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Port of Palm Beach
TIGER 3 Grant Application:
Economic Analysis of Proposed Port Reconstruction and Improvement

Prepared for AECOM, Inc. and the Port of Palm Beach by Nicolas O. Rockler, Ph.D.

October 28, 2011

Contents

INTRODUCTION

This appendix presents an economic analysis of consequences associated with a forced closure of Slip 3 at the Port of Palm Beach (the Port.) This closure would result from the failure of its bulkheads, regarded as a certainty by 2015 according to engineering consultants citing deterioration from advanced age. The Slip has already been in service for nearly 56 years, and is beyond its original design-life by six years.

Closing Slip 3 would have negative consequences for the Florida and U.S. economies. Nearly two-thirds of the cargos handled at Slip 3 are bulk commodities that are part of U.S. international trade. Some U.S.-produced goods, notably molasses, are currently exported from the Port. In addition, several important new cargos, including wood chips, wood pellets, and processed metals, are soon to being moving through the Port and require the services of Slip 3 owing to constrained capacity elsewhere on the Port.

A closed Slip 3 would entail shippers finding alternative ports to handle their cargo. The additional cost of shipping via alternative ports would be borne initially by the shippers, and in all likelihood, passed along to consumers. Assuming that the new delivered price of goods to be handled at other ports does not render them economically unviable, the diversion costs of existing and future cargos are very large, both in terms of out-of-pocket costs, and more so after including external economic and social costs.

In this analysis, we present projections of cargo quantities and economic costs that would result under two scenarios: In the first, we present the costs of diverted cargo and related handling investments and operating expenses in the event that Slip 3 closes without a replacement project. In the second, we evaluate the avoided cargo diversion costs, here treated as a benefit, against we compare the investment and recurring expenditures needed to reconstruct and operate the Slip. As shown, (and under the most stringent assumptions as regards economic growth in general and for specific commodities), the cost of replacing the current infrastructure at Slip 3 is far less than that which would be incurred in the absence of its reconstruction. Additional transportation and handling costs, plus as well as substitute investments that would be required, will reflect themselves in higher prices paid for through purchases of goods and services presently relying on the Port. In view of the sizeable increase in costs relative to the size of the needed investment to avoid them, we present compelling evidence that the reconstruction of Slip 3 with partial assistance of a Tiger III grant is fully justified.

THE WITHOUT-PROJECT SCENARIO

Historical Context

The Port of Palm Beach ("the Port") handles a variety of vessels and cargos, including cruise ships, container vessels, bulk carriers, roll-on/roll-off vessels, and smaller boats, both pleasure and commercial. Slip 3, the area of the Port proposed for reconstruction and improvement presently handles bulk cargos, largely sugar, molasses, fuel oil, cement, and diesel fuel, as well as break bulk cargo. Specialized equipment is located on the slip for the handling of all but the break bulk cargo. The eminent closure of Slip 3 due to aging of the present bulkheads (most of which were constructed 55 years ago and have now exceeded the their design-life by several years) means that presently handled cargo will shift to other slips within the Port or that these cargos will divert to other nearby ports or not be shipped at all. With current utilization of other Slips presently running close to their capacity, it is most likely that Slip cargos will be diverted to other Ports.

In Figure A.1, we show cargo tonnage handled at the Port over the last fifteen years. It is clear that sugar and molasses are the largest by tonnage. Sugar is both imported through the Port (from Mexico and other Caribbean suppliers) to supplement local crops for milling operations in Clewiston, FL, and is shipped out of the Port, exclusively to New York City, NY for processing there.[1] Sugar is handled exclusively

[1] The apparent cross-hauling of the sugar cargos are the direct consequence of Port serving two large domestic competitors, one which processes cane in Florida but does not own sufficient quantities to operate its mill efficiently, while the other does its processing in New York State.

at Slip 3 because a specialized conveyor system located there is needed to load and unload cargo. Molasses is also handled almost exclusively on Slip 3, with discharge hardware (largely pumps, pipelines, and storage) located there to handle molasses bound for Europe. Fuel oil for two Florida Power and Light (FPL)-owned power plants, one adjacent to the Port and one located 39 miles away in Indiantown, FL is handled almost entirely at Slip 3, with the Port being the endpoint of a utility-owned pipeline that delivers fuel oil to the distant power plant. Both power plants operate multiple steam-powered generators, and both have dual fuel capability. In addition to the fuel handling, the adjacent FPL-Riviera Beach power plant, presently offline for complete reconstruction, has its cooling water intake located in the bulkhead of Slip 3, and would require relocation in the event Slip 3 fails near the intake. The recent demolition of Rivera Beach plant accounts for sizeable reduction in fuel oil handled at the Port, most of which will not return to the Port once a replacement plant is completed, as the replacement is designed for natural gas.

Diesel fuel is a relative newcomer at the Port, with fuel refined in the U.S. Gulf of Mexico region being brought into Palm Beach to serve local trucking and diesel customers. Other bulk commodities, including liquid asphalt from U.S. refineries and cement are the other main commodities handled at Slip 3. As in the case with fuel oil, liquid asphalt is offloaded almost exclusively at Slip 3.

It is evident that a number of these cargos have seen a sharp reduction in quantities handled by the Port since just before the official onset of the recession in 2007. Florida was one of the first states to see a rapid fall-off in population growth and employment following the collapse of the building sector beginning in 2006 after a period of very strong growth. The most sensitive of these cargos are cement, used in the manufacture of concrete products, and liquid asphalt, used in both road paving mixtures and roofing materials. These features are important for projecting cargo handled at the Port as the Florida economy grows beyond the present levels, which remain close to their post-recession levels.

