

A Look at the  
**Economic Impacts**  
Projected for the Proposed  
**North Carolina International Terminal**

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Appendix A

## A Look at the Economic Impacts Projected for the Proposed North Carolina International Terminal

*Yesterday's manufacturing jobs are today's logistics jobs.*  
--North Carolina State Ports Authority

The North Carolina State Ports Authority, a component of the North Carolina state government, has purchased 600 acres of undeveloped land on the Cape Fear River near Southport, and plans to develop an international container terminal with an annual capacity of 3,000,000 twenty-foot equivalent units (TEU). The new terminal, intended to facilitate imports from Asia, would be called the North Carolina International Terminal (NCIT).

The project would require a substantial investment of federal and state funds for infrastructure, including a new channel in the Cape Fear River, a new highway to connect the terminal to interstate highways, and bridges over the railroad serving the terminal. Should private investment for the terminal itself not be available, the entire development and construction cost would require public funds.

The NC State Ports Authority justifies the project by projecting job creation and other economic benefits in the region and the state. This report provides a preliminary assessment of those projections.

### *Conclusions*

Martin Associates, the consulting firm providing estimates of economic impacts for the State Ports Authority, based its estimates on projections of container traffic prepared by CH2M Hill, Inc., another consultant to the State Ports Authority. That firm projected container movements of 3,000,000 TEU per year in 2030—more than fifteen times the 196,000 TEU moving through the Port of Wilmington in 2008. Such projections cannot be considered credible, nor can any estimates of economic impacts based thereon.

The business plan prepared by CH2M Hill, Inc., is based on substantial penetration of markets in other states. Indeed, that is the only reason for the forecast increase in market share by a factor of six over the market share enjoyed by the container terminal at the Port of Wilmington. But the Martin Associates economic impact report counts all of the economic effects as if they occurred in the State of North Carolina.

Moffatt & Nichol, another consultant to the State Ports Authority, examined the market for a container terminal at the Cape Fear and determined that such a terminal enjoyed cost advantages only for markets in North Carolina, and that such a container terminal could not expect to gain market share in other states from other ports.

With the market so limited, any growth in container traffic for area served by the Port of Wilmington (and, perforce, a new terminal at Southport) can comfortably be handled by the existing container terminal for the foreseeable future. Thus the economic impacts, if any, of increased container traffic would be realized without incurring the financial and environmental cost of a new container terminal at Southport.

Any projections of economic impacts, such as jobs related to or created by a container terminal, must be compared with the recent history of substantial job loss in North Carolina and the United States due to large-scale importation of goods from Asia facilitated by public investment in facilities for receipt of containers.

### ***The Container Terminal at Wilmington***

The North Carolina State Ports Authority operates the Ports of Morehead City and Wilmington. Both ports accommodate coastwise trade and import-export of bulk and breakbulk cargoes. The Port of Wilmington includes a container terminal, which currently handles only import-export. The current annual capacity of the terminal is approximately 350,000 TEU; the highest actual usage was 196,000 TEU, in 2008. Although container traffic is approximately symmetrical, nearly half of the outgoing containers are empty. Loaded container movements are approximately two-thirds import, one-third export. The bulk of the imports is from Asia, through the Panama Canal.

The channel to the Port of Wilmington currently can accommodate vessels of 40-foot draft, the largest vessels that can pass through the Panama Canal. Those are called "Panamax" vessels.

The State Ports Authority has projects underway to increase the capacity of the terminal to 500,000 TEU annually. Cranes have recently been installed to accommodate post-Panamax vessels up to 18 containers wide, approximately 144 feet, although the Panama Canal is currently limited to vessels 108 feet wide. This is in contemplation of the wider and deeper locks planned to be available at the Panama Canal in 2014.

Revenues from port operations do not cover capital costs, and sometimes do not cover operating costs. The State Ports Authority looks to the North Carolina legislature for infusions of capital for improvements. The legislature has provided approximately \$42 million in the three fiscal years 2006-2008.

