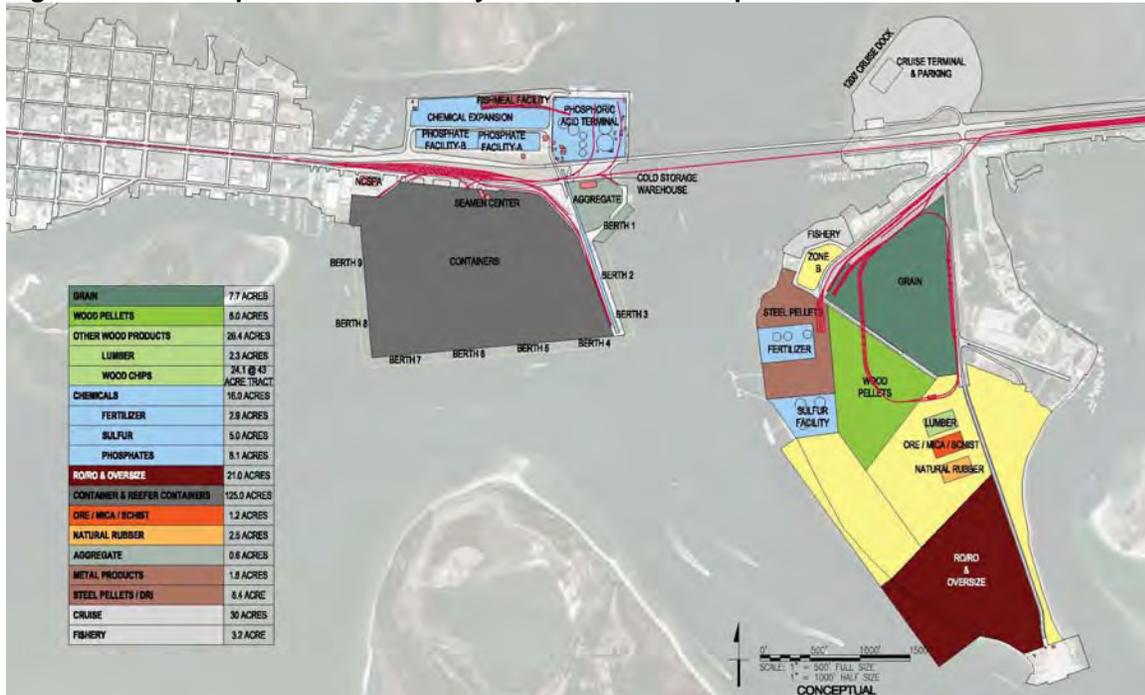
Wood chip processing that is currently handled on the general cargo terminal is proposed to be relocated to the 43-acre Edgewater Tract. This would move the chipping operation away from adjacent tourism uses and would provide sufficient land area to accommodate the projected growth of the wood chip market.

Relocation of existing bulk and breakbulk operations from the general cargo terminal will free up this area for use as a container terminal. The available space, however, limits the container throughput to about two-thirds of the anticipated North Carolina-generated container demand in year 2040, thereby constraining the potential economic benefits that could be realized for this market. The portion of the main terminal that is north of US 70 remains dedicated to chemical use and has the land capacity to accommodate the predicted growth in phosphate volumes. The aggregate can remain in its current location, with a portion of the current area designated for aggregate storage dedicated to use for a cold storage warehouse.

In consideration of local stakeholder input, the conceptual master plan for the Port of Morehead City includes a passenger/cruise terminal on the land north of US 70 at Radio Island. The area

is adequate to develop a cruise terminal with a 1200-foot berth for cruise vessels, a 120,000 square foot terminal building and the associated parking for cruise passengers. A portion of the Radio Island site near US 70 could also be set aside for a three-acre fish market co-operative.

Figure 113: Conceptual Morehead City Port Master Plan Option 1



Source: AECOM

Figure 114: Proposed Use of 43-Acre Edgewater Tract



Source: AECOM

Under this proposed layout, the Port of Morehead City conceptual master plan accommodates most but not all of the activities proposed and evaluated as individual market scenarios. Economic impacts of container terminal are constrained because full 2040 demand is not met. The plan does, however, support projected growth of the port's existing commodities and would realize a positive return to the State.

Table 63: Benefit/Cost Analysis of Morehead City Port Master Plan Option 1, 2017-2046

Benefits (millions, 2011 \$)	7%	3%
Shipper Savings	\$ 519	\$ 1,167
Logistics Benefits	\$ 35	\$ 79
Accident Savings	\$ 10	\$ 24
Travel Time Savings (net of shipper savings)	\$ 3,234	\$ 7,806
Highway Maintenance Avoided	\$ 247	\$ 477
Emissions	\$ 146	\$ 333
Grade Crossing Benefits	\$ 11	\$ 27
Residual Value of Infrastructure	\$ 126	\$ 459
Total Benefits	\$ 4,328	\$ 10,371
Costs (millions, 2011 \$)	7%	3%
Operating Costs	\$ 46	\$ 107
Capital Costs	\$ 2,174	\$ 3,490
Total Costs	\$ 2,220	\$ 3,597
Direct Freight Costs	\$ 576	\$ 576
Freight Benefits/Freight Costs BCR	1.65	3.57
Total Benefits/Total Costs BCR	1.95	2.88

Source: AECOM

Table 64: Employment, Earnings and Fiscal Impacts Associated with Construction of Morehead City Port Master Plan Option 1 and Related Maritime Infrastructure

Employment Impacts (job years)		Earnings Impacts (millions, 2011\$)		Fiscal Impacts (millions, 2011\$)	
Construction	58,982	Construction	2,035	Personal Income Tax	88.19
Professional Services	20,034	Professional Services	841	Sales Tax	58.77
Total Jobs	79,016	Total Earnings	2,876	Total Tax Collected	146.96

Source: AECOM

Table 65: Employment, Earnings, and Fiscal Impacts Associated with Operation of Morehead City Port Master Plan Option 1

Employment Impacts		Fiscal Impacts (millions, 2011\$)	
Permanent Jobs (average, 2017 to 2046)	2,476	Personal Income Tax	63.23
Earnings (millions, 2011 \$)	2,062	Sales Tax	42.14
		Total Tax Collected	105.37

Source: AECOM

The Morehead City Port concept provides for additional non-cargo functions for consideration by the State of North Carolina, including a potential passenger cruise terminal and a cooperative fish dock and warehouse for use by local fisherman. Capitalizing on both the co-op fish market and the cruise terminal berth opportunities will require investments beyond the physical infrastructure evaluated in the *Maritime Strategy* to realize success. The potential benefits and economic impacts of these opportunities, therefore, are not included in the calculations above. Nevertheless, these uses have the potential to generate tangible economic benefits for the local community. Further examination of the economic viability of these alternatives would be required.

The cruise opportunity supports the existing tourism base of both port communities and offers growth opportunities over the long-term. Success as a port of call will require both industry partnerships with cruise operators and vendor attractions, as well as a proactive marketing campaign as North Carolina is not known as a cruise destination currently. Ecotourism opportunities, restaurants, historical and cultural tour attractions are scalable with the growth of tour traffic and provide small business opportunities for the communities that host the ports.

The cruise industry bridges the traditional maritime economy and the tourist economies of the ports' host communities--Morehead City and Wilmington. Support for building an industry in North Carolina was voiced as several public meetings. Tourism-related businesses such as tour operators, restaurants, and providers of ground transportation would all benefit from cruise industry spending, along with providers of business services such as insurance and food processors. The Southeast region (of which North Carolina is a part) is the single largest source of US cruise passengers. Both Wilmington and Morehead City are small communities but that does not preclude the potential of a niche cruise industry. New Hanover County (Wilmington) had a population of 202,667 in 2010. By comparison, Carteret County (Morehead City) had 66,469 residents in the same year. Moreover, both communities have active tourist markets.

As an example, Newport RI is a peer in terms of size and tourist focus. The population of Newport County RI was 82,888 in 2010. In 2010, 71 cruises visited Newport demonstrating the feasibility of a small market to host cruise passengers. The ship that visits Newport has a capacity of 96 passengers, or about 6,800 cruisers per year. Of those, a recent study found that about 30 percent took package tours, 60 percent strolled around the town, and 10 percent stayed on the ship. Thus, the potential market for Morehead City would be about 6,100 visitors per year based on Newport's experience. Morehead City's market may be greater due to its milder climate. Of note for the cruise element of the master plan, the ability to dock at the port would eliminate any need for tendering (and its costs to the cruise ships) and would improve access to the port communities. Assuming that the cruises came in the spring or fall, outside of

the hottest months, the cruise activity could strengthen the “non-peak” or shoulder season between peak beach time and peak winter getaway seasons⁷⁴.

The co-op fish market supports a historic industry for the community more than it creates growth opportunities. The presence of the market provides fishermen with direct market access to the local consumer market. Fish markets have taken a variety of business models in other locations; some are traditional retail opportunities, others take “subscriptions” from consumers and provide fresh catch over a season in return for an upfront payment. The later model is particularly attractive as it provides fishermen with a predictable revenue over the season and improves their ability to make improvements and repairs to their boats and equipment. Nearly all such venues market or even brand the catch as “locally caught,” thereby raising consumer awareness of the option and capitalizing on the growing locavore movement.