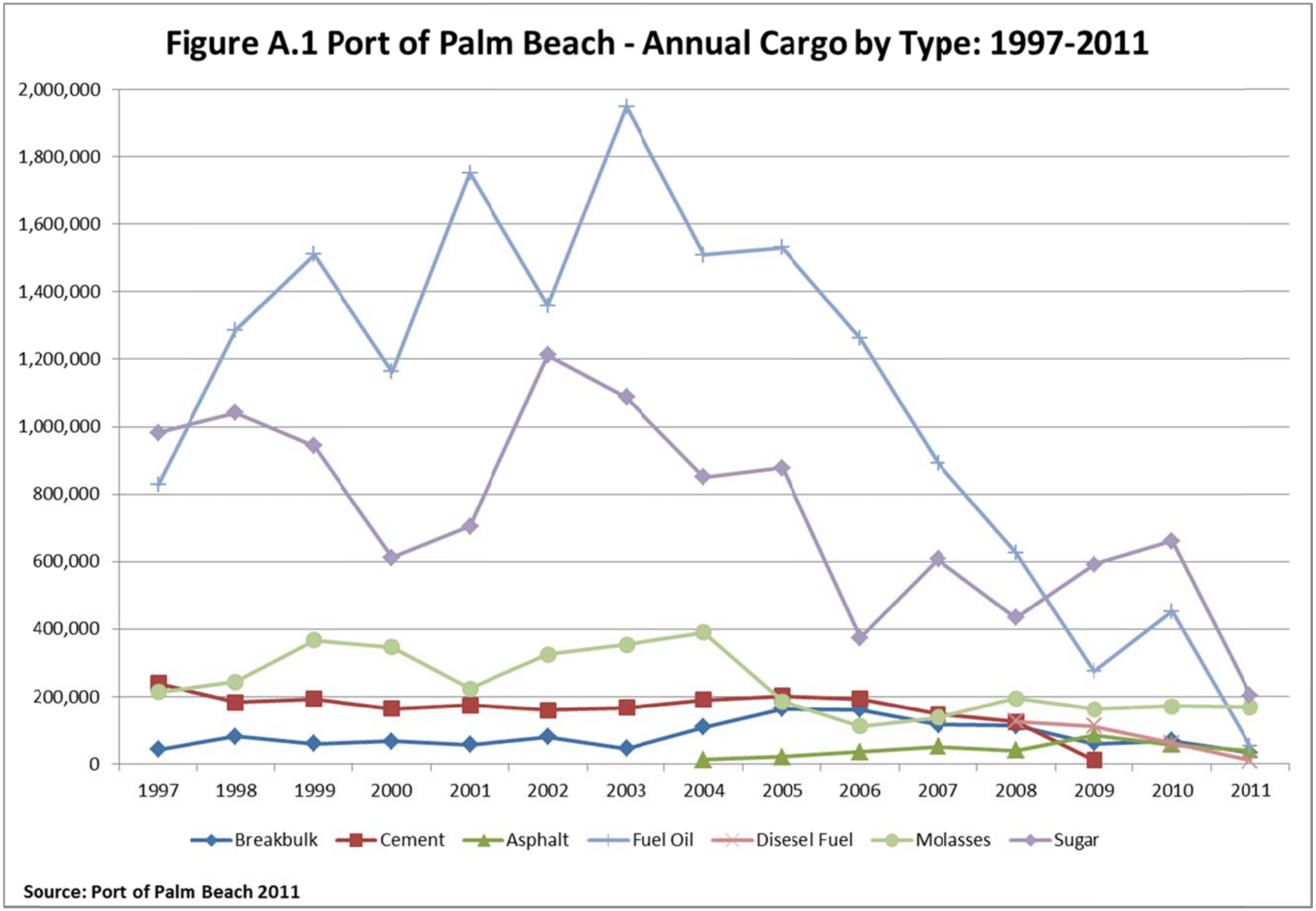
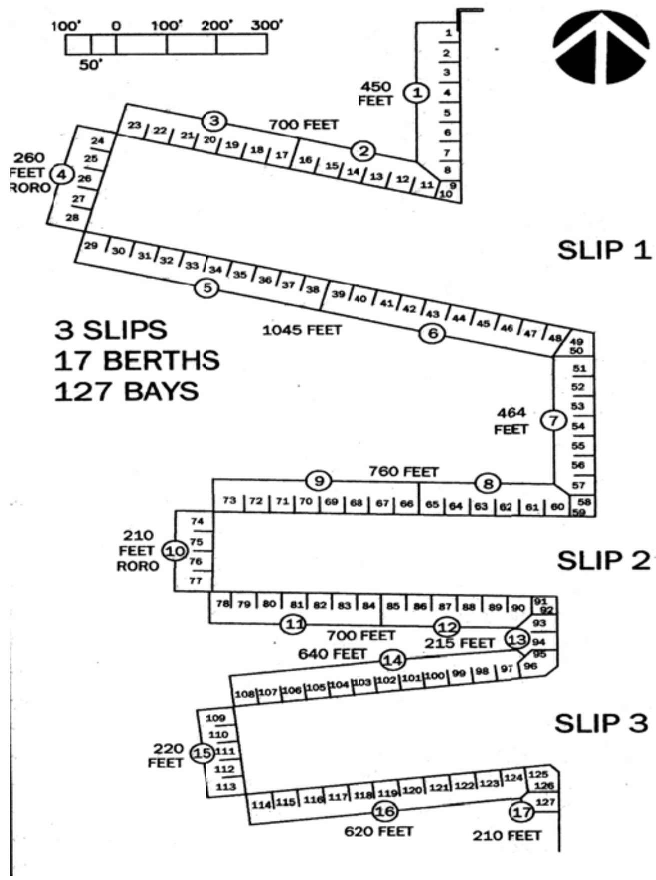


Figure A.1 Port of Palm Beach - Annual Cargo by Type: 1997-2011
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Breakbulk
Cement
Asphalt
Fuel Oil
Disesel Fuel
Molasses
Sugar
Source: Port of Palm Beach 2011

Port Output Projections

Key Assumptions
We have prepared projections of the Port's activities in three linked-forms: total activity (vessel movements), total cargo tonnage, and tonnage for the individual commodities that are of importance to Slip 3 operations. These projections span the 2011-2065 period, covering both the period that encompasses the anticipated failure/closure of Slip 3, (the "Without Project" scenario) and that of its eventual replacement, a project that would begin in 2013 and be completed by the beginning of 2015 (the "With-Project" scenario). It is anticipated that the reconstructed slip will remain in service for fifty years until 2065, based on the expected service-life of the replacement. The reconstruction is contingent on receipt of the TIGER 3 Grant.



In preparing the Port's activity projection, we rely on the Port's estimation of berth utilization to guide our estimate of available Port capacity. We have based our estimates of capacity on the vessel dockage history for the 2007-2011 year-to-date, and concurrent reported berth utilization at all of the Port's berths, not only those of Slip 3. Since the Port handles not only the Slip 3 bulk cargos, but a sizeable number of cruise ships, container ships, and roll-on/roll-off vessels, it is important to recognize that when berth utilization reaches an effect maximum (considered by one authority to be 80 percent of available time[2]), additional vessels cannot be handled in a timely and efficient manner. For our estimates, we use a more conservative 85 percent capacity utilization and apply the docking information for all three slips to estimate that the current configuration of the Port can handle as many as 3,618 vessels per year.

We show the Port slip layout in figure A.2. Passenger vessels using Slip 1-North Side face a maximum at 1,425 vessels per year. Slip 1-South Side has a maximum vessel handling capability of 902 per year, while Slip 2-North and South sides combined have a capacity of 504 per year. Finally, we estimate the Slip 3-North and South Sides to be 787 vessels per year, giving a grand total 3,618.

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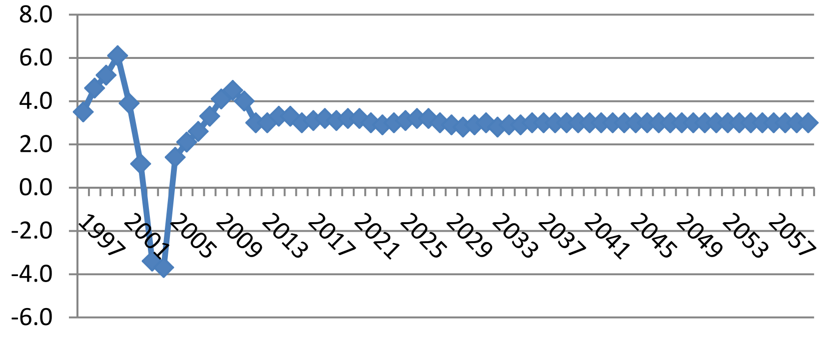
[2] Patrick Fourgeaud. 2000. "Measuring Port Performance." The World Bank Group. Washington, DC, pp. 11.