The State Ports Authority relies on the US Army Corps of Engineers to maintain the channel in the Cape Fear River, with funds appropriated by Congress. Improvements, such as deepening the channel or enlarging the turning basin would be shared by the Federal government and the State of North Carolina. The cost of a current project to increase the channel depth to 42 feet for Panamax vessels was estimated in April 2009 to be \$533 million. The North Carolina share, 35%, is \$186.5 million. The North Carolina share for the dredging for the proposed North Carolina International Terminal would be 60%, because the deeper depth invokes a different cost-sharing formula.

### ***The North Carolina International Terminal***

The proposed container terminal near Southport would be designed to accommodate vessels of 50-foot draft, which would be able to pass through the Panama Canal after completion of a third set of locks, planned for 2014. At 3,000,000 TEU annual capacity, the terminal would be the largest container terminal on the Atlantic coast of the United States, except the combined ports of Port Elizabeth and Port Newark, New Jersey. The preliminary plan prepared by CH2M Hill, Inc., consultants to the North Carolina State Ports Authority, describes an automated facility to load and unload containers from very large container ships:

1263 feet long, with a beam of 185 feet. Such ships are larger than any other vessel in commercial or naval service today.

The project would require dredging a new channel in the Cape Fear River, crossing the current channel, for five miles to the mouth of the river. The new channel would be 600 feet wide (at the bottom) and 52.5 feet deep (plus a two-foot overdredge), cut through areas with a depth now measured in single digits. The channel would be continued over the course of the existing 500-foot wide, 42-foot deep channel seven miles out to sea, and would extend another ten miles to deep water. The distance from the terminal site to deep water is 22 miles.

The project would also require a new four-lane highway to planned interstate highway connections approximately 20 miles away in the northeast part of Brunswick County, and improvements to the existing 23-mile, single-track railroad to the CSX Transportation, Inc., railroad line at Leland.

Operations would be conducted 24 hours a day, seven days a week, 364 days a year. The terminal would be open for truck traffic 16 hours a day, five and a half days per week.

Under the current plans, the first phase of construction would provide for opening of the terminal in 2017. Initial operations would be at the rate of one million TEU per year. Full capacity of three million TEU would be available in 2027.

### ***Cost of the Project***

CH2M Hill, Inc., consultants to the State Ports Authority, has provided this estimate of costs of the project and the associated infrastructure (excluding the channel), in 2008 dollars:

Container terminal	\$1,430,229,000
Roadway and bridges	260,826,000
Rail line and bridges	72,779,000
Project development	<u>72,770,000</u>
Total	\$1,836,604,000

The Wilmington District of the US Army Corps of Engineers has recently estimated the cost of the channel dredging at \$1,208,000,000. The aggregate cost of the project would be \$3,045,000,000. At the current cost-sharing formula for projects of depth greater than 45 feet, the Federal government would bear 40% of the dredging cost, approximately \$480,000,000, leaving \$720,000,000 for the State of North Carolina, an aggregate cost of \$2,525,000,000.

The “pro forma” business plan prepared by CH2M Hill, Inc., contemplates the cost of the container terminal itself, approximately \$1.43 billion, being covered by investment by a private terminal company, which would be granted a long-term concession. Such investment would require an assured annual return in the range of 15% to 17%, which would only be possible with a market share of six times the share of the terminal at Wilmington and container handling rates approximately three times those charged by the State Ports Authority at Wilmington. The prospect of such private investment is as unlikely as fulfillment of those conditions.

## ***Benefit Claims and the Martin Associates Report***

Because port facilities seldom operate at a profit or even cover costs, ports authorities typically justify the investment of public funds by claims of economic benefits. The North Carolina State Ports Authority does the same, and engaged Martin Associates to prepare a report on economic impacts: *The Projected Economic Impacts of the North Carolina International Terminal*, dated March 14, 2008.

This report has been used by the State Ports Authority for public statements about employment effects and tax revenues in the region and throughout the State. Some are rather extravagant, such as a claim of "477,000 new jobs statewide" appearing on the State Ports Authority Web site.