Seafood dealers in North Carolina represent an industry with an economic impact of about \$255 million annually, according to a recent study⁷⁵ conducted by the North Carolina Division of Marine Fisheries. The study found that the majority of seafood dealers in the state are small single or family owned businesses. By law, wild caught seafood landed in North Carolina must initially be sold through a licensed seafood dealer. Shrimp, flounder, blue crab, oysters, groupers and tuna are the leading species sold—about 72 percent of the catch is sold in North Carolina to a mix of restaurants, dealers, and households. Of particular note for the fish co-op element of the conceptual master plans, the report concluded that North Carolina’s seafood dealers are facing “significant headwinds” in maintaining their business operations. Challenges are coming from regulatory burdens, difficulties in obtaining an adequate supply of seafood, and competition from imported fish and shellfish. The report recommends increased marketing and emphasizing the values of locally caught seafood to support this part of the state’s economy—entirely consistent with the fish co-op concept. The initiative supports not only the dealers, but the commercial fishermen as well—bolstering the small business sector in the ports’ host communities.

12.3.2 Morehead City Option 2

The second option at Morehead City utilizes most of Radio Island for a container terminal with the capacity to fit the entire required 1.3 million TEUs including refrigerated cargo. Existing chemical facilities on Radio Island, including the fertilizer and sulfur terminals, have enough land immediately adjacent for their anticipated growth through the forecast year. A steel pellet operation, which has been proposed by a potential port user, can be accommodated within land adjacent to the fertilizer operation.

As in the first Morehead City option, wood chip processing is proposed to be relocated to the 43-acre Edgewater Tract, thereby freeing up space to accommodate Ro/Ro and oversize cargo, wood pellets, grain, as well as other existing bulk and breakbulk commodities on the general cargo terminal. The portion of the main terminal that is north of US 70 remains dedicated to chemical use and has the land capacity to accommodate the predicted growth in phosphate

⁷⁴ Source: Rhode Island’s Ports: Opportunities for Growth, Executive Summary, prepared by Martin Associates for the Rhode Island Bays, Rivers, and Watersheds Coordination Team, April 2011.

⁷⁵ John Hadley and Scott Crosson, “A Business and Economic Profile of Seafood Dealers in North Carolina,” Prepared for the North Carolina Division of Marine Fisheries (December 2010)

volumes. There is adequate room on the general cargo terminal south of US 70 for Ro/Ro and oversized operation adjacent to the existing Ro/Ro ramp used for military cargo; the terminal would be improved to include heavy lift cranes to accommodate other Ro/Ro and Lo/Lo needs. Wood pellets and grain are located within a rail loop to support both operations. The remaining area within the main terminal is adequate to locate the lumber, natural rubber, ore/mica/schist and metal products.

A potential passenger terminal and fish co-operative are also provided at Radio Island as in Morehead City Option 1.

Figure 115: Conceptual Morehead City Port Master Plan Option 2



Source: AECOM

The key difference between the operating impacts of this as compared to Option 1 is the capacity of the container terminal. This alternative master plan for the Port of Morehead City accommodates all proposed market scenarios and activities and also supports projected growth of the port's existing commodities to realize a positive return to the State.

Table 66: Benefit/Cost Analysis of Morehead City Port Master Plan Option 2, 2017-2046

Benefits (millions, 2011 \$)	7%	3%
Shipper Savings	\$ 703	\$ 1,603
Logistics Benefits	\$ 48	\$ 109
Accident Savings	\$ 10	\$ 24
Travel Time Savings (net of shipper savings)	\$ 3,050	\$ 7,369
Highway Maintenance Avoided	\$ 247	\$ 477
Emissions	\$ 146	\$ 333
Grade Crossing Benefits	\$ 11	\$ 27
Residual Value of Infrastructure	\$ 126	\$ 459
Total Benefits	\$ 4,341	\$ 10,400
Costs (millions, 2011 \$)	7%	3%
Operating Costs	\$ 46	\$ 107
Capital Costs	\$ 2,343	\$ 3,679
Total Costs	\$ 2,389	\$ 3,786
Direct Freight Costs	\$ 745	\$ 745
Freight Benefits/Freight Costs BCR	1.54	3.02
Total Benefits/Total Costs BCR	1.82	2.75

Source: AECOM

Table 67: Employment, Earnings and Fiscal Impacts Associated with Construction of Morehead City Port Master Plan Option 2 and Related Maritime Infrastructure

Employment Impacts (job years)		Earnings Impacts (millions, 2011\$)		Fiscal Impacts (millions, 2011\$)	
Construction	61,132	Construction	2,109	Personal Income Tax	91.40
Professional Services	20,795	Professional Services	871	Sales Tax	60.91
Total Jobs	81,897	Total Earnings	2,980	Total Tax Collected	152.32

Source: AECOM

Table 68: Employment, Earnings, and Fiscal Impacts Associated with Operation of Morehead City Port Master Plan Option 2

Employment Impacts		Fiscal Impacts (millions, 2011\$)	
Permanent Jobs (average, 2017 to 2046)	3,379	Personal Income Tax	86.64
Earnings (millions, 2011 \$)	2,825	Sales Tax	57.74
		Total Tax Collected	144.38

Source: AECOM

12.3.3 Wilmington

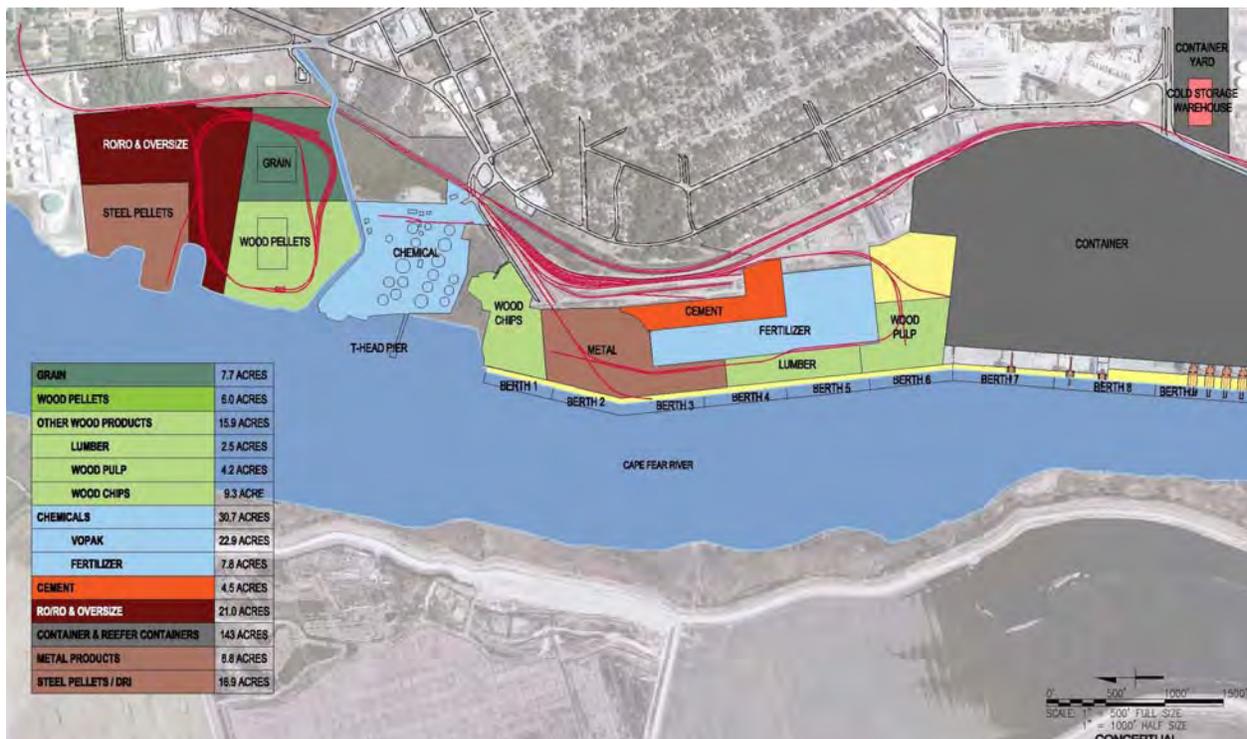
The Port of Wilmington, including the North Property, has adequate land area to accommodate all market scenarios evaluated by the *Maritime Strategy* and to support organic growth of existing commodities. In the conceptual land use plan for Wilmington, the North Property is proposed to be developed to support Ro/Ro and oversize cargo as well as grain and wood pellet operations. A rail loop supports unloading of bulk grain and wood pellets; rail spurs a provided for oversized loads.

Expansion of the existing Wilmington container terminal is proposed to accommodate anticipated 1.3 million TEU demand including reefer needs. A cold storage warehouse is provided within the existing Container Yard B parcel currently used for chassis storage.