Current utilization has been separately projected for Port using the US Department of Agriculture (USDA) "USDA Agricultural Projections to 2020" for sugar cane, which show output and acres in production.[3] These USDA projections are extended for 2021-2065 by holding projected output constant at 2020 levels, consistent with the fixed number of acres harvested shown during the 2015-2020 period. Thus, in addition to holding the number of acres fixed, our level output assumption entails no-productivity growth. We note that given the rising pressures on the Florida sugar producers to reduce both water use and contaminated water run-off problems, such a level-productivity assumption may be reasonable. With sugar output projected, we can estimate the number of vessels required to move both sugar and molasses (the latter being a product of sugar refining) and the tonnage of sugar and molasses to be transported, based on the Port's data regarding vessel movements and cargo tonnages for both sugar and molasses for the 2007-2011 year-to-date period.

Figure A.4 Florida Gross State Product: 2002-2065, Annual Percentage Change



Source: Nicolas Rockler, Economist with projections from the Institute for Economic Competitiveness, University of Central Florida July, 2011 long-range forecast

After controlling for sugar and molasses vessels and tonnage, we can derive the tonnage of other cargo handled at the Port, which includes containers, break bulk, and the individual commodities shown previously in Figure A.1. For these shipments, we apply the average cargo size per vessel from the 2007-2011 data to estimate the total nonsugar/nonmolasses cargo tonnage. The disaggregation of these other cargos is based on the historical composition of cargo at the Port for 1997-2011.

Finally, we note that sugar handling costs may be significant in the "Without Project" scenario in this analysis. Presently, the Port's tenants operate a sugar conveyor system for handling sugar being moved for transport at the berth. If the Port's sugar cargos are to be handled elsewhere, a new conveyor system will need to be constructed at a new location. In the interim, manual handling of diverted sugar will entail an additional $5.15 per ton ($2010) handling cost totaling $9 million during 2011-2015 until a replacement is constructed. We include these costs in the "Without Project" scenario. Further, the replacement conveyor is estimated to cost $12 million at Port as a part of its reconstruction, and we include this estimate as a required "Without Project" investment that will become necessary in the event Slip 3 closes and is not reconstructed.

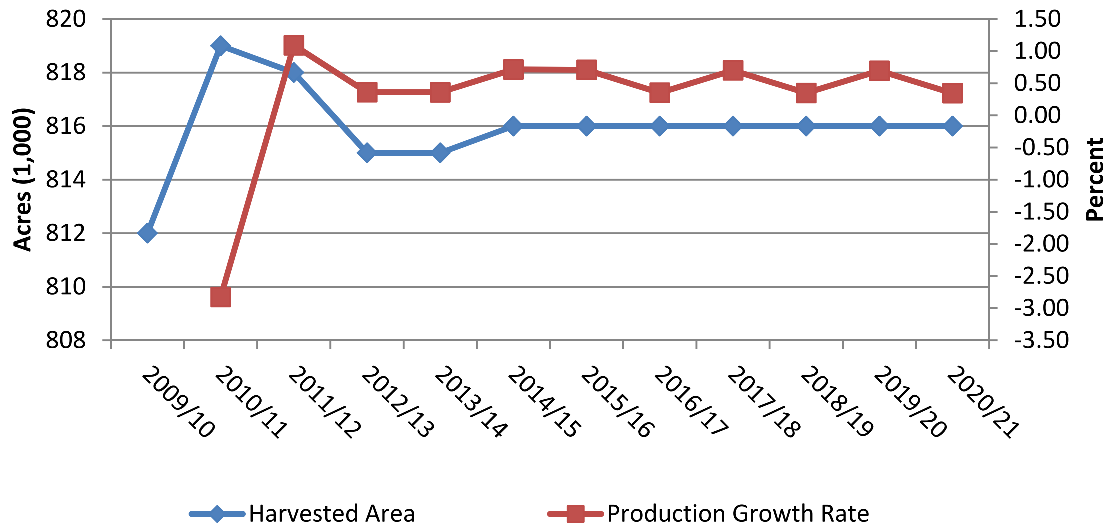
Methodology for Projecting Cargo Throughput by Commodity

Sugar and Molasses

Sugar and molasses, as noted above, are projected using the USDA crop production projections for 2011-2020, with the 2021-2065 figures based on holding the 2020 production figure level for the remaining 45 years. The USDA sugar projection is shown in Figure A.5. Sugar production in the Florida is largely limited to the amount of land now in cultivation, with little prospect of expansion. Domestic sugar is protected under a long-standing and complex tariff scheme that imposes a sizeable tariff on most imported sugar and sugar products. Although the size of the tariff and amount of sugar subject to tariff have eased somewhat over the last decade, our projection implicitly assumes that tariff protection for domestic production will remain in effect. Relaxing this assumption would reduce domestic production and the volume of sugar and molasses passing through the Port.

[3] See http://www.usda.gov/oce/commodity/archive_projections/USDAAgriculturalProjections2020.pdf

Figure A.5 US Sugar Cane Production Projection: 2011-2020

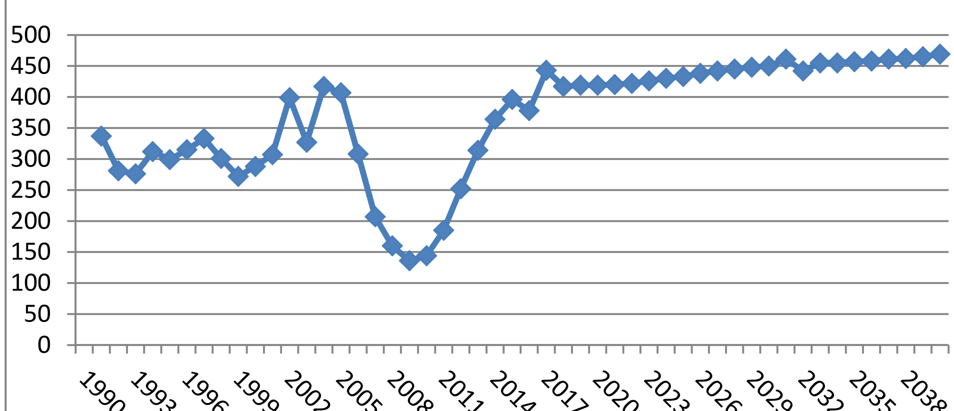


Source: USDA Agricultural Projections to 2020, Report OCE-2011-1

Liquid Asphalt and Portland cement

Liquid asphalt and Portland cement are both products whose demand is derived from construction activity, which is itself governed by the rates in-migration and population growth. Of these two commodities, the liquid asphalt is the only presently active cargo for the Port, with cement shipments presently suspended due to the very low level of building activity in the State. For asphalt and cement, we developed simple regression models that regress commodity shipment tonnage on population change. For both commodities, these models show close correlation between commodities shipments and population change (adjusted R2 values above .75), with significant coefficient estimates, and significant overall equation, i.e., the variance "explained" by the model is significantly larger than that unexplained. We show projected population rate of change in Figure A.6, based on the IEC-UCF long-range forecast cited earlier. As with GSP, we extend this projection from 2042-2065 using average population growth rates implicit in the projection for the 2031-2041 period.