The report prepared by Martin Associates for the NC State Ports Authority does not purport to be a cost/benefit analysis of the type normally used to determine the economic worth of a transportation project. Such analyses follow accepted and rigorous methods of comparing costs and benefits over the life of a project, to determine *first*, whether the project is justified by a surplus of quantifiable benefits over costs, and *second*, where the project ranks with other projects competing for funds. Appendix A describes the methods used by state agencies and the US Army Corps of Engineers for such studies.

The Martin Associates report is instead an "economic impact" study. In a search for project justification, a project sponsor may commission such a study to predict the effects a project may have on the economy of the affected area. This would estimate economic effect by such measures as jobs and tax revenues resulting from the business expansion facilitated by the project--measures that resonate with government officials.

Economic impact analysis is supplemental to cost/benefit analysis. It is not a substitute. It cannot be regarded as the basis for decision, as can cost/benefit analysis. An economic impact analysis is intended to persuade, not to analyze in any objective fashion. Such reports must be read carefully, to determine what is said, exactly, and what is not said.

Martin Associates, led by Dr. John C. Martin, an accomplished economist, prepares economic impact studies for most of the ports authorities in the United States, and also does work for the American Association of Ports Authorities, a trade association. Indeed, the Martin Associates report for the North Carolina State Ports Authority contains a passage left over from a report done for the Port of Jacksonville.

The report prepared for the NC State Ports Authority presents estimates of business revenue impact, employment impact, personal earnings impact, and tax impact of the proposed container terminal. Martin Associates warns that those impacts overlap and adding the impacts would be double-counting.

The report provides these estimates of employment impacts:

	2017 (Estimated opening) <u>916,000 TEU</u>	2030 (Capacity operation) <u>3,000,000 TEU</u>
Direct	2,057	6,481
Induced	2,697	8,369
Indirect	515	1,664
Related	145,977	477,528

*Direct employment* means jobs "directly generated by the movement of containers via the terminal." This category is not limited to employees of the terminal, but includes employees of the railroads and trucking lines moving the containers, and various supporting activities.

*Induced employment* means employment created because individuals employed in the "direct" category spend wages on goods and services such as food, housing and clothing.

*Indirect employment* means employment with firms doing business with the terminal and engaged in activities other than the movement of containers, such as maintenance and repair.

*Related employment* means jobs with companies using the terminal for shipment and receipt of cargo. Martin Associates observes that "The level of employment with these firms is driven by the demand for the firm's products, not because the International Terminal is being used. Therefore, the degree of dependence of the related jobs on the International Terminal is less than the other components of the job impact."

The nuances of the different categories of employment effects usually are lost in brief public statements. This is particularly troublesome with the term "direct employment," which suggests the number employed by the terminal itself, but is not, and the term "related employment," usually associated with some very large numbers, which also suggests something other than what Martin Associates states.

The Martin Associates report does not disclose the number of people anticipated to be employed at the container terminal itself. The State Ports Authority has not disclosed that figure, and none of the documents released by the State Ports Authority have that information. The business plan prepared by CH2M Hill, Inc., speaks of a highly automated facility, with labor savings not possible at other ports with "entrenched unions."

The existing facility most resembling the terminal planned by the State Ports Authority is the AP Moller (APM) terminal at Portsmouth, Virginia, opened in 2007. This terminal has a current capacity of 1,000,000 TEU, but has sufficient land area--approximately the same as that purchased by the NC State Ports Authority in Southport--to increase that capacity to 2,500,000 TEU.

The APM terminal uses automated rail-mounted gantry cranes to handle containers instead of the lift trucks employed at Wilmington and other facilities. The business plan for the terminal proposed for Southport specifies the same type of crane. One operator can handle six such cranes. The APM terminal has 44 regular employees, with an additional 50 to 200 longshoremen employed from day to day, depending on need. On average, about 160 employees.

The proposed container terminal at Southport would be expected to employ the same number of regular employees, 44, and to hire longshoremen as needed. Thus actual employment depends on container movements. Whether that would be more or less than at Portsmouth is explored below and in the companion analysis of the business plan.