The remainder of the Port of Wilmington general cargo terminal can support the port's other cargos. The land adjacent to Berth 1 would be used for the wood chipping process and metal in the area directly south, adjacent to Berths 2 and 3. Cement, fertilizer, lumber and wood pulp is located adjacent to Berths 4 through 6.

The land currently occupied by Vopak is adequate to accommodate their predicted growth through 2040.

Figure 116: Conceptual Wilmington Port Master Plan



Source: AECOM

The Port of Wilmington conceptual master plan accommodates all of the activities proposed and evaluated as individual market scenarios -- and can also support projected growth of the port's existing commodities. The Port of Wilmington master plan yields a positive return using both metrics.

Table 69: Benefit/Cost Analysis of Wilmington Port Master Plan, 2017-2046

Benefits (\$ millions)	7%	3%
Shipper Savings (a)	\$ 887	\$ 2,025
Logistics Benefits	\$ 60	\$ 138
Accident Savings	\$ 8	\$ 18
Travel Time Savings (net of shipper savings)	\$ 1,735	\$ 4,243
Highway Maintenance Avoided	\$ 135	\$ 262
Emissions	\$ 80	\$ 183
Grade Crossing Benefits	\$ 0	\$ 0
Residual Value of Infrastructure	\$ 94	\$ 342
Total Benefits	\$ 2,999	\$ 7,210
Costs (\$ millions)	7%	3%
Operating Costs	\$ 41	\$ 96
Capital Costs	\$ 2,136	\$ 3,179
Total Costs	\$ 2,177	\$ 3,274
Direct Freight Costs	\$ 1,014	\$ 1,183
Freight Benefits/Freight Costs BCR	1.15	2.22
Total Benefits/Total Costs BCR	1.38	2.20

Source: AECOM

Table 70: Employment, Earnings and Fiscal Impacts Associated with Construction of Wilmington Port Master Plan and Related Maritime Infrastructure

Employment Impacts (job years)		Earnings Impacts (millions, 2011\$)		Fiscal Impacts (millions, 2011\$)	
Construction	50,516	Construction	1,743	Personal Income Tax	75.53
Professional Services	17,159	Professional Services	720	Sales Tax	50.34
Total Jobs	67,675	Total Earnings	2,463	Total Tax Collected	125.87

Source: AECOM

Table 71: Employment, Earnings, and Fiscal Impacts Associated with Operation of Wilmington Port Master Plan

Employment Impacts		Fiscal Impacts (millions, 2011\$)	
Permanent Jobs (average, 2017 to 2046)	3,367	Personal Income Tax	86.43
Earnings (millions, 2011 \$)	2,818	Sales Tax	57.60
		Total Tax Collected	144.03

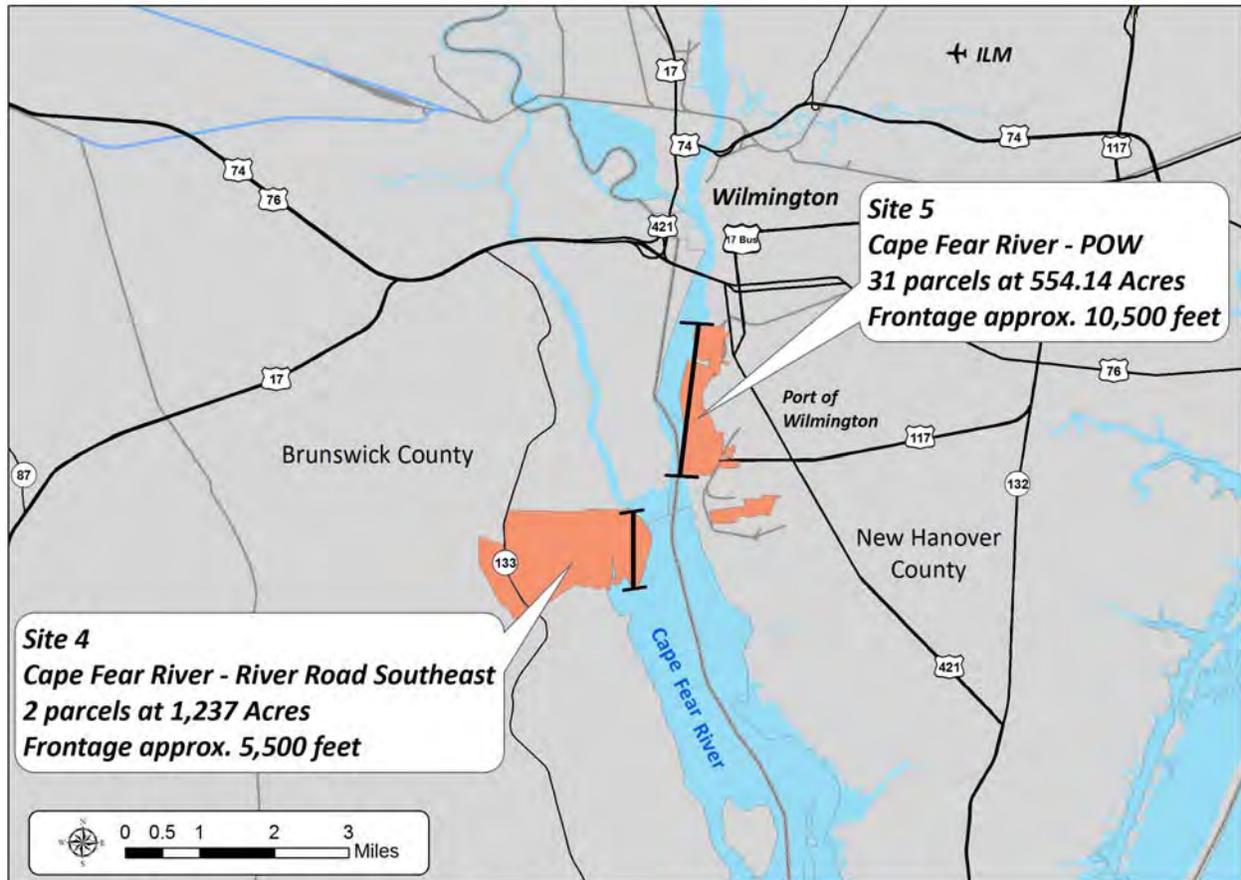
Source: AECOM

12.4 Focused Consideration of Greenfield Container Port Sites

In consideration of the unique infrastructure needs of a container terminal -- including greater water depth, double berth, a large backland area for container storage and on-dock rail, high-frequency intermodal rail service, and efficient truck access – the *Maritime Strategy* included a broad screening of potential port sites along the full length of the North Carolina Coast. This screening and subsequent analysis identified four potential container port locations that could meet North Carolina’s anticipated demand for import and export containers in 2040: on Radio Island in Morehead City; at the Port of Wilmington; and either River Road or Southport, two potential greenfield sites on the Cape Fear River in Brunswick County. Based upon a comparative analysis of the likely cost effectiveness of various container port alternatives (refer to Section 7.5.8), the Port of Wilmington expansion had been selected for detailed benefit-cost analysis. The Port of Wilmington container alternative, comprising an expanded 143-acre container terminal with two premium berths and RTG operations, channel deepening to 51 feet, along with associated landside road and rail improvements, is the basis for the information presented in Table 75: NC Maritime Market Evaluation Matrix.