Figure A.6
State of Florida Population Change: 1990-2041



Source: U.S. Bureau of the Census and IEC-UCF, 2011

Fuel Oil
Fuel oil is projected in deterministic fashion, based on FPL's projected fuel usage for the two plants served by the Port.[4] The Riviera Beach plant, presently off-line during complete reconstruction, is changing its primary fuel choice to natural gas from fuel oil, with fuel oil to be used as a back-up energy source. The other plant, Indiantown-Martin County, has five separate generators, two of which use fuel oil primarily, with natural gas as a back-up. Two the three remaining generators rely on natural gas exclusively, and the remaining generator uses natural gas with distillate fuel (not the same is product presently handled at the Port) as a back-up. FPL notes that it intends to maintain operating capacity in all fuel types to some degree, but their projected use of residual fuel oil is shown to decrease from current levels of 4.1% of total energy used to 0.6% in 2020. We apply the annual percentage change given for 2011-2020 and for all years thereafter, we continue reducing the annual volume at a -14.8% per year rate (the implicit rate of decline over 2011-2020) until we reach 2,618 tons in 2042. This value is equal the 0.6% use-rate targeted by FPL, their outlook. We hold this constant for 2042-2065 at a level consistent with maintaining fuel oil as a supplement or back-up fuel.

Diesel, Container, Break bulk, and Miscellaneous Cargo
We project diesel, container, break bulk, and miscellaneous cargos to grow at the Florida GSP rate given in the IEC-UCF projection. In so much as these cargo are tied to general economic conditions in Florida, we expect these to grow at rates illustrated in Figure A.4.[5]

[4] Florida Power and Light, Inc. 2011. "Ten Year Power Plant Site Plan 2011-2020." Submitted to the Florida Public Service Commission. April, 2011. See http://www.fpl.com/about/ten_year/pdf/plan.pdf.

[5] Over the last 23 for which gross state product data are available. Florida's growth rate as outperformed the national rate by a significant margin. In the latest 10 interval, Florida's product grew 33% faster than the U.S. as a whole, while in the prior 10 year interval, i.e., 1990-2000, it grew at a rate 13% higher. We do not believe that the IEC-UCF projected growth is abnormally high, and even its highest project growth rate, 4.5% per year, was exceeded in 10 of the past 23 years.

Processed Scrap Metal
The Port is presently finalizing plans to handle between 100,000 and 275,000 tons of processed scrap metal per year. Current plans are to expect shipments moving through the Port for a period of 40 years. These shipments are all destined for foreign processing centers. In view of the stage of the negotiations (agreement scheduled for review by the Port's Board of Commissioners, the last step in finalizing the agreement), we have included all of the projected cargo volume in our overall projection.

Wood Chips/Pellets
Another two cargos that are likely to ship through the Port are wood chips and wood pellets. Both are processed from waste citrus trees that have been removed from the groves, but which remain suitable for used as alternative fuels for power plants and heating purposes. Both products will be shipped to Europe, where alternative fuel sources are needed to enable emission reductions. Given that these cargos have yet to be established and that the negotiations between the Port and the shipper are only partially complete, the Port's marketing officers accord both cargos with a .75 probability of starting up in 2012 and continuing for an eighteen year period thereafter. Pellets are expected to maintain a constant volume of 120,000 tons per year (which we thus project at an expected value of 90,000 tons per year). Wood chips are expected to start at 100,000 tons (expected value of 75,000 tons) and double to 200,000 tons (expected value of 150,000 tons) by 2015.

Aggregates
Aggregates (consisting of crushed stone and gravel), are a new commodity to the Port, and are likely to begin shipping when construction activity recovers, sometime in 2012. The Port believes the prospective shipper is likely to commence operations by shipping aggregates from Honduras. The Port's marketing officers maintain a subjective probably of this occurring at .75. We use this as the weighting factor to generate the expected value of prospective shipments. At present, prospective shipments start in 2012 with 100,000 tons and increase by 100,000 tons per year, but are limited to only for three years. Although it's somewhat likely that these will continue beyond three years, the Port's negotiations with the prospective shipper presently center on a three year planning horizon. We have adjusted the estimated

shipping amounts by the .75 probability to derive expected values of shipments.

Biofuel
The Port has just completed negotiations and is contracted to handle 148,000 tons of biofuel to be shipped into the Port, blended on site, and then shipped by rail to U.S. markets. The contract calls for an eight year initial term, followed by two five year renewal options. The Port, by accommodating this additional cargo, will be supporting highly innovative technology in biofuel processing technology, which will help enhance the competitiveness of biofuels in the regional energy market. This, in turn, has the further benefit of improving environmental quality when these fuels displace conventional motor fuel. Much of this development, however, appears to be contingent on Slip 3 reconstruction, as the amount of cargo the Port presently handles precludes these shipments in the event of a permanent Slip 3 closure.

Consequences of Slip 3 Failure
As noted in the Collins Engineering, Inc. report, [6] the failure of part or all of Slip 3 over the next five years is considered to be a virtual certainty. As the bulkheads that form the slip are nearly all past their design-life by nearly six years already, a failure could come at any time. There are several consequences of failures worth noting:

Since some cargo can only be handled efficiently on the south berths of Slip 3, a closure of the south side would essentially cut-off the handling of sugar and molasses. Closure of the northern berths of Slip 3 would drastically reduce bulk and break bulk handling capacity. Should both sides fail, all handling of liquid asphalt, fuel oil, diesel, as well as any of the new cargos expected to develop will be nearly completely cut-off, if only because Slip 2, where these cargos could be handled, is at full capacity now.

In this section, we discuss how we handle the uncertainty of Slip 3 bulkhead failure and ultimate closure. Further, we discuss cargo diversion locations, distances to those locations, and the unit-costs of shipping cargos to those locations. Following that, we present the projected tonnage of diverted cargo, estimated cost of transportation.

Probability of Slip 3 Closure
Based on Collins' analysis, we regard the failure of one or more of the bulkheads in Slip 3 as a certainty by 2015. Since the probability is evenly distributed over the time-interval from the present to the end of 2015 the annual probability of failure is seen to be .20, such that the cumulative probability of a failure is equal to 1.0 by the end of 2015. We apply the cumulative annual probability of failure to the projected cargos volumes to be handled at Slip 3 to develop their expected values. We regard the failure of any bulkheads to cause the closure of the entire slip, in so much as a single-side failure reduces available water depth, creates potential below water obstructions, and may undermine above water structures rendering them too dangerous to use. (As presently configured and even when operable, Slip 3 presents challenges of working multiple vessels because of its narrow configuration. If effectively made more narrow by a failure, all capacity at the slip is in doubt.) Thus, we do not attempt to simulate the closure of only one side of the Slip, as it is unlikely that the other could remain is service for long, given the poor condition of both sides.

Assignment of Diverted Cargo to Nearby Ports
Upon closure of Slip 3, cargos that would have been handled there can no longer be accommodated in so much as Slips 1 and 2 will already reached their maximum capacity. Displaced cargos, i.e., sugar, molasses, other bulk cargo and liquids, and all of the new prospective cargos will all need to find a new port for handling. We expect that nearly all of the Slip 3 cargos that will be diverted to Port Everglades, 48 miles due south of the Port of Palm Beach. There are several exceptions to this: For handling cement, we expect that Port of Ft. Pierce, 56 miles from the Port will have better handling capability for this bulk cargo than Port Everglades. (Vessels currently calling on Palm Beach with cement cargos tend to be smaller vessels than those normally handled at Port Everglades.) For the processed metal scrap, the nearest available on-wharf rail service is found at the Port of Tampa, nearly 197 miles away. Although far five times more distant than Port Everglades, the rail

[6] See Collins Engineering, Inc." Underwater Inspection of Slip Number 3 at the Port of Palm Beach." March, 2010, submitted with the grant application.

transportation cost is approximately one-fifth the cost per ton compared to truck transportation and effectively eliminates a large price differential when the commodity ships through Tampa as opposed to Port Everglades.

