Mississippi River Valley Division,
Regional Planning and Environment Division South

Port of New Orleans Access Channel Deepening Feasibility Study

Appendix C - Economic and Social Consideration

March 2020

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Section 1
Introduction

1.1 PROJECT AREA

The Port of New Orleans Access Channel Deepening Feasibility Study (PONO) examines the stretch of the Mississippi River that encompasses the access channel for the Port of New Orleans (PORT) container docks from River Mile (RM) 99.5 to RM 100.5.[1]

The report entitled "Integrated General Reevaluation Report & Supplement III to the Final Environmental Impact Statement, Mississippi River Ship Channel, Baton Rouge to the Gulf, Louisiana Project (2018)" justifies deepening the Mississippi River Ship Channel (MRSC) from the Gulf of Mexico to Baton Rouge, LA to 50 feet. Because the PORT's approach channel is currently authorized at a depth which is less than the authorized depth of the MRSC, the PORT cannot receive vessels that fully utilize the 50 feet of the MRSC.[2]

The PORT's container docks located within RM 99.5 to RM 100.5 are named Napoleon A, Nashville C, and Nashville B and are the focus of this study (Figure C:1-1). Though the approach channel is federally maintained at a depth of 35 feet Mean Low Gulf (MLG), the PORT dredges their container berths on an as-needed basis to depths between 35 feet and 45 feet. For the economic analysis, the depths below are considered to be the future without-project depths for each dock. Depths in this appendix are in Low Water Reference Plain (LWRP) unless otherwise specified.

- Napoleon A: 45 feet
- Nashville B: 40 feet
- Nashville C: 45 feet

[1] In August 2019 the non-Federal Sponsor requested the project area be limited from RM 98.3 to RM 100.6 to the area between RM 99.5 to RM 100.5. This was done because the downstream wharfs would either need to be replaced or require new construction at costs too prohibitive to consider at this time. See Section 3.3 of the main report.

[2] Although the approach channel is authorized to a depth of 40 feet per the Water Resources Development Act (WRDA) of 1986; this project feature was not implemented due to the PORT's desire to limit their maintenance to 100 feet from the front of the wharfs. Instead it is federally maintained at a depth of 35 feet. See Section 1.5 of the main report.

Figure C:1-1. Project Area

1.2 HINTERLAND

1.2.1 Related Ports

The PORT, along with the Port of Plaquemines, the Port of South LA, and the Port of Baton Rouge collectively make up the largest port cluster in the United States, effectively servicing a large portion of the country by connecting inland waterways, rail, and road while also serving as a gateway to foreign trade with Latin America, North Europe, the Mediterranean, and the Far East.

Within a 500 mile radius alone, these ports can provide quick market access to a number of US metropolitan areas (Figure C:1-2).

Figure C:1-2. Metro Areas within 500 Miles

1.2.2 Waterway Access

The strength of the PORT lies in its location, namely the intersection of the Mississippi River and the Gulf of Mexico. Access to the 14,500 miles of inland waterways through the Mississippi River and its tributaries provides convenient barge and vessel transportation throughout the Mississippi valley; the Gulf Intracoastal Waterway, running approximately 1,050 miles from Carrabelle, Florida, to Brownsville, Texas, provides direct access along the Gulf Coast. The vast majority of transported cargo is dry bulk for the Midwest through the use of the Mississippi River network and petroleum and petroleum products. Although oil is largely processed on site or transported by pipeline, a significant portion (along with chemical products) is shipped by barge. These two commodity groups comprise approximately two-thirds of the tonnage transported along the Mississippi River from Minneapolis, MN to Mouth of Passes (Table C:1-1).