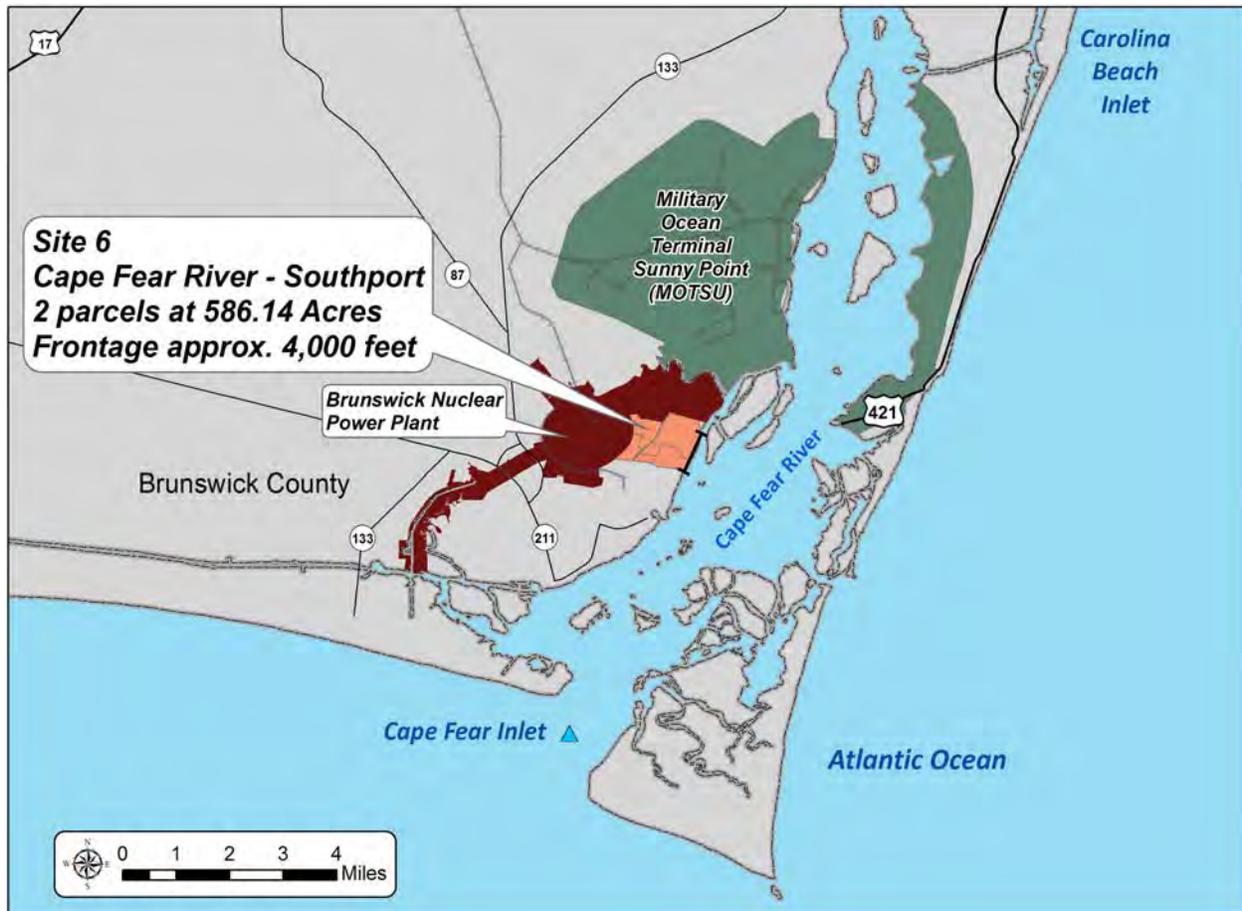
In response to stakeholder input and given the range of container options considered, a supplemental analysis of the relative benefits and costs of container developments at River Road or at Southport is warranted to provide the State with sufficient information to support the selection or rejection of either of these alternatives.

Figure 117: Deepwater Container Port Sites 4 and 5 (duplicate of Figure 67)



Source: AECOM/URS from ESRI, NCDOT, FAF v3.1, USGS ThematicMapping world borders dataset

Figure 118: Potential Deepwater Container Port Site 6 – Southport (duplicate of Figure 68)



Source: AECOM/URS from ESRI, NCDOT, FAF v3.1, USGS ThematicMapping world borders dataset

In terms of overall size to allow for future expansion or to provide land for supportive industrial uses, both the River Road and Southport sites offer great potential as container developments. At less than ten miles from open ocean, Southport offers water access that is second only to Radio Island. Nearly 600 acres of land and channel frontage sufficient for three container berths provides room for expansion at the Southport site that could not be achieved at the other possible container port locations.

While nearly as far up the channel as Wilmington, the River Road site does not require road or rail crossing of the Cape Fear River. From a landside perspective, River Road beats all other container port locations for road and rail access to North Carolina's inland intermodal yards and population centers. This would provide significant benefit to shippers in terms of reduced transport costs. Based on truck travel time and cost, River Road is the preferred port (as compared to out-of-state ports) for 26 of the 29 inland locations evaluated.

The freight benefits of the large greenfield sites, however, come at a significant capital cost. Up-front investments in channel dredging, wharf and terminal construction, and new “last mile” road and rail connections (exclusive of highway network) to Southport and River Road total \$1.70 billion and \$2.24 billion, respectively. Additional improvements to the highway network total \$3.2 billion for Southport and \$3.8 billion for River Road (refer to Table 40 on page 160).

A reflection of the large and front-loaded costs, neither the River Road nor the Southport market scenarios are strong performers in terms of the freight and comprehensive benefit cost metrics. They perform better when considering total BCR over freight BCR due to mobility benefits generated to non-freight highway users. The volume of containers and related economic impacts projected to support the North Carolina-based container market is not large enough to recover the freight investment required to realize this market. Pairing of these investments with complementary uses within adjacent land, or further diversion of containers to one of these greenfield ports from volumes originating or destined from surrounding states, could improve the economic performance of these sites.

Table 72: Benefit/Cost Analysis of River Road and Southport Container Port Alternatives

2017-2046	River Road		Southport	
Benefits (\$ millions)	7%	3%	7%	3%
Shipper Savings	\$ 511	\$ 1,334	\$ 501	\$ 1,307
Logistics Benefits	\$ 35	\$ 91	\$ 34	\$ 89
Accident Savings	-	-	-	-
Travel Time Savings (net of shipper savings)	\$ 1,247	\$ 2,869	\$ 1,406	\$ 3,251
Highway Maintenance Avoided	\$ 112	\$ 217	\$ 133	\$ 258
Emissions	\$ 66	\$ 151	\$ 79	\$ 180
Grade Crossing Benefits	-	-	-	-
Residual Value of Infrastructure	\$ 74	\$ 271	\$ 256	\$ 489
Total Benefits	\$ 2,046	\$ 4,933	\$ 2,409	\$ 5,573
Costs (\$ millions)	7%	3%	7%	3%
Operating Costs	\$ 30	\$ 70	\$ 34	\$ 79
Capital Costs	\$ 2,757	\$ 3,712	\$ 2,414	\$ 3,384
Total Costs	\$ 2,787	\$ 3,782	\$ 2,448	\$ 3,463
Direct Freight Costs	\$ 1,833	\$ 2,067	\$ 1,407	\$ 1,591
Freight Benefits/Freight Costs BCR	0.40	0.87	0.53	1.16
Total Benefits/Total Costs BCR	0.73	1.30	0.98	1.61

Source: AECOM

Construction and operating impacts are provided below, consistent with the presentation of other market scenarios.

Table 73: Employment, Earnings and Fiscal Impacts Associated with Construction of River Road and Southport Container Ports

Site	Employment Impacts (job years)			Earnings Impacts (millions, 2011\$)			Fiscal Impacts (millions, 2011\$)		
	Total Jobs	Construction	Prof. Services	Total Earnings	Construction	Prof. Services	Total Tax	Personal Income	Sales Tax
River Road	68,176	50,890	17,286	2,481	1,756	725	126.80	76.09	50.71
Southport	71,794	53,591	18,203	2,613	1,849	764	133.53	80.13	53.4

Source: AECOM

Table 74: Employment, Earnings, and Fiscal Impacts Associated with Operation of Southport and River Road Container Ports

Site	Employment Impacts		Fiscal Impacts (millions, 2011\$)		
	Permanent Jobs (average, 2017 to 2046)	Earnings (millions, 2011 \$)	Total Tax	Personal Income	Sales Tax
River Road	2,788	\$ 2,285	117.03	70.23	46.80
Southport	2,724	\$ 2,290	116.76	70.07	46.70

Source: AECOM

12.5 Supporting Policies and Strategies

Beyond capital investments in maritime-supporting infrastructure, realization of maritime market opportunities also depends upon the implementation of supportive policies and institutional strategies.

12.5.1 Comprehensive Maritime Vision and Marketing Plan

An organization's marketing strategy is, first, defined by its mission—a statement of what the organization is and does. A clear and unified mission and vision is paramount to advancing North Carolina's maritime industry. Other regional ports are perceived to have realized a closer alignment between overall state vision and the goals of host communities, yielding successful partnerships that benefited both the host communities and the ports. A joint economic development and marketing plan, such as has been developed by the South Carolina Ports Authority in collaboration with the City of Charleston, would demonstrate broad-based support for a single mission.

Through a collaborative marketing and economic effort, the State, GTP, the Port, and the port community can advance a single mission—leveraging resources and providing a unified message to potential relocating firms that need reliable port access, to ocean carriers whose competitive service must be supported by complementary port and landside infrastructure, and to landside transportation providers who seek cargo volumes that can justify their own capital and operating investments.

Greater collaboration among the State's various marketing and operating functions could also raise the port's profile in the market. A few illustrative examples are provided below.

North Carolina offices beyond the port. Focus on NCSPA's customers, identifying future customers, and achieving economic development for the State requires direct customer contact. Maintenance of a local office at major shipper and customer locations demonstrates commitment to the local market and offers an important channel to both learn of upcoming opportunities in a more timely way than can be achieved through periodic trade visits by North Carolina based staff.

Targeting new exporters. A suggestion provided in one of the stakeholder workshops was that it might be useful for the port to coordinate with smaller firms or firms with similar transportation needs to achieve greater volumes at the port. The participant's logic in making the suggestion was that 1) smaller firms lack the expertise to effectively export and the port staff (or a dedicated small business coordinator) could help bridge this gap and 2) shippers with similar logistics requirements tend to be competitors, making it difficult for them to collaborate directly. By collaborating through a third party at the port (or another state agency), they each can benefit in delivering their products to the broader market efficiently without introducing competitive conflicts.