THE WITH-PROJECT SCENARIO

Diverted Cargo Transportation Unit-Costs

We use two different figures to calculate diverted cargo transportation costs, one for truck shipments, and one for rail. These rates, assembled by the U.S. Department of Transportation, Bureau of Transportation Statistics up to 2002, have been updated using U.S. Bureau of Labor Statistics Producer Price Indices for truck and rail transportation. The updated rates for 2010 are $0.1592 per ton-mile for truck shipments, and $0.0332 for rail shipments, both in $2010.[7]

Projected Tonnage Diversion

Based on our assumptions above regarding the timing and expected value of diverted cargos upon the eminent failure of Slip 3, we have estimated the costs of diverting cargo to the different ports based on tonnage diverted and the above described unit costs. We summarize these data in for all commodities combined in Table A.1. (To see commodity specific detail for the "without project" and "with-project" scenarios, including diverted tonnage, see the included spreadsheet to this Appendix, "Economic Analysis of Port of Palm Beach Slip 3.xls" which is found on the tab labeled, "Commodity Summary."

[7] For cost data by mode and year, see: http://www.bts.gov/publications/national_transportation_statistics/html/table_03_21.html. For the producer price indices for truck and rail, see: http://data.bls.gov/cgi-bin/dsrv?pc and enter industry codes 482 and 484 for rail and trucking, respectively.

Table A.1 Cargo Handled With No Slip 3 Closure, With Closure, With Reconstruction, and Diverted Tonnage

Year	Projected shipments Up to Port Capacity [no closures] (tons)	Projected shipments, Up to Slip 3 Failure/Closure (tons)	Cargo diverted (tons)	Projected shipments with Slip 3 Reconstruction and Additional Capacity (tons)	Without – Project Diversion Cost ($2010)	Discounted Present Value (@3%, $2010)	Discounted Present Value (@7%, $2010)
2010	1,325,739	1,325,739	0	1,325,739	0	0	0
2011	1,122,698	898,159	224,540	898,159	2,309,879	2,242,601	2,158,765
2012	1,625,755	927,453	618,302	927,453	6,873,937	6,479,345	6,003,963
2013	1,722,924	647,170	970,754	647,170	20,822,967	19,055,965	16,997,744
2014	1,851,890	344,378	1,377,512	344,378	12,519,272	11,123,211	9,550,893
2015	1,702,364	0	1,622,364	0	15,427,084	13,307,538	10,999,298
2016	1,739,717	0	1,659,717	1,584,434	15,733,342	13,176,426	10,483,790
2017	1,816,789	0	1,736,789	1,723,423	16,240,063	13,204,657	10,113,495
2018	1,855,646	0	1,775,646	1,778,640	16,578,099	13,086,905	9,648,605
2019	1,862,033	0	1,782,033	1,770,484	16,611,159	12,731,070	9,035,370
2020	1,864,022	0	1,784,022	1,793,539	16,627,646	12,372,530	8,452,652
2021	1,858,544	0	1,778,544	1,791,580	16,585,617	11,981,802	7,879,707
2022	1,908,025	0	1,828,025	1,839,123	16,903,601	11,855,846	7,505,401
2023	1,904,922	0	1,824,922	1,834,370	16,881,016	11,495,150	7,005,021
2024	1,904,210	0	1,824,210	1,832,254	16,878,008	11,158,352	6,545,583
2025	1,901,050	0	1,821,050	1,827,897	16,856,211	10,819,360	6,109,466
2026	1,899,563	0	1,819,563	1,825,393	16,846,642	10,498,270	5,706,540
2027	1,954,809	0	1,874,809	1,879,772	17,211,321	10,413,132	5,448,663
2028	1,955,257	0	1,875,257	1,879,482	17,217,212	10,113,298	5,093,952
2029	1,955,975	0	1,875,975	1,879,572	17,224,563	9,822,928	4,762,735
2030	1,489,378	0	1,489,378	1,492,441	11,391,885	6,307,410	2,943,879
2031	1,490,906	0	1,490,906	1,493,514	11,404,839	6,130,663	2,754,418
2032	1,497,349	0	1,497,349	1,499,569	11,461,024	5,981,423	2,586,904
2033	1,489,186	0	1,489,186	1,491,076	11,386,730	5,769,562	2,401,995
2034	1,497,087	0	1,497,087	1,498,696	11,455,331	5,635,264	2,258,380
2035	1,498,775	0	1,498,775	1,500,145	11,468,286	5,477,317	2,113,022
2036	1,501,841	0	1,501,841	1,503,007	11,493,036	5,329,260	1,979,049
2037	1,504,784	0	1,504,784	1,505,777	11,516,236	5,184,483	1,853,312
2038	1,508,725	0	1,508,725	1,509,571	11,548,319	5,047,502	1,736,893
2039	1,512,011	0	1,512,011	1,484,775	11,574,142	4,911,445	1,626,894
2040	1,516,487	0	1,516,487	1,484,158	11,610,333	4,783,303	1,525,216
2041	1,521,776	0	1,521,776	1,483,432	11,653,369	4,661,198	1,430,719
2042	1,526,660	0	1,526,660	1,484,725	11,692,469	4,540,619	1,341,607
2043	1,532,021	0	1,532,021	1,483,223	11,735,244	4,424,495	1,258,425

2044	1,537,511	0	1,537,511	1,483,223	11,779,016	4,311,649	1,180,485
2045	1,543,133	0	1,543,133	1,483,223	11,823,815	4,201,987	1,107,453
2046	1,548,892	0	1,548,892	1,483,223	11,869,668	4,095,420	1,039,017
2047	1,554,791	0	1,554,791	1,483,223	11,916,606	3,991,860	974,884
2048	1,560,834	0	1,560,834	1,483,223	11,964,659	3,891,220	914,780
2049	1,567,026	0	1,567,026	1,483,223	12,013,860	3,793,419	858,450
2050	1,573,370	0	1,573,370	1,483,223	12,064,242	3,698,376	805,655
2051	1,579,871	0	1,579,871	1,483,223	12,115,838	3,606,013	756,168
2052	1,311,533	0	1,311,533	1,483,223	10,370,072	2,996,528	604,871
2053	1,318,362	0	1,318,362	1,483,223	10,424,201	2,924,436	568,251
2054	1,325,361	0	1,325,361	1,483,223	10,479,651	2,854,361	533,901
2055	1,332,537	0	1,332,537	1,483,223	10,536,461	2,786,247	501,678
2056	1,339,893	0	1,339,893	1,483,223	10,594,669	2,720,039	471,448
2057	1,347,436	0	1,347,436	1,483,223	10,654,316	2,655,682	443,086
2058	1,355,170	0	1,355,170	1,483,223	10,715,443	2,593,124	416,475
2059	1,363,101	0	1,363,101	1,483,223	10,778,093	2,532,316	391,505
2060	1,371,235	0	1,371,235	1,483,223	10,842,309	2,473,207	368,072
2061	1,379,578	0	1,379,578	1,483,223	10,908,137	2,415,751	346,081
2062	1,388,135	0	1,388,135	1,483,223	10,975,623	2,359,900	325,441
2063	1,396,914	0	1,396,914	1,483,223	11,044,816	2,305,609	306,068
2064	1,405,920	0	1,405,920	1,483,223	11,115,765	2,252,834	287,883
2065	1,415,160	0	1,415,160	1,483,223	11,188,520	2,201,533	270,810
TOTAL	**88,334,682**	**4,142,898**	**82,676,784**	**82,927,881**	**699,914,661**	**356,783,841**	**190,784,820**