There is also the question of the effect on employment at the container terminal at the Port of Wilmington. Jobs would be lost at that terminal if container operations were moved down river to Southport. The net effect is unknown. The most likely result is that direct jobs, at the port and in supporting activities, would simply move down the river.

### *Observations*

In considering the projections presented by Martin Associates in their report, these qualifications are necessary:

*Geography.* The Martin Associates report appears to treat the State of North Carolina as a geographically separate region, an island without land connections to neighboring states. Interstate movements of containers are ignored. All economic impacts of container movements projected for the proposed terminal are treated as impinging within the State of North Carolina. However, a fundamental basis of the container movement projections prepared by CH2M Hill, Inc., upon which the Martin Associates projections of impacts are based, is capture of market share of container traffic from terminals in other states, and movements of substantial numbers of containers into the "hinterlands" of the Midwest. Stuffing all of the effects of such regional traffic into one state results in incongruous results: Martin Associates attributes about one-third of the growth in jobs in the State of North Carolina over twenty years to the proposed container terminal.

*Container movement projections.* The Martin Associates projections of economic impact for the North Carolina International Terminal are based on the projections of container movements supplied by CH2M Hill, Inc., without comment as to validity. Those projections are based on assumptions of (a) continuous growth in container traffic at the 6.3% compound annual rate experienced by east coast and Gulf coast ports in the ten years prior to 2007, and (b) capture of substantial market share from the terminals at Hampton Roads, Charleston, and Savannah. Both assumptions are faulty. The rapid expansion of container imports following the joining of the World Trade Organization by The People's Republic of China in 2001 has been shown by recent events to be both atypical and unsustainable. And capture of market share from Hampton Roads, Charleston, and Savannah is not a reasonable expectation. All of those terminals have surplus capacity, are closer to markets, and have better road and rail connections than Wilmington and Southport,

*The base case.* A cost/benefit analysis would compare the effects of a proposed plan with a "base case," that is, the case if the project were not to be built. Only the incremental effects--the additional effects--would be counted. The Martin Associates report does not do that. If the project were not built, the same goods would reach the same markets through the existing terminal at the Port of Wilmington and through the terminals at Hampton Roads, Charleston, and Savannah. Only if those terminals reached their capacity would any additional goods be moved to market through the proposed terminal, and only then would there be any economic impacts. But giving effect to expansion projects underway at those terminals, capacity would be sufficient for the foreseeable future. Dr. Martin observed in 2007, before the recent downturn in container traffic, that "There's a lot of hysteria that terminals are out

of capacity, ... In my opinion, these are all urban myths, like alligators in New York City sewers."

We explore the latter two issues.

### ***Container Traffic Projections***

The economic impacts presented by Martin Associates are based on projections of container movements supplied by CH2M Hill, Inc., in their *Pro Forma Business Plan*. Martin Associates does not comment on the validity of those projections.

Inasmuch as CH2M Hill, Inc., projects container movements for the proposed terminal at Southport at an annual rate of more than fifteen times the current level of container movements through the container terminal at the Port of Wilmington, we think such projections deserve scrutiny.

The companion to this report, *A Look at the Business Plan for the North Carolina International Terminal*, presents estimates of the container movements to be expected in the market served by the container terminal at Wilmington. Such are the movements that would be expected for the proposed North Carolina International Terminal, for it would serve the same markets, be connected by the same roads and railroad, and have the same competition from other terminals.

This graph shows those estimates, at three rates of growth.