Updated operating hours. The NCSPA ports have the smallest window for operations among its regional competitors. While this may yield a savings in operating costs, it is affecting shippers' use of the ports, particularly those that ship to the port by truck. In particular, it affects the number of truck turns that can be achieved in a given day—a key metric of truck profitability. Stakeholders reported instances of drivers driving to the local port communities the night before in order to be ready when the gate opens the following morning—a practice that can create conflict with the local communities. Addressing this issue through a different operating schedule or through designated off-site truck parking could demonstrate commitment to being a good neighbor to the surrounding communities and improve goodwill.

12.5.2 Continued Stakeholder Input

Involvement of the maritime industry and community stakeholders was an important element of the *Maritime Strategy* development. Maritime stakeholders provided valuable input – by participating on the Maritime Advisory Council, through industry workshops, and as part of focused stakeholder meetings -- that supported the identification and evaluation of a variety of maritime market alternatives. Members of the Advisory Council, who included industry representatives from ocean shipping, trucking, railroads, manufacturers, academia, and community interests, have expressed a willingness and desire to provide continued input to the strategic direction of North Carolina's ports and maritime-supporting transportation and facilities. Additionally, port staff and local residents agreed that greater interaction and understanding of port operations would establish a stronger, more supportive relationship between NC Ports and the surrounding port communities.

A repeated theme in several of the stakeholder workshops was that the local communities around the ports were not supportive of the port authority's operation. The perception⁷⁶ was that

⁷⁶ NC Maritime Strategy industry workshop with shippers – held August 10, 2011

other ports in the region were much more closely aligned with overall state vision and goals of host communities, yielding successful partnerships that benefited both the host communities and the ports. There were two main consequences from this perception.

In the words of one shipper “you don’t want to be against the consumer.” Particularly for retailers and those serving the domestic market directly, if given an option, they would choose to operate in locations where the customer base welcomed their logistics operations because market perception is so important for a retailer. Stakeholders described public campaigns in other communities that demonstrated support for the ports—an example cited were bumper stickers with the slogan Ports = Jobs. Similarly, when the City of Charleston developed an economic development and marketing plan, it was a combined effort with the port and demonstrated state-level support. The port, the city and state all market together—leveraging resources and providing a unified message to potential relocating firms or port customers.

Second, the perceived conflict between the North Carolina communities and the resident ports combined with the perceived harmony between local communities and competitor ports in the region adds uncertainty to the future outlook for the North Carolina ports. Shippers and carriers value stability and predictability highly. While the perceived conflict does not affect day-to-day operations (shippers and carriers both reported that port operation were high quality and staff were flexible and easy to work with), it does affect the market’s assessment of potential realization of future plans announced by the port. Because of the greater uncertainty concerning developments at NCSPA, the market is likely to discount these more than at other ports in the region. The outside perception of NCSPA activities is that there is fragmentation and that the port, the local communities, and the state do not share the same vision.

Continued efforts to engage both the maritime industry and the port community are important components of the State’s future success in advancing one or more proposed maritime market opportunities. This could be achieved through an ongoing role of the Maritime Advisory Council, by a more focused role of the NCSPA Ports Advisory Council, and leadership efforts of NCDOT’s newly established Statewide Logistics Office, which has been tasked to facilitate a more strategic approach to the State’s transportation assets.

12.5.3 Integration of Maritime Freight Needs into Statewide Transportation Planning

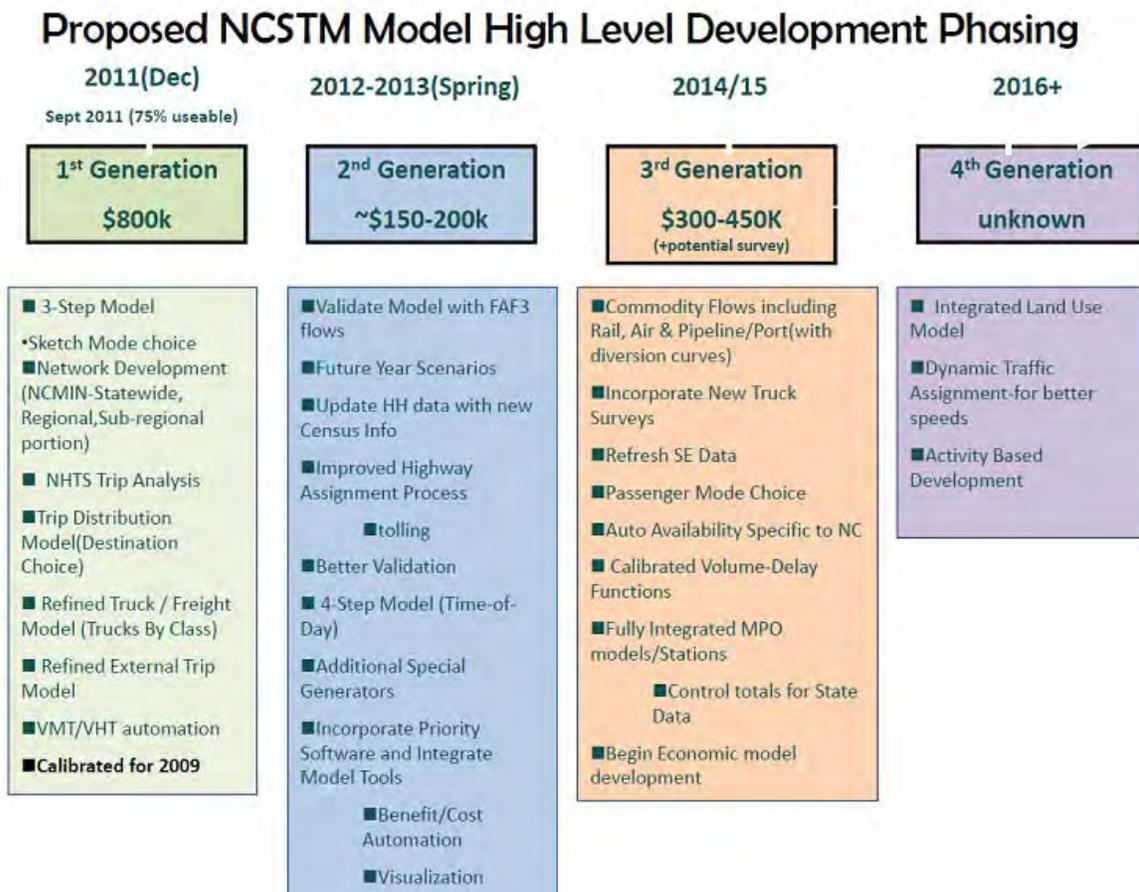
In January 2009, Governor Perdue issued Executive Order No. 2, Transportation Reform at NCDOT, which called for the prioritization and award of transportation projects based on a transparent and data-driven process. The Strategic Planning Office of Transportation (SPOT) developed a set of objective criteria for project prioritization that is based on a combination of quantitative data, qualitative input, and multimodal characteristics. Quantitative data includes volume-to-capacity ratios, crash rates, and pavement condition ratings. Qualitative input is based on the top 25 priorities of each respective MPO, RPO, and NCDOT Division. The multimodal score identifies those projects that would benefit more than one mode of transportation. The adopted prioritization approach has been effective in achieving the strategic goals of the Order; however, the current prioritization approach does not capture the potential economic benefits of maritime investments beyond the traditional measures of congestion and safety. While clearly very important, these measures tend to favor improvements that enhance passenger mobility over those that provide freight mobility within the state.

In support of long-range transportation planning efforts, NCDOT is also developing a state of the art State Travel Demand Model (TDM) to simulate and project future traffic patterns. The TDM

will facilitate long range transportation planning and allow for the analysis of large projects, such as major bypasses and new loop facilities that extend beyond the limits of existing regional models. This effort is being advanced in phases, with the first generation model scheduled to be complete in Spring 2012. In order to incorporate freight (truck) movements in the model, NCDOT has created a truck count database and is working to identify major warehousing locations as well as sample origin/destination data from NC trucking companies. As part of the second generation model development, NCDOT plans to expand the TDM to incorporate benefit/cost analysis. Freight components would incorporate FHWA Freight Analysis Framework (FAF) flows, validated for North Carolina. Third and fourth generation model updates would incorporate commodity flows and land use plans to facilitate statewide infrastructure prioritization.

A State Travel Demand Model that incorporates truck patterns and commodity movements through validated integration of the FHWA FAF model, will serve as an important tool to evaluate and prioritize freight-focused investments. Shipper input received as part of the NC Maritime Strategy reveals that land-side (truck and rail) transport costs can represent 50 percent or more of the total delivered cost of goods imported or exported overseas. Targeted investments in the State's road and rail infrastructure, therefore, can reduce shipping costs and enhance the competitiveness of North Carolina businesses.