Table C:1-1. Mississippi River: Minneapolis, MN to Mouth of Passes

2018 - Tonnages by Major Commodity Group

Commodity Group	Tons (1,000's)	Distribution
Food and Farm Products	177,493	32%
Petroleum and Petroleum Products	171,561	31%
Crude Materials	63,601	11%
Chemicals and Related Products	63,958	11%
Coal, Lignite & Coal Coke	48,109	9%
Primary Manufactured Goods	28,781	5%
Manufactured Equipment	4,119	1%
Total	557,622	100%

Source: Waterborne Commerce Statistics Center (WCSC)

1.2.3 Rail

Rail plays an effective role as well in contributing to the PORT's effectiveness. Customers of the PORT benefit from direct access to a 133,000 mile rail network. In fact, the PORT is the only seaport in the United States to be served by all six Class 1 railroads, effectively linking it to nearly every region in the country. The New Orleans Public Belt Railroad connects these railroads to the PORT with 26 miles of track along the New Orleans riverfront and inner harbor (Figure C:1-3).

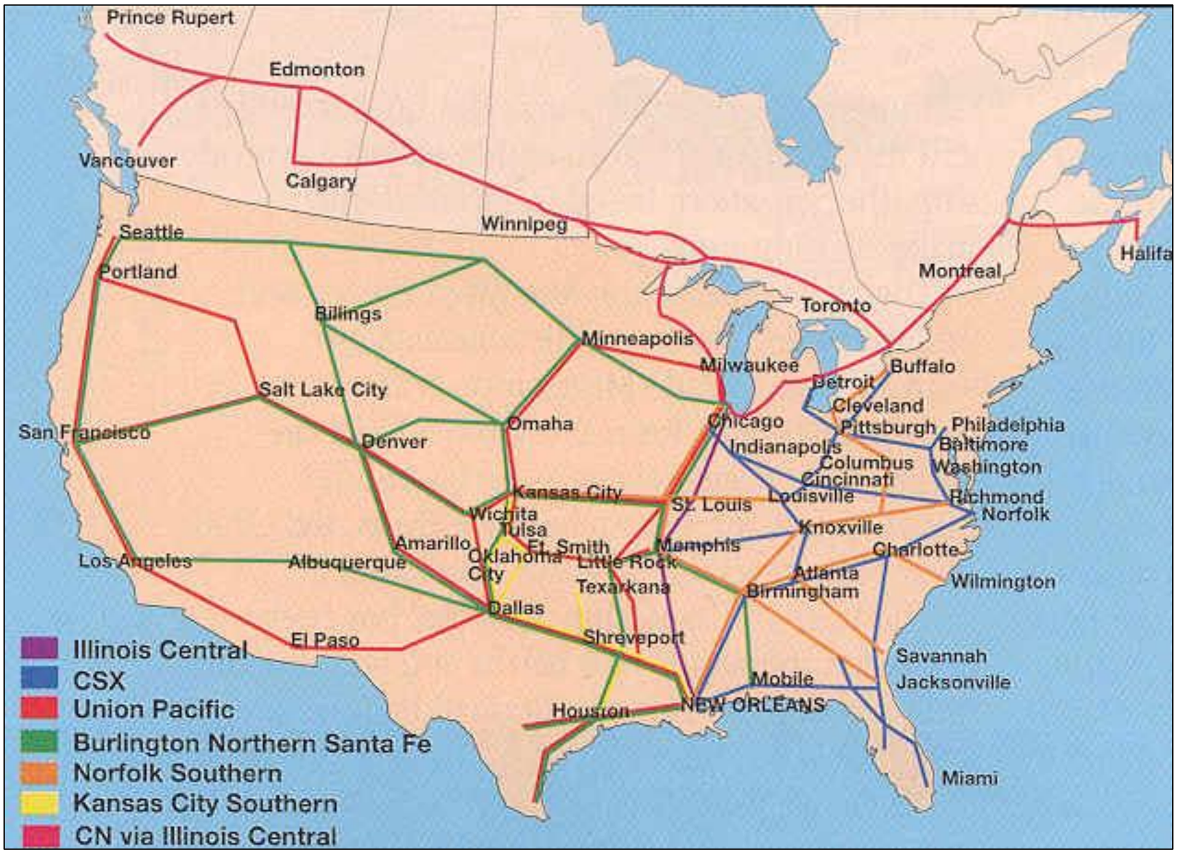