Sensitivity of Estimates to Alternative Economic Conditions and Assumptions Regarding New Cargo

We tested the sensitivity of our estimating procedure for two different set of assumptions: First, we test the sensitivity with respect to the IEC-UCF long-run growth rate of the gross state product (GSP). Second, we test the assumption of using a constant rate of sugar and molasses productivity growth. For the first test, we found the model to be relatively insensitive to adoption of a lower GSP growth rate. We reduce the IEC-UCF Florida GSP by 20 percent on the assumption that a changed economic structure after the last recession resulting in a permanent lower rate of wage and income growth, will have a lasting effect on growth overall. This means going from an average growth rate of 3.1 percent per year in the control projection to 2.5 percent per year over 2011-2065. We find that the lower rate, actually causes estimated overall diverted tonnage to increase by 1percent over the 50 year projection period, with the reason being that the lower annual growth rate for *certain* cargos, i.e., those subject to the effects of a Slip 3 closure, are offset by having longer period of growth of *all* cargos before the Port reaches its maximum cargo limit. (Note that in our model, not all cargos are affected by GSP. Some, like sugar, molasses, and fuel oil use projections that are independent of State economic performance. Other cargos, such as containers and break bulk, which are affected by GSP, are not affected by the Slip 3 closure until such time as the Port reaches its maximum cargo handling capacity.) Thus, rather than reaching maximum cargo handling limit in 2034 for the control projection, the lowering of the GSP growth rate results in a 5 year delay before the Port's capacity is reached in 2039. The extra five years growth essentially offsets the reduction in the growth rate per year, not an unreasonable result.

For the second test, we simulated the effect of increasing productivity in Florida's sugar output by increasing the projected sugar and molasses tonnage handled at the Port at an annual rate of 1.58 percent per year, which is the 60-year U.S. agricultural productivity growth rate for 1948-2008.[8] In this instance, we see sugar and molasses tonnage rising by 38% over the control projection, generating a 10 percent increase in overall diverted tonnage from the Port. Thus, were Florida's sugar industry to repeat the past productivity growth performance of the U.S. agricultural sector as whole, the value of reconstructing Slip 3 would rise sharply, certainly well above that of our conservative control projection, and increase the ratio of project-benefits to cost.

External Environment and Social Cost Estimates

Based on the diverted tonnage figures, we have estimated the ton-miles and vehicle miles entailed in transporting diverted cargos to and from the nearest suitable alternative port. These estimates form the basis for estimating the external social costs associated with the additional transportation. We apply these cost factors to estimate congestion, pollution, CO_2, safety, infrastructure development, and infrastructure operations and maintenance costs. The cost factors, taken from the cost estimating software maintained by the Marine Highways Cooperative[9] are shown below in Table A.2. The resulting estimated external economic and social costs from diverting cargo from the Port as shown in Table A.3.

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[8] See http://www.ers.usda.gov/Data/AgProductivity

9 The Marine Highways Cooperative developed these factors and software with inputs from AECOM, Inc. and with the support of U.S. Department of Transportation and U.S. Maritime Administration.

Table A.2
External Economic and Social Costs of Transportation ($2010)

COST TYPE	UNIT OF MEASURE	LOCATION/VEHICLE SUBCATEGORY	TRUCK	RAIL
Congestion Costs	$ per vehicle-mile	Urban/Combination Truck	0.20625	0.00030
Emission (not. including SO_x)	$ per ton-mile	All locations/General Truck	0.00550	0.00194
Green House Gases (CO_2)	$31.70 per ton; Grams per ton-mile	All locations/General Truck	150.00	18.60
Safety	$ per vehicle-mile	All locations/Combination Truck	0.01426	NA
Infrastructure Investment	$ per vehicle-mile	All locations/Combination Truck	0.00843	NA
Infrastructure Operation and Maintenance	$ per mile	Allocation/All trucks	0.15207	NA

NA-Not available

Sources: http://www.marinehighways.org/benefits_calculator/variables.php, U.S. Bureau of Labor Statistics, Producer price indices for transportation modes at http://data.bls.gov/cgi-bin/dsrv?pc, and Consumer Price Index at http://www.bls.gov/cpi/tables.htm for CO_2

Table A.3
External Economic Social Costs of Diverted Transportation

Year	Cargo diverted (tons 000s)	Total External Economic and Social Costs ($000)	Discounted Present Value (3% Discount Rate, $000)	Discounted Present Value (7% Discount Rate, $000)
2011	225	262	255	245
2012	618	771	727	674
2013	971	1,178	1,078	962
2014	1,378	1,636	1,454	1,248
2015	1,622	1,948	1,680	1,389
2016	1,660	1,983	1,661	1,322
2017	1,737	2,257	1,835	1,405
2018	1,776	2,299	1,815	1,338
2019	1,782	2,301	1,763	1,252
2020	1,784	2,305	1,715	1,172
2021	1,779	2,302	1,663	1,094
2022	1,828	2,524	1,770	1,121
2023	1,825	2,523	1,718	1,047
2024	1,824	2,524	1,668	979
2025	1,825	2,526	1,621	916
2026	1,826	2,529	1,576	857
2027	1,885	2,758	1,668	873
2028	1,888	2,762	1,622	817
2029	1,892	2,767	1,578	765
2030	1,508	2,377	1,316	614
2031	1,513	2,382	1,280	575
2032	1,523	2,392	1,249	540
2033	1,518	2,387	1,209	504
2034	1,514	2,383	1,172	470
2035	1,513	2,382	1,138	439
2036	1,512	2,381	1,104	410
2037	1,511	2,381	1,072	383
2038	1,510	2,380	1,040	358
2039	1,510	2,380	1,010	335
2040	1,509	2,380	980	313
2041	1,509	2,379	952	292
2042	1,508	2,379	924	273
2043	1,508	2,379	897	255
2044	1,508	2,379	871	238
2045	1,508	2,379	845	223

2046	1,508	2,379	821	208
2047	1,508	2,379	797	195
2048	1,508	2,379	774	182
2049	1,508	2,379	751	170
2050	1,508	2,379	729	159
2051	1,508	2,379	708	148
2052	1,233	1,256	363	73
2053	1,233	1,256	352	68
2054	1,233	1,256	342	64
2055	1,233	1,256	332	60
2056	1,233	1,256	322	56
2057	1,233	1,256	313	52
2058	1,233	1,256	304	49
2059	1,233	1,256	295	46
2060	1,233	1,256	286	43
2061	1,233	1,256	278	40
2062	1,233	1,256	270	37
2063	1,233	1,256	262	35
2064	1,233	1,256	254	33
2065	1,233	1,256	247	30
TOTAL	**80,624**	**110,105**	**54,729**	**27,441**

Benefit-Cost Performance of the Proposed Project

We combine project estimated benefit, which consists of the avoided additional transportation costs and the avoided external economic social costs of transportation, to yield the Slip 3 reconstruction total economic benefit, shown in Table A.4. At a 3 percent discount rate, the project benefits are seen to be $342.7 million in net present value terms. At the higher 7 percent rate, they have a net present value of $188.9 million.