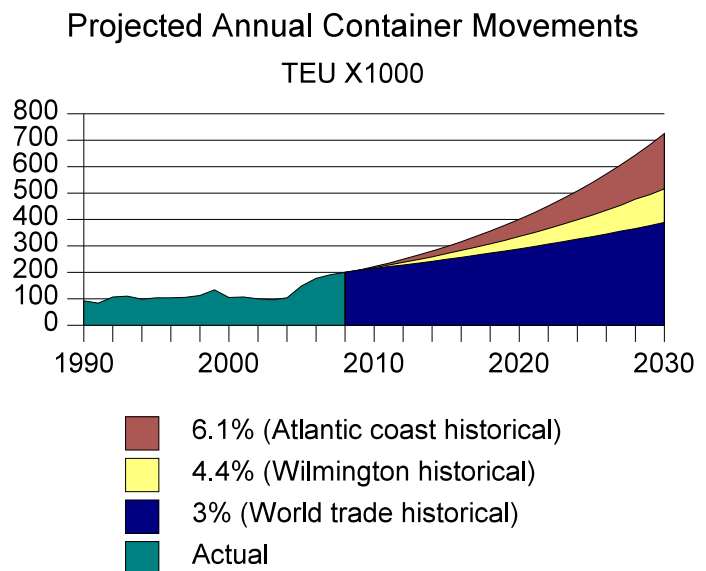
The line from 1990 to 2008 shows the actual movements at the container terminal at the Port of Wilmington. The increase over that period was at an average annual rate of 4.4%.

From 2008, the middle line is a continuation of that historical growth of container movements at Wilmington, an annual rate of 4.4%.

Container movements on the Atlantic coast have grown at an annual rate of 6.1% since 1990. That has stopped, and even retreated in 2008. But if that rate resumes, and container movements for southeastern North Carolina are carried along, that is presented as the "high case."

If on the other hand container movements adopt the growth rate of a mature freight medium, we use as the "low case" 3%, the annual rate of growth of all seaborne freight from 1975 to 2006, as reported by the Institute for Shipping Economics and Logistics.

The projection at the historical rate of 4.4% yields 515,000 TEU in 2030, approximately the planned capacity of the container terminal at the Port of Wilmington. The

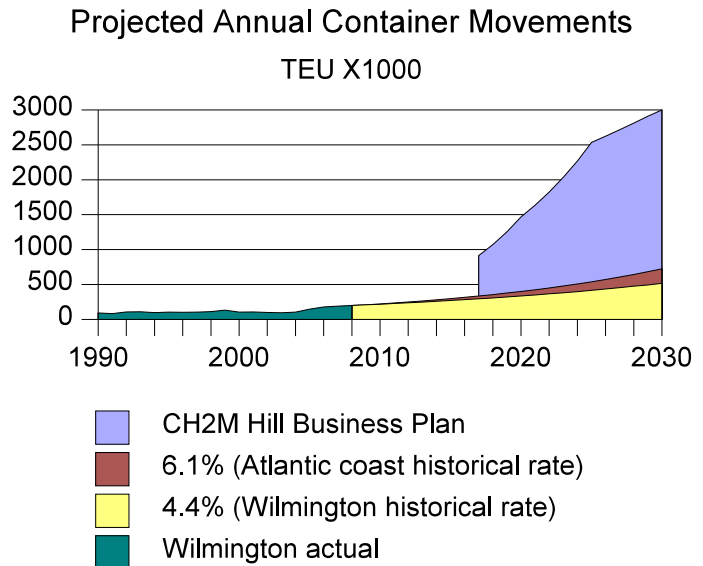


high case, about 200,000 TEU more, could also be handled at Wilmington in the available space with adoption of container handling technology now coming into use at various ports.

The CH2M Hill analysis used as a basis by Martin Associates did not consider the history at Wilmington. Instead, the firm projected container movements for the east and Gulf coasts at the rate of growth prevailing in the ten years before 2007, 6.3%, and then, using a computer model, estimated the market share that the proposed terminal on the Cape Fear River “could” achieve.

This is the result, shown on a graph with the previously displayed projections of container movements at 4.4% and 6.1% (the vertical scale has been compressed to suit).

By comparison with the projections of the historical trend, the CH2M Hill, Inc., projection of container movements for the proposed North Carolina International Terminal is so high as to suggest grievous analytical error. The CH2M Hill, Inc., projection for the year 2030 is 3,000,000 TEU annually; normal growth of the Wilmington market suggests annual movements of 500,000 TEU, with the possibility of movements as high as 725,000 TEU.