Figure 119: NCDOT State Travel Demand Model Development Schedule



12.5.4 Wind Power Initiative

Gov. Perdue issued Executive Order 23 in September 2009 creating the Scientific Advisory Panel on Offshore Energy. The final report was released to the public in January 2012. The Panel concluded that North Carolina has the largest offshore wind resource on the east coast that may “offer significant opportunities for renewable energy generation and for economic development and job creation.” The report recommended that North Carolina 1) continue to move ahead to promote opportunities for offshore-wind development with the appropriate statutes, rules and regulations; 2) seek appropriate offshore-wind development consistent with concerns for the coastal environment and communities; and 3) work to attract a wide range of supply-chain facilities and jobs associated with the emerging wind-energy industry to the state. In addition, the state has a goal of supplying 12.5 percent of its retail electricity through renewable sources by 2020. Ensuring that North Carolina’s ports are able to accommodate both the service and maintenance of an offshore wind farm is critical to realizing the state’s renewable power goals. Moreover, as the state engages with wind power manufacturers, the ability to demonstrate efficient movement of outputs and finished products to domestic and foreign locations will be an important pre-requisite to attracting this industry to the state.

As part of the *Maritime Strategy*, the employment impact of a potential offshore wind farm initiative was evaluated. The key factor in assessing the impact is the size of the wind farm. For the purposes of this assessment, the wind farm was sized to provide 12.5 percent of the state’s retail electricity needs, although recent studies of the state’s offshore wind potential concluded that a much higher share could be produced—offering upside risk for this estimate. The state’s current retail market is about 136 million megawatts in 2010, according to data from the US Energy Information Administration. Retail electricity consumption will grow over the next decade with growth in the population and in per capita consumption as each individual consumes more with our greater use of electronic appliances and goods. This growth in consumption is tempered by increasing energy efficiency of new electronic goods and appliances, as well as initiatives to make houses more energy efficient. One of the greatest unknowns is the rate of adoption of electric cars that would charge up at individual residences. For the purposes of this exercise, an annual two percent growth in consumption is assumed recognizing that there are many unknowns. This provides an estimate of 166 million megawatts in 2020.

Sharing the state’s 2020 consumption down to 12.5 percent yields an estimate of 20.8 million megawatts. Wind turbines vary in size and this affects the number of turbines needed to meet the 12.5 percent target. Assuming a 3.6 MW turbine operating over a full year, 1,925 turbines would be required to generate the target amount of power. The European Wind Energy Association reports that the typical turbine requires 40 hours of regular maintenance and 40 hours of non-routine maintenance per year; crews typically work in two-person teams. Assuming a 2,000 hour work year, that translates into 75 jobs directly serving the offshore wind farm annually.

This figure does not include construction or supporting manufacturing activities, which could generate significantly more jobs for the state. The State’s wind power opportunities are further assessed in the *Report of the Governor’s Scientific Advisory Panel on Offshore Energy*, submitted to Governor Bev Perdue on September 30, 2011.

12.5.5 Defense Logistics Initiative

With extensive military personnel in the state and military bases that support shared resources across military branches, North Carolina is well-positioned to offer a cost effective solution to the US military for the redeployment, rehabilitation and renewal, and reset of military equipment. Maritime investments would complement and enhance the efforts underway through the North Carolina Defense Logistics Initiative and Military Growth Task Force to enhance the use of North Carolina ports and facilities for equipment reset.

Many of the infrastructure investments identified to support the movement of Ro/Ro and oversize cargo would also improved highway and rail access from North Carolina military bases to Morehead City and Wilmington.

12.5.6 Defense Production Zones

Given the large military presence in the state and success in attracting contractors with technical expertise, the establishment of Defense Production Zones in coordinate with the ports and military installations may help to anchor this important industry. For example, Virginia permits communities to establish local defense production zones to benefit businesses engaged in the design, development, or production of materials, components, or equipment required to meet the needs of national defense, much of which may need a port for efficient distribution. The zones qualify businesses for tax breaks on tools and machinery created for national defense when they locate within those zones. Although the government coffers lose tax revenue, the technical innovation and potential for spinoff from such commercial activities is high, especially when they are clustered in a region. Collectively, the ports, the military presence, and the defense contracting firms producing equipment for defense have the potential to create a synergy within the state for a defense driven engineering and manufacturing industry—particularly given the high-tech focus of the state's economy.

12.5.7 Shared Rail Service

North Carolina's freight market is, today, dominated by truck freight. Long term strategies would benefit from improved rail service. Sufficient rail tonnages, however, are required for rail carriers to be competitive with trucking. In order to offer North Carolina shippers the benefits of service from both Class I railroads operating in the state, the implementation of shared rail service across CSX and NS should be promoted.

NC Ports and in-state shippers contend that the lack of dual rail service contributes to high quotes for rail transport to the state's port facilities. Dual rail service would introduce rail freight competition by offering service of two railroads to each port location. In theory, competition would cause the railroads to reduce their rates and make rail service more competitive with truck transport. With low rail density on port-connecting rail lines, however, the operation of additional trains (without an accompanying increase in volume) could actually increase variable rail costs and quoted rail freight prices.

An alternative to dual rail service is shared rail service, whereby two railroads enter into agreement to transport the other's cars on their trains. CSX and NS hold shared service agreements in other locations, but do not have such an arrangement in North Carolina. Shared rail service would allow shippers to contract with one railroad while obtaining access to the other railroad's operating lines (as set forth in the shared service agreement); an interchange of cars

would be required between the two railroads. Implementation of shared service could also benefit NC Ports in attracting ocean carriers, who may enter into exclusive agreements with a single US rail carrier to provide point-to-point transportation service to shippers. Under the provisions of the existing trackage rights agreement that grants NS exclusive freight operating rights over designated NCRR rights of way, explicit agreement of NS and NCRR may be required to allow for CSX freight to be transported over these lines.

12.5.8 Update of NCRR/NS Trackage Rights Agreement

As the expiration of the NCRR-NS trackage rights agreement nears, the State is in a position to refocus or clarify certain provisions to the benefit of rail freight movement in North Carolina. For example:

- The existing trackage rights agreement identifies general goals regarding industrial development to include NS cooperation with rail-related development efforts adjacent to the eastern rail line; however, the specific actions or objectives under this provision are not identified. An updated agreement could more clearly establish NCRR and NS roles in promoting industrial and economic development along its rights of way or define P3 opportunities that would support the state's freight rail users.
- The agreement defines three operating segments (Charlotte-to-Greensboro, Greensboro-to-Raleigh, and Raleigh-to-Morehead City) that may not be subdivided. NS may cease rail service on one or more segments and allow for its operation by a third party carrier. Interestingly, while a reduction in annual trackage rights fee would be realized for cessation of service on either the Charlotte-to-Greensboro or Greensboro-to-Raleigh segment, no reduction in fee would be realized by NS should the railroad cease operations on the Raleigh-to-Morehead City segment. The railroad, therefore, has no incentive to release the segment serving Morehead City to a third party operator that may be interested in enhancing service.

12.5.9 Current and Future Role of NCRR

The North Carolina Railroad Company is a private corporation whose shares are fully-owned by the State of North Carolina. The NCRR mission is "to maximize the value of the North Carolina Railroad's properties for the people of North Carolina through partnerships that drive economic growth, enhance freight and passenger service, improve safety and respect the natural environment." Toward this end, NCRR has partnered with NS, the NCDOT Rail Division, the federal government, and others to advance various capital improvements on the NCRR rights of way. These investments, however, have largely been focused on the heavily-traveled north-south line, including various capacity, speed and safety improvements to benefit both passenger and freight rail operations between Charlotte and Raleigh. As evidenced by the findings of the *Maritime Strategy*, North Carolina shippers could benefit from greater investments in freight rail access to the state's port facilities, including the NCRR-owned line from Raleigh to Morehead City.

The future role of NCRR to advocate, promote, or even operate rail service should be examined. The potential short line operation along the NCRR Raleigh-to-Morehead City segment was suggested by industry stakeholders. The feasibility and viability of a new short line service was beyond the scope of the *Maritime Strategy*, however, NCRR could lead the effort to

evaluate such a proposal in advance of renegotiation of the NCRR-NS trackage rights agreement as the December 31, 2014 contract term approaches.

The State of North Carolina has been moving forward to implement many of the recommendations put forth by the Governor's Logistics Task Force such as establishment of a State-level logistics office. The ongoing integration of NCDOT and NC Ports and GTP will enhance the coordination of these entities to advance their shared goals. The state-owned railroad, however, has not included in this integration. Closer alignment of NCRR objectives with other State departments and divisions that are charged with moving the state's people and could be realized.