The project cost has two parts: The first cost is the project's total investment, estimated to be $46,375,984 in $2010 including design, engineering, and construction costs. The second cost is the recurring annual maintenance and repair (M&R) costs to ensure the good operating condition of the infrastructure. This is estimated by AECOM, Inc.'s port engineers to be a function of infrastructure age. It is expressed as a percentage of the invested amount. For the first 10 years after completion, the M&R is estimated to be 1 percent of the original investment value. In years 11-20, it is estimated to be 2 percent per year of the original investment value. In years 21-50, it is estimated as 3 percent of the investment value. Based on these recurring costs and the original investment amount, we show the discounted present value of the total costs in Table A.4. At the 3 percent discount rate, this is net present value of $68.8 million. At the 7 percent discount rate, this is a net present value of 51.0 million.
With the estimated discounted benefit and cost figures shown in Table A.4, we compute the benefit-cost (B-C) ratio. As shown in Table A.4, for combined transportation and external social benefits, the project has a B-C ratio of 5.9 at a 3 percent discount rate, and 4.2 at a 7 percent discount rate. As shown, the transportation B-C ratio represents about five-sixths of the total benefit, with the remainder being social benefits.

We note that these rates are based on cargo composition, vessel size, and present capacity utilization that reflect actual conditions. We have not incorporated any assumptions regard changing vessel sizes serving the Port or operating conditions in and around the Port. The only speculative element to our estimates concerns the amount and time-period over which new cargos will be handled at the Port. For these, we have already discounted the current estimated quantities to be shipped by 25 percent and have limited the time interval over which they will be handled to the minimum presently being negotiated by the Port's marketing personnel, such that the cargo diversion estimates are not upwardly biased as a consequence of including the new cargos. We note that without considering the diversion of new cargos (not already contracted), the B-C ratios for combined transportation and external social benefits are 4.5 and 3.2 for the 3 percent and 7 percent discount rates, respectively. That the ratios remain in this range under the most severe assumptions appears to underscore the value of this project to the U.S. economy.

Table A.4

Benefit-Cost Comparison at Discount Rates of 3% per Year and 7% per Year

Economic Benefits (Foregone transport costs of diverting cargo to other ports owing to Slip 3 capacity losses at PoPB)	Diverted Cargo Benefit Only	Diverted Cargo and External Social Benefit Combined
Total Undiscounted Benefit ($2010)	678,386,198	759,010,686
Net Present Value @3% per year discount	348,340,624	403,069,141
Net Present Value @7% per year discount	184,615,153	212,056,297
Economic Costs (Initial investment plus required Project M&R)		
Total Undiscounted Costs ($2010)	160,874,121	160,874,121
Net Present Value @3% per year discount	68,410,123	68,410,123
Net Present Value @7% per year discount	50,709,782	50,709,782
Benefit-Cost Ratio		
@3% per year discount	5.1	5.9
@7% per year discount	3.6	4.2

PoPB-Port of Palm Beach

M&R-Maintenance and Repair

OTHER ECONOMIC CONSEQUENCES OF THE PROJECT

Construction, Maintenance and Repair

We have estimated the project direct short-run employment for both the initial construction associated with the investment of $46.4 million and the $56.6 million that will be required to maintain the infrastructure in sound operating condition. Using the U.S. Input-Output accounts[10], we estimate that the project will generate 376 on-site construction jobs over the 2 year construction period, as shown in Table A.5.

[10] We used the Minnesota Implan Group, Inc. U.S. model of the U.S. economy. This model incorporates price updating of the benchmark account data from the 2002 U.S. inter industry accounts from the U.S. Bureau of Economic Analysis. It also incorporates estimated intermediate transactions based on nonsurvey adjustments using national economic accounting data for estimated detailed value-added and final-demand control total measures.

Table A.5

DIRECT JOB CREATION EFFECT OF THE PROJECT: 2013-2015

Impact Type	Employment	Labor Income	Total Value Added	Output
Direct Effect-Construction	376	19,070,389	21,666,716	46,375,984
Direct Effect-Maintenance and Repair	520	25,971,718	30,695,285	59,008,481
Total Project Direct Employment	900	45,042,107	52,362,001	105,384,465

Source: Minnesota Implan Group, Inc., "Implan model."

For the direct construction jobs, we anticipate that the work will be conducted starting in the 3rd quarter of 2013 to be completed by the 2nd quarter of 2015. The anticipated expenditures result in the following direct employment during construction, shown in Table A.6.

Table A.6

Direct Construction Jobs: 2013-2015

Yr:Qtr	2013:Q3	2013:Q4	2014:Q1	2014:Q2	2014:Q3	2014:Q4	2015:Q1	2015:Q2	TOTAL
Jobs	38	50	50	50	50	50	50	38	376

Source: AECOM, Inc. Minnesota Implan Group, Inc. "Implan model" data.

The construction activity on the Port stimulates a wide variety of activity in industries that supply goods and services to construction. In Table A.7, we show that construction activity will further generate 208 jobs, many in the Port area. We see that these jobs will be found in both the manufacturing and services sector, including professional services, transportation, building products (i.e., concrete manufacturing, metal products, fabricated structural products, etc.), and distribution, both wholesale and retail. This construction activity, by virtue of is strong backward linkages, is disbursed over the regional and national economy, stimulating activity across a range of industries, providing wage and salary income over an equally wide range of income classes.

Table A.7

Jobs in Other Industries Generated by Project Construction: 2013-2015

Industry Sector	Jobs
Architectural- engineering- and related services	32.8
Wholesale trade businesses	11.8
Employment services	8.4
Transport by truck	7.0
Real estate establishments	6.4
Services to buildings and dwellings	5.2
Automotive repair and maintenance	5.1
Food services and drinking places	5.0
Plate work and fabricated structural products	4.2
Accounting- tax preparation- bookkeeping	4.2
Legal services	4.1
Management of companies and enterprises	3.5
Commercial and industrial machinery and equipment	3.4
Ready-mix concrete manufacturing	2.7
Retail Stores - General merchandise	2.6
Ornamental and architectural metal products	2.6
Business support services	2.5
Commercial and industrial machinery and equipment	2.5
Monetary authorities and depository credit in	2.3
Management- scientific- and technical consulting	2.3
Civic- social- professional- and similar organizations	2.1
Telecommunications	2.1
Retail Stores - Food and beverage	1.9
Extraction of oil and natural gas	1.8
Securities- commodity contracts- investments	1.8
All Other Industries	75.5
Total	203.8

Source: Minnesota Implan Group, Inc. "Implan model."

Maintenance and repair for the facility is estimated to generate 520 jobs over the project lifetime of 50 years, as shown in Table A.6. The annual employment is a direct function of spending levels on maintenance and repair, which in $2010 is $463,760 in years 1-10; $927,520 in years 10-20, and $1,291,280 in years 21-50. Thus, the annual employment is 4.3 jobs per year in years 1-10, 8.6 jobs per year in years 11-20, and 12.9 jobs per year in years 21-50.

As in the case of construction, maintenance and repair activity also stimulate a wide number of industries, albeit at a much slower pace, as shown in Table A.8. The total job creation shown here is over a fifty-year period and despite that long interval, is comparable in scale to the two-year employment generated off-site in construction.