The analysis of the CH2M Hill business plan in the report *A Look at the Business Plan for the North Carolina International Terminal* examines the discrepancy between the projections, with these findings:

- While the rate of regional traffic increase used by CH2M Hill, Inc., 6.3%, is not without basis, it is unlikely to continue. Indeed, movements in 2008 have dropped to the level before 2006, and are not expected to resume growth until 2012. However, this rate is not enough different from the high case of 6.1% to explain the discrepancy.
- The CH2M Hill, Inc., analysis predicted that capacity shortages at other terminals would push container traffic to the proposed terminal on the Cape Fear River. However, their data and data from Martin Associates in another report show that capacity at other terminals in the region will exceed demand until some time between 2027 and 2041.
- CH2M Hill, Inc., proposed that a “focused marketing strategy” would result in capture of market share from other terminals in the region. However, their data on relative distances of ports from Asian sources and from ports to markets show that a port on the Cape Fear River would not have any advantages that would suggest capture of market share larger than that currently enjoyed by the container terminal at the Port of Wilmington. The Port of Wilmington already offers lower rates than other ports.

A report recently prepared by Moffatt & Nichol, another consultant to the State Ports Authority, examined the issue of the market and the prospect of increasing market share in

some detail. The firm examined the path of least cost of containers shipped from various points on the globe to 179 business-economic areas in the United States. The result is that the Port of Wilmington is on the path of least cost for only five of the 179 areas, all within North Carolina. The firm concluded that no increase in market share at all was in prospect. The same conclusions would be applicable to the proposed container terminal at Southport, which is twenty miles farther from markets.

The CH2M Hill, Inc., projection of container movements cannot be used as a valid basis for any analysis of economic impacts. Thus the Martin Associates analysis, relying on that projection, would overstate economic effects by a factor of six, even if valid in other respects.

Which it is not. There a further fatal flaw.

### ***The Starting Point—the Container Terminal at Wilmington.***

An analysis used for evaluation of the worth of a project must consider the “base case”: what would happen without the project. Then only the incremental effects of the project, the reduction in transportation costs or any additional economic benefits, should be considered. This comparison is fundamental.

That was not done by Martin Associates. The economic impacts counted by Martin Associates and attributed to the proposed container terminal disregard what would happen anyway. The Martin Associates approach might be valid if there were not any other container terminals on the continent. But there are. There is a container terminal at Wilmington with excess capacity, and there are container terminals in neighboring states with excess capacity. Dr. Martin has himself observed that container terminal capacity in the United States is sufficient, and will be sufficient for the foreseeable future.

Thus the goods from Asia will reach markets in the region and elsewhere with or without the proposed container terminal, and any trucking and distribution jobs related to the movement of such goods would be available in either case. It is improper and misleading to attribute such effects to a container terminal that only would share in traffic already occurring.

The container terminal at the Port of Wilmington has a capacity of 350,000 TEU, and projects underway will bring that up to 500,000 TEU. Adoption of improved technology for container handling, already in use at other terminals, could improve that substantially.

The current traffic of approximately 200,000 TEU and the future estimate of 500,000 (plus or minus 200,000 TEU) for the market served by the container terminal at Wilmington is comfortably within that capacity. Any other terminal on the Cape Fear River would add no benefit at all.

There is one circumstance, however, in which the proposed container terminal at Southport might move more containers than the terminal at Wilmington.

As more fully developed in *A Look at the Business Plan for the North Carolina International Terminal*, container vessel traffic in the Cape Fear River was, and might again be, affected by the depth of the channel. During the period 1990-2003, container traffic through the Port of Wilmington did not rise at the same rate as traffic at other Atlantic coast

terminals during the same period. In 2004, traffic suddenly increased, nearly doubling in three years.

The channel in the Cape Fear River to Wilmington could only accommodate vessels of 35-foot draft until 2004. As vessel size increased over the years the container terminal at Wilmington gradually lost market share to other terminals. Early in 2004, the channel was opened at a new depth of 42 feet, permitting Panamax vessels, with 39-foot draft, to reach the Port of Wilmington without regard to tide. Container traffic nearly doubled in three years. However, container movements at the Port of Wilmington have not quite reached the market share enjoyed in the early 1990's.