12.5.10 Logistics Villages and Foreign Trade Zones

The State-sponsored Seven Portals Study was undertaken to investigate potential logistics villages and what infrastructure improvements would be needed to support those facilities. Among the study's conclusions was that seaports and inland ports where goods can pass through US Customs serve as important portals to international trade and allow North Carolina to engage more directly in international commerce. The Seven Portals Study stresses the role of logistics villages (including mega sites, inland ports, and logistics centers) to complement the overall freight transportation network including direct connection to seaports, highways, and rail networks. Logistics villages can improve the efficiency of maritime trade through shared use of freight infrastructure and services. Core on-site transportation services may include integrated distribution, smart warehousing or specialized warehousing (e.g., refrigerated), value-added production or processing, intermodal operations, logistics, and customs operations with Foreign Trade Zone status.⁷⁷

The State or other public entities can support the establishment and success of logistics villages through such efforts as:

- providing truck and rail access to promote intermodal transport;
- making zoning decisions that are consistent with proposed industrial uses;
- providing utility service, permits, and site infrastructure that facilitate private development; and
- sponsoring foreign trade zones (FTZ) to allow companies to realize duty exemptions or deferral for qualifying activities within the FTZ.

FTZs provide manufacturers with relief from inverted tariffs, where an imported input component or raw material carries a higher duty rate than the finished product. Duties are not applied to products that are re-exported from FTZs, and duties may be deferred for goods sold domestically. There is no duty on waste or scrap resulting from processing or manufacture within the FTZ. FTZ users can also realize savings through weekly customs entry processing to minimize customs fees on multiple shipments.

⁷⁷ Source: Seven Portals Study, December 2011.

Stakeholders reported that competing ports had integrated agricultural inspection and customs clearance procedures that provided for more seamless movement of goods. Through the use of inland logistics villages as well as FTZs at the port, NCSPA can provide improved border customs processing and agricultural inspection operations. This was reported as a feature that could differentiate the ports and make the use of the infrastructure more attractive.

North Carolina's six foreign trade zones (and associated subzones) are an important asset to the state in advancing its freight-focused development strategy. North Carolina is in the process of updating its FTZs to meet new federal regulations, which will offer greater flexibility in the operation of FTZs and associated subzones. The individual zones, however, are fragmented across several organizations, except for the two that are connected to the North Carolina State Ports Authority. Of the Charlotte Regional Partnership; NCSPA: Wilmington; NCSPA: Morehead City; Longistics at Research Triangle Park; Global TransPark Authority; and the Piedmont Triad Regional Partnership several have a regional focus. Efforts to coordinate the foreign trade zones with transportation planning activities are important policy innovations to ensure that the state receives the maximum economic benefit from FTZ-based businesses. This coordination is also an inducement for companies that are considering a North Carolina site for their business, as it provides a more integrated package of services.

12.5.11 Port Enhancement Zone Funding

In considering the use of incentives to attract business, the state's effort to create the Port Enhancement Zone is an important innovation. This was created by House Bill 751 [Session Law 2011-302] to allow companies which choose to locate within a 25 mile radius from NC State Ports Authority facilities the opportunity to receive addition credits for investments (hiring of persons, property) based on the tier classification of the area in which they are located. By inducing firms to locate in parts of the state that are "captive" to North Carolina's ports, the risk that they will divert their business to another port is minimized. Thus, the incentive not only attracts jobs to the state, but helps to drive traffic to the port. Moreover, by collocating port users within a group of corridors or particular region, the state can better focus its freight resources geographically, efficiently using the finite resources available for freight improvements to serve the greatest share of this part of the state's business base.

12.5.12 Partnerships to Advance Short Sea Shipping and Barge Opportunities

To promote opportunities for short-sea shipping and barge services as a cost-effective, environmentally sound and low-congestion alternative to traditional truck routings, the following recommendations are offered for consideration:

- Establish an information clearinghouse, through NCDOT or NCDOC, to provide information to movers of freight that may be interested in considering water routings and seeking to match potential short-sea shippers with each other to help facilitate reliable regular service in each direction;
- Advance joint exploration, including through the I-95 Corridor Coalition, MARAD and/or other appropriate bodies, to identify potential partner ports that are 400 or miles from North Carolina ports, to and from which short-sea service may be attractive to existing North Carolina port users and/or that may attract new business;
- Evaluate the ability of promising short-sea shipping opportunities using the Marine Highways Benefit Calculator (www.marinehighways.org/benefits_calculator/), which can estimate

monetary value (congestion, pollution and carbon reductions; safety benefits; reduced infrastructure development and maintenance; and operational cost reductions) of using water routes as opposed to truck or rail and of locating distribution centers directly on the water to facilitate transferring containers or trailers between water and truck or rail.

- Through engagement of I-95 Corridor Coalition and others, support legislative and regulatory actions (including regarding the Jones Act and HMT) that foster short-sea shipping, should it be determined that same would be of benefit to North Carolina;
- Seek grant funding to advance specific short-sea initiative(s), including pursuit of opportunities that may be brought to light upon the release of the East Coast Marine Highway Initiative final report, scheduled for March 2012 delivery;
- Consider incentives to encourage modes to work together to offer modally integrated service under a single contract of carriage, with liability and convenience built in; and
- Examine possible benefits to be achieved through implementation of tax credits to shippers that use short-sea routes to and/or from a North Carolina port, pursuing implementation of same should study indicate fruitfulness.



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Table 75: NC Maritime Market Evaluation Matrix

	Grain	Wood Pellets	Other Wood Products	Containers	Refrigerated Cargo	Ro/Ro & Oversize
Overview						
2010 Volume	5,000 tons (containerized)	NA	180,000 tons	250,000 TEU	93,000 tons (approx. 7,000 TEU)	10,000 tons
2040 Volume	730,000 tons	450,000 tons	1,320,000 tons	1,260,000 TEU	73,000 TEU	192,000 tons
NC Port Location	Radio Island	Port of Wilmington (north property)	Port of Wilmington	Port of Wilmington	Port of Wilmington	Radio Island
Other Sites Considered	Wilmington	Radio Island	Radio Island	Radio Island at 45' and 51' Southport River Road Multiple Depths at POW	Radio Island	Wilmington
Import / Export	Export	Export	Export	Import & Export	Export & Import	Export & Import
Cargo Type	Bulk	Bulk	Bulk, Breakbulk	Containerized	Containerized and Breakbulk	Ro/Ro and Lo/Lo
Foreign Trade Partners	Asia via Panama Canal	Asia via Panama Canal, Europe	Africa, Asia via Panama Canal, Asia via Suez Canal, Europe, Mediterranean	Africa, Asia via Panama Canal, Europe, Asia via Suez Canal, west coast of S America via Panama Canal	Africa, Asia via Panama Canal, Caribbean, Europe, east coast of South America	Africa, Asia via Panama Canal, Asia via Suez Canal, Europe, Mediterranean
Domestic Mode	90% Truck / 10% Rail	50% Truck / 50% Rail	80% Truck / 20% Rail	70% Truck / 30% Rail	90% Truck / 10% Rail	50% Truck / 50% Rail
Implementation Investments and Strategies						
Leverage of Existing Infrastructure (existing and programmed)	Existing grain elevators Railroad bulk transfer terminals	Railroad bulk transfer terminals Pembroke rail turn	Existing port terminal capacity Pembroke rail turn	CLT Intermodal Facility Greensboro Intermodal Facility Raleigh area distribution centers I-40; I-95; I-85; I-73/74 Cape Fear Skyway and Wilmington Bypass National Gateway Corridor Crescent Corridor Pembroke rail turn	Reefer plug-ins CLT Intermodal Facility Greensboro Intermodal Facility Raleigh area distribution centers I-40; I-95; I-85; I-73/74 Cape Fear Skyway and Wilmington Bypass National Gateway Corridor Crescent Corridor Pembroke rail turn	Global TransPark and associated road and rail connections Existing rail interchanges
Highway Corridor Improvements (\$ 2011)	North Carteret Bypass; Upgrades to NC 11, NC 24, US 17, US 421, US 70, US 74/76 \$1.4 billion	Upgrades to US 17, US 74/76 \$3.5 billion	Upgrades to US 17, US 74/76 \$3.5 billion	Upgrades to I-73/74, US 74, NC 540, I-40, US 17 \$2.9 billion	--	Upgrades to I-40, NC 24, NC 42, US 401, US 421, US 70 inc. but not limited to North Carteret Bypass and Kinston Bypass \$2.2 billion