Table A.8

Jobs in Other Industries Generated by Project Construction: 2016-2065

Industry Sector	Jobs
Architectural- engineering- and related services	25.5
Wholesale trade businesses	12.9
Transport by truck	8.9
Real estate establishments	6.8
Retail Stores - General merchandise	6.7
Employment services	6.7
Automotive repair and maintenance	5.5
Food services and drinking places	5.1
Legal services	4.9
Services to buildings and dwellings	4.8
Retail Stores - Food and beverage	4.8
Accounting- tax preparation- bookkeeping	4.5
Retail Stores - Motor vehicle and parts	3.6
Mining and quarrying stone	3.6
Retail Stores - Miscellaneous	3.5
Commercial and industrial machinery and equipment	3.4
Management of companies and enterprises	3.1
Ornamental and architectural metal products	2.9
Commercial and industrial machinery and equipment	2.6
Retail Stores - Health and personal care	2.6
Monetary authorities and depository credit institutions	2.4
Business support services	2.4
Retail Stores - Clothing and clothing accessories	2.3
Telecommunications	2.2
Sawmills and wood preservation	2.1
All Other Industries	87.7
Total	221.7

Source: Minnesota Implan Group, Inc. "Implan model."

On-Port Employment Impact of the Project

By avoiding the permanent loss of Slip 3 at the Port, jobs associated with cargos handled there will be saved. Based on the 2006 Port master plan[11], 1,154 jobs are linked to the Port's cargo operation, and of these, 315 jobs are in the bulk and dry cargo area in which Slip 3 plays an import role. Based on the tonnage of cargo now handled at Slip 3 or projected to be handled barring its closure, Slip 3 accounts for an approximate average of 200 on-port jobs per year. These jobs, if lost through closure, would constitute a major loss to the Palm Beach-Riviera Beach area. Further, while it is true that these jobs, if diverted to other ports, would likely be recreated elsewhere on a one-for-one basis, it is uncertain whether all would located in areas as economically distressed as those from which the Port draws in employment. Thus, with a primary justification of the project being avoidance of net economic costs, both for transportation and externalities which would be borne by U.S. consumers and businesses without the project, we note that the project's on-port employment is not included in the benefit-cost calculation. In stating this, we assume that cargo diversion will not force the loss of a market altogether though higher delivered prices, nor will it alter the international geographic distribution of trade as a result. Thus, we hold all else constant in the cargo diversion approach. This is in keeping with the concept that an internal spatial redistribution of employment is an offsetting movement in which one region gains employment (a benefit), while another losses employment (a loss.) If economic conditions in both locations are identical, the offset is exact. However, if the losing area is already distressed and the gaining region is less so, then social costs would need to be adjusted to reflect this. We know of no means of performing such an adjustment in this instance, but in view of the distress level of the area from which the Port draws much of its labor, we contend that some net national economic cost would flow from the on-port job losses attributable to Slip 3's closure.

[11] See http://www.portofpalmbeach.com/business-opportunities/master-plan/downloads/031506_ppb_masterplan.pdf, pp. 54-55.

Effect on United States Foreign Trade supported by the Project

The reconstruction of Slip 3 will serve to maintain efficient trade flows between the U.S. and international markets. Cargos presently using Slip 3 or likely to use it after reconstruction, include some of the Port's largest non-container commodities, such as sugar, molasses, and most of the new cargo anticipated to become significant in the near future. We expect that nearly two-thirds of the cargo handled at Slip 3 originates or is destined for shipment outside the U.S. See Table A.9. While our diversion cost estimates are premised on the supposition that alternative ports, while raising costs of shipment, will not raise the delivered price of these goods such they are no longer feasibly handled in international trade. Were that to happen, the value of such lost trade would then entail U.S. job loss in the producing sector, if the good is exported, as well as the distribution costs (transportation, inventory finance, inventory insurance, warehousing , wholesaling, and retailing being among the major sectors affected) for both import and export goods. As in the case of on-port jobs, our assumption that diverted cargos would be handled by other domestic ports results in no net economic benefit or cost from a foreign trade perspective. However, were trade lost due diversion costs, this would enter this analysis as benefit of funding of the reconstruction project. For the commodities presently or likely to use Slip 3, we believe the likelihood of losing some international trade is real, in so much as many of these cargos have low value-to-weight ratios, making them transport cost sensitive.

Table A9

International Trade Through the Port of Palm Beach

Commodity	% Tonnage Handled of Foreign Source or Destination
Sugar	50
Molasses	50
Asphalt	0
Cement	100
Diesel	0
Fuel Oil	0
Miscellaneous	50
Biofuel (feedstock+biodiesel)*	50
Processed Metal Scrap*	100
Wood Chips*	100
Wood Pellet*	100
Aggregates*	100

*Contracted Future or Prospective Cargo

Effect on Port finances without project

The potential loss of services from Slip 3 has adverse consequences for the Port's finances. The loss of revenues that are used, in part, to meet the Port's debt service requirements, will result in the need to levy taxes on commercial and residential property in the Port's tax district. This prerogative has not been used up to now, but may be become necessary to meet $4.1 million per year for fifteen years to retire current bonded indebtedness. As in the case of on-port jobs related to the flow of cargo, if cargos are diverted to other ports, a shift occurs without affecting the national economic conditions. Presumably, the port which handles the diverted cargos would see an increase in revenues that would support a lowering of its own financial obligations, thus balancing those created at the Port due to lost revenues from a larger spatial perspective. We note that the $62 million shortfall over the next 15 years are not included as costs in the benefit-cost analysis, but which would be genuine costs to Port district's property owners.

CONCLUSIONS

The closure of Slip 3 with five years is a highly likely event in view of its advanced age and condition, which will have a sizeable impact on U.S. businesses and consumers. Increases in transportation and external social costs will total nearly $800 million in constant dollar terms over the 55 year period between now and the lifetime of its replacement with a reconstructed slip.

In the absence of the project, not only will cargo be diverted to other ports for handling, but sugar transport will require a conveyor system to be constructed costing approximately $12 million at the alternative port to avoid continuing charges for manual handling of the cargo at a cost of nearly $9 million over the 2011-2015 period over the cargo is diverted without benefit of a conveyor system.

The diverted cost of transporting cargos now being handled at Slip 3 or expected to be handled in the near future, when adjusted to their expected values is a cost that will be borne by U.S. consumers and business. Assuming that the delivered price of commodities still permits these good to be marketed after adding those costs, the $800 million (which is equivalent to$403 million discounted at 3 percent over the 55 year period of the proposed project), far outweighs the cost of replacing the slip and the maintenance entailed by its replacement, which amounts to $161 million (which is equivalent to $68 million discounted at 3 percent.) The resulting net present value of the benefit and costs results in a ratio that ranges from 3.6 to 4.2 for the 3 percent and 7 percent discount rates, respectively.

These ratios do not include potential costs for cargos that could no longer be economically transported to alternative ports, nor does it include the job losses what would inevitably occur were markets for U.S. production lost as a consequence. The risk of this occurring is high for low value-to-weight commodities such as several of the new cargos (i.e., wood pellets, wood chips, and aggregates), as well as cement and possibly sugar. As such, the benefit-cost ratios understate the potential costs to the U.S. economy associated with the loss of service at Slip 3.

We have tested alternative scenarios for lower economic growth rates, higher productivity in sugar productivity (as opposed to the USDA assumption of no productivity growth), and the impact of handling no new cargo varieties at the Port. The results are unambiguous: The costs of diverting cargo from the Port greatly exceed the necessary investment and recurring spending for maintenance and repair. This is true when considering only the out-of-pocket costs that additional transportation would entail, and the return is even greater when considering external economic and social costs.