The same phenomenon might occur again, when the Panama Canal opens the third set of locks, permitting vessels of draft greater than 40 feet to cross between oceans. That is scheduled for 2014. Hampton Roads now has a 50-foot deep harbor, and Charleston and Savannah have projects underway to dredge to nearly that depth. That would again create a disadvantage for the Port of Wilmington. The proposed container terminal at Southport, if and when its new channel is constructed to 52-foot depth, would not have that disadvantage, and would be expected to retain the market share for the Cape Fear region.

This would not affect the analysis, if the proper incremental approach is taken. Any depth disadvantage would only shift container movements from Wilmington to other ports that have adequate capacity. The markets, the distribution system, and the related economic impacts would be unaffected. The effects might be attributed properly to Hampton Roads or Charleston, but they would still occur.

If we consider that the container terminal at the Port of Wilmington is subsidized, and that the proposed terminal at Southport would require a much greater subsidy, it is difficult to conclude that shifting the burden of importing goods from Asia to terminals in other states would be a bad thing for the State of North Carolina.

### ***Public Policy Implications***

The public statements of the North Carolina State Ports Authority, claiming jobs to be "supported" or "created" by the proposed container terminal at Southport, recognize the changing character of jobs related to a container terminal and its traffic--logistics (trucking and warehousing) rather than manufacturing. Implicit in this is the recognition that jobs have been lost, and will continue to be lost, because of the imports the container terminal facilitates.

The Economic Policy Institute ([www.epi.org](http://www.epi.org)), on March 23, 2010, released a briefing paper, number 260, *Unfair China Trade Costs Local Jobs*, addressing the issue of job loss.

Among the facts reported are these:

- The trade deficit with China has caused 2.4 million workers in the United States to lose their jobs or be displaced since 2001.
- 95,100 of those lost jobs were in North Carolina. Only seven states, all much more populous, have lost more jobs to the trade deficit with China.
- North Carolina ranked second among the states in percentage of job loss attributable to the trade deficit--2.3% of total employment.

- Two-thirds of the jobs lost were in manufacturing, which tends to provide higher wages and benefits than other occupations.

The American Manufacturing Trade Action Coalition ([www.amtacdc.org](http://www.amtacdc.org)) released a report in May 2008 specific to North Carolina, focusing on the loss of jobs in manufacturing and retarded economic growth due to trade deficits. That report points out that, although most of the people losing manufacturing jobs eventually found other work, the new jobs offered lower pay and fewer benefits than jobs in manufacturing. For example, the average annual pay in manufacturing is \$58,516, while the average pay in state and local government is \$45,099. The average for trucking is \$48,930. Warehousing, \$41,844. Retail, \$27,667.

All of the past job loss in North Carolina cannot be attributed to the container terminal in Wilmington, and all of the future job loss cannot be attributed to expansion of container terminal facilities. Many of the imported goods arrive and will continue to arrive through other ports.

Moreover, container terminals do facilitate exports as well as imports. Public investment in container terminals, to the extent capacity supports exports, is money well spent. But investment to increase capacity beyond that, to facilitate imports in greater quantities, can only damage the economy of the State and the nation.

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## Appendix A

### Cost/Benefit Analysis

Investments in public projects, particularly transportation improvement projects, ordinarily do not return the cost directly. Thus the worth of the project must be determined by comparing project costs to potential benefits accruing to users of the project, over the life of the project. Such an analysis would determine *first*, whether such a project deserves public investment, and *second*, how such a project ranks when compared to other public projects competing for public funds.

Cost/benefit analysis methods have evolved from their first general use for dams by legislative mandate in the Flood Control Act of 1936. Although traditionally called cost/benefit analysis, the process is now more commonly called benefit/cost analysis by project sponsors. The order of the terms suggests the outcome.

A proper analysis compares the project to a base case, and to alternatives. For example, for an analysis of construction of a new channel in the Cape Fear River, the base case would be doing nothing, that is, continuing to maintain the existing channel at the 42-foot depth so that container ships drawing 40-feet or less would continue to call at the Port of Wilmington.