	Grain	Wood Pellets	Other Wood Products	Containers	Refrigerated Cargo	Ro/Ro & Oversize
Railroad Improvements (\$ 2011)	Port terminal connection and loop track \$12 million	Port terminal connection and loop track \$12 million	Port terminal connection \$1 million	Port terminal connection \$1 million	--	Havelock to Morehead City Railroad Relocation; Port Terminal Connection and loop \$218 million
New At-Port and Near-Port Facilities (\$ 2011)	Bulk grain terminal \$80 million	Bulk wood pellet terminal \$55 million	None	Expanded and modernized container terminal \$301 million Channel dredging \$427 million	Near-port cold storage and logistics services \$24 million	New Ro/Ro & heavy lift terminal \$49 million
New Inland Facilities (\$ 2011)				E. Charlotte Intermodal Facility \$131 million		Rail ramps at targeted industrial / manufacturing locations \$78 million
Policy Agreements Partnerships Regulations Operations	Partner with private grain terminal operator(s) Collaboration and commitments from NC soy growers to attract bulk vessel calls	Partner with private wood pellet producer(s) Rail service agreements based on targeted tonnage	Rail service agreements based on targeted tonnage	Shared rail service and associated rail service agreements Coordinated infrastructure plan Facilitate land exchange and public-private partnership to support relocation of west Charlotte intermodal terminal Collocate NCSPA "Sprinter" container service with new intermodal facility	On-site USDA inspections US Customs inspection for imported goods Collocated distribution and logistics services to support transload / stuffing of containers	Incorporate freight corridors into Port Enhancement Zones Coordinated strategy and marketing of NC infrastructure assets, workforce skills, FTZ, and logistics services Integration of efforts with NCDOT Rail Division industry access program Designate corridors for oversize loads; facilitate permitting
Investment Benefits to Other Market Scenarios	Enhanced access to Morehead City and Radio Island would also benefit Ro/Ro & Oversize If there is a shift in demand for soybean exports, port-related infrastructure could be repurposed for export of other bulk commodities.	Shares common production sources (and inland infrastructure needs) with other wood products If there is a shift in demand for wood pellet exports, port-related infrastructure could be repurposed for export of other bulk commodities.	Shares common production sources (and inland infrastructure needs) with wood pellets	Complements refrigerated cargo market	Complements container market	Enhanced access to Morehead City and Radio Island would also benefit grain
Benefits and Outputs						
Benefits through 2046 discounted at 3%; residual value of transportation assets not shown						
Shipper Savings	\$92 million	\$125 million	\$60 million	\$1,334 million	\$127 million	\$64 million
Supply Chain Benefit	\$5 million	\$8 million	\$4 million	\$91 million	\$9 million	\$4 million
Accident Savings	\$30 million	--	--	\$99 million	--	\$51 million
Travel Time Savings	\$2,103 million	\$628 million	\$693 million	\$2,998 million	--	\$4,872 million
Highway Maintenance	\$12 million	\$14 million	\$14 million	\$115 million	\$5 million	\$5 million

	Grain	Wood Pellets	Other Wood Products	Containers	Refrigerated Cargo	Ro/Ro & Oversize
Emissions Benefits	\$14 million	\$17 million	\$17 million	\$138 million	\$6 million	\$3 million
Grade Crossing Benefits	\$49 million	--	--	--	--	\$27 million
Benefit/Cost Ratio	2.64	3.13	4.04	2.09	6.69	3.38
Link to NC Economy	Agriculture and agribusiness comprise nearly 20 percent of NC jobs and income: 52,400 farms and over 50,000 jobs in food manufacturing. Supports non-metropolitan areas. Supports existing industry by increasing profitability and opening up new markets.	NC timber production supports 2,800 jobs in forestry and logging; 20,000 jobs in wood product manufacturing; supports non-metropolitan areas of the state. Wood pellet market opens up a new market for an important state industry. Maritime market focus on other wood products supports an existing industry by increasing profitability.		Manufacturing and retail account for 24% of state GDP; consumption (products purchased by households including imports) accounts for about two-thirds of the economy. Reduces shipment cost across statewide industries, thereby improving profitability.	NC is leading US producer of sweet potatoes; second in poultry, pork, trout, and Christmas trees; third in processed cucumbers and strawberries. Niche services support large agriculture industry and specialty manufactured goods	Durable goods manufacturing is 7% of GDP; about 28,000 jobs in transportation equipment manufacturing; over 30,000 jobs in machinery manufacturing. Supports aerospace industry, manufacturing of heavy equipment and capital goods for export.
Ancillary Benefits	Improved highway capacity to Morehead City benefits local tourist economy. Availability of grain export facility in NC could attract exports from non-NC growers.	Availability of wood pellet export facility in NC could attract exports from non-NC producers.		Diversion of northbound rail traffic frees up capacity on designated high speed rail corridor. Availability of Post-Panamax container facilities and efficient road and rail connections to inland intermodal terminals could in NC could attract container imports and exports generated by other states.		Supports US military needs and objectives of Military Growth Task Force Complements ongoing efforts of Governor's Wind Initiative Improved highway capacity to Morehead City benefits local tourist economy
Environmental						
Sensitive lands and waterways	Significant natural heritage areas and shellfish growing areas affected by terminal development and new wharf construction on Radio Island	New wharf construction adjacent to shellfish growing habitat and fish nurseries		Channel deepening, turning basin, and berth construction has potential to affect 52 acres significant natural heritage areas, 81 acres fish nurseries, and 51 acres shellfish growing habitat Likely additional dredging impacts at Cape Fear River entrance channel		Significant natural heritage areas and shellfish growing areas affected by terminal development and new wharf construction on Radio Island North Carteret Bypass access passes through National Forest
Permits & studies required	Reevaluation of Radio Island EIS USACE dredging permit Environmental permitting	Applicable NEPA docs Environmental permitting		Applicable NEPA docs USACE dredging permit Environmental permitting		Reevaluation of Radio Island EIS USACE dredging permit Environmental permitting

Notes: accident data as currently shown reflects accident cost savings realized by addition of median to improved highway segments and upgrade to interstate quality where applicable.

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REFERENCES

North Carolina Maritime Technical Memoranda and Meeting Records

Technical Memoranda

NC Maritime Strategy Action Plan for Further Data Collection and Analysis

NC Maritime Strategy Industry Outreach Action Plan

NC Maritime Strategy Public and Agency Involvement Plan

NC Maritime Strategy Existing and Planned Port Infrastructure

NC Maritime Strategy Peer Ports Existing and Planned Port Infrastructure

NC Maritime Strategy Future Port Infrastructure

NC Maritime Strategy Planned Utility Demands for Container Terminal Market Scenarios

NC Maritime Strategy Proposed Port Infrastructure for Non-Containerized Cargo

NC Maritime Strategy Green Ports Strategies

NC Maritime Strategy Maritime Assets, Freight Eligible for Maritime Travel, and Trade Agreement Impacts

NC Maritime Strategy Technical Memorandum on Competitive Landscape

NC Maritime Strategy Marketing Memorandum

NC Maritime Strategy Target Market Conditions, Trends, & Opportunities

NC Maritime Strategy Market Scenarios

NC Maritime Strategy Overview of Potential Funding Strategies for North Carolina's Port Projects

NC Maritime Strategy Economic Impact and Benefit Cost Assessment of Market Scenario Outcomes

NC Maritime Strategy Existing and Planned Freight Nodes and Facilities

NC Maritime Strategy Inland Port Opportunities for North Carolina

NC Maritime Strategy Site Assessment and Environmental Screening

NC Maritime Strategy Short Sea Shipping

NC Maritime Strategy Delivered Cost Model

NC Maritime Strategy Highway Infrastructure Assessment

NC Maritime Strategy Existing and Planned Railroad Infrastructure

NC Maritime Strategy Proposed Railroad Infrastructure

Meeting Records

2011-05-10 Advisory Council Meeting 1

2011-07-11 Advisory Council Meeting 2

2011-09-16 Advisory Council Meeting 3

2011-11-09 Advisory Council Meeting 4

2012-02-16 Advisory Council Meeting 5

2011-02-22 MSET Meeting 1

2011-05-24 MSET Meeting 2

2012-01-13 Joint Legislative Transportation Oversight Committee

2011-06-13 Industry Meeting – No Port Southport

2011-06-13 Industry Meeting – Save the Cape

2011-07-01 Industry Meeting – US Army Corps of Engineers

2011-07-21 Industry Meeting – Railroads, Trucking and Distribution

2011-07-21 Industry Meeting – Southport/ Oak Island Chamber of Commerce

2011-07-21 Industry Meeting – YesPort NC

2011-08-10 Industry Meeting – Shippers

2011-08-10 Industry Meeting – Non-Agricultural Shippers

2011-08-16 Industry Meeting – Agricultural Shippers

2011-08-19 Industry Meeting – North Carolina Division of Coastal Management

2011-08-30 Industry Meeting – Containership Lines

2011-09-28 Industry Meeting – Clean Carteret County Coalition

2011-09-28 Industry Meeting – Morehead City Port Committee

2011-10-05 Industry Meeting – Logistics Centers and Foreign Trade Zone Operators

2011-10-06 Industry Meeting – US Military

2011-10-21 Industry Meeting – Bulk and Breakbulk Shippers

2011-10-26 Industry Meeting – Progress Energy

2012-01-26 Industry Meeting – US Nuclear Regulatory Commission
2011-07 & 2011-08 Stakeholder Meeting – MPOs (by URS)
2011-07 & 2011/08 Stakeholder Meeting – NCDOT Division Engineers (by URS)
2011-08 Stakeholder Meeting – NCDOT Rail and Operations (by URS)
2011-08 Stakeholder Meeting – NC Department of Commerce (by URS)
2011-08 Stakeholder Meeting – NC State Ports Authority (by URS)
2011-08-22 Stakeholder Meeting – Global TransPark (by URS)
2011-08-24 Stakeholder Meeting – NC Chamber of Commerce (by URS)
2011-09 Stakeholder Meeting – NC Trucking Association (by URS)

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