The costs to be counted are those to be expended by the entities providing the project. In the example, that would be the federal government, acting through the Corps of Engineers, with financial support from the State of North Carolina. Environmental and social costs, whether or not quantifiable, would not be included, except to the extent of mitigation measures included in the project. Costs would include all to be encountered in the life cycle: planning, construction, maintenance, and deactivation.

The benefits to be counted are those to be received by the users of the project, and those directly affected. For a transportation project, such benefits are usually limited to the actual reduction in the cost of transportation provided by the project--time and distance saved, economies of scale. The universe of beneficiaries is not limited: The language of the Flood Control Act of 1936, which guides the Corps, is "benefits to whomsoever they may accrue."

Such a scope of benefits would also include negative effects. In the calculus of cost/benefit analysis, those are not counted as costs, but as "negative benefits," or "disbenefits," because they fall on the users or society, and not the project sponsor. Such disbenefits might include noise effects, construction delays and dislocations, and habitat and air and water quality impacts. Many negative effects are difficult or impossible to quantify, and relegated to an environmental impact statement. Yet they must be considered in a proper decision.

Direct economic effects would also be counted in the benefits column. Those might be reductions in business operating costs and household cost of living, to the extent not included in reductions in transportation costs. But benefits must be counted only once--beneficial effects of transportation cost reductions cannot be added. And only those effects should be counted as benefits (or disbenefits) that involve consumption or savings of real resources with economic value. If money or other resources are merely moved around among members of the affected group, those movements are called "transfer payments" and should not be counted. A Corps of Engineers analysis of the benefits of navigation improvements ordinarily counts only

transportation cost savings. Tax revenues are regarded as transfer payments and would not be counted in any accepted method.

Methods of analysis and presentation of results vary, but they all include these steps:

1. Identify and define types of costs and benefits.
2. Measure dollar values and times of occurrence for each cost and benefit.
3. Convert to comparable measures by discounting to net present value, total each of costs and benefits, and compare.

There are many accepted procedures for cost/benefit analysis, with variations in factors to be included, discount rates used for present-value determination, and presentation of results. The Corps of Engineers has established its own methods for benefit/cost analysis over the course of many years. The California Department of Transportation has another, but similarly rigorous, method described in detail on its Web site.

A major challenge in benefit/cost analysis is the comparison of amounts occurring at different times. Project costs occur at the beginning of the project; benefits occur at times well into the future. Selection of discount rate to bring future amounts to the present for comparison substantially influences the outcome.

Rather than comparing the sums of the present values of costs and benefits, the Corps calculates average annual costs and benefits for comparison. The Corps establishes a base year for benefits (when the project begins to produce benefits). Increases in benefits for future years would be converted to present worth and added to the base year benefits.

Costs are determined by estimating the “project first costs,” that is, the costs of construction; then interest during the construction period to the base year is added to obtain the “project financial cost.” That is amortized with interest over the estimated life of the project to obtain the annual cost. To that would be added the annual cost of maintenance, to obtain the average annual cost. For navigation projects, the Corps uses a life of 50 years.

Then the annual expected benefits, the transportation cost savings, would be determined and divided by the average annual cost to obtain the benefit/cost ratio. A ratio of greater than one justifies the project going forward.

For example, in the 1996 analysis for the recent project to dredge the Cape Fear River to a depth of 42 feet, the project cost was estimated at \$249,539,000. Amortized over 50 years at 7.625%, the then prevailing long-term rate on government bonds, and adding the cost of maintenance dredging, the equivalent annual cost was determined to be \$19,799,000. The Corps of Engineers determined that annual benefits would be \$24,663,000, which consisted of savings to shippers of using larger vessels that have lower operating costs per ton of load. Although most of those benefits accrue to foreign shipping lines, they were counted in the analysis. The benefit/cost ratio, determined by dividing the annual benefits by the annual cost, was 1.2. This met the Corps’ test of economic feasibility—a benefit/cost ratio of greater than one. The project went forward.

When that was revisited in 2007, project costs had doubled, benefits had increased 59% due to cost escalation, and the interest rate had gone down 36%. The Corps of Engineers reported that the project still met the test of a benefit/cost ratio greater than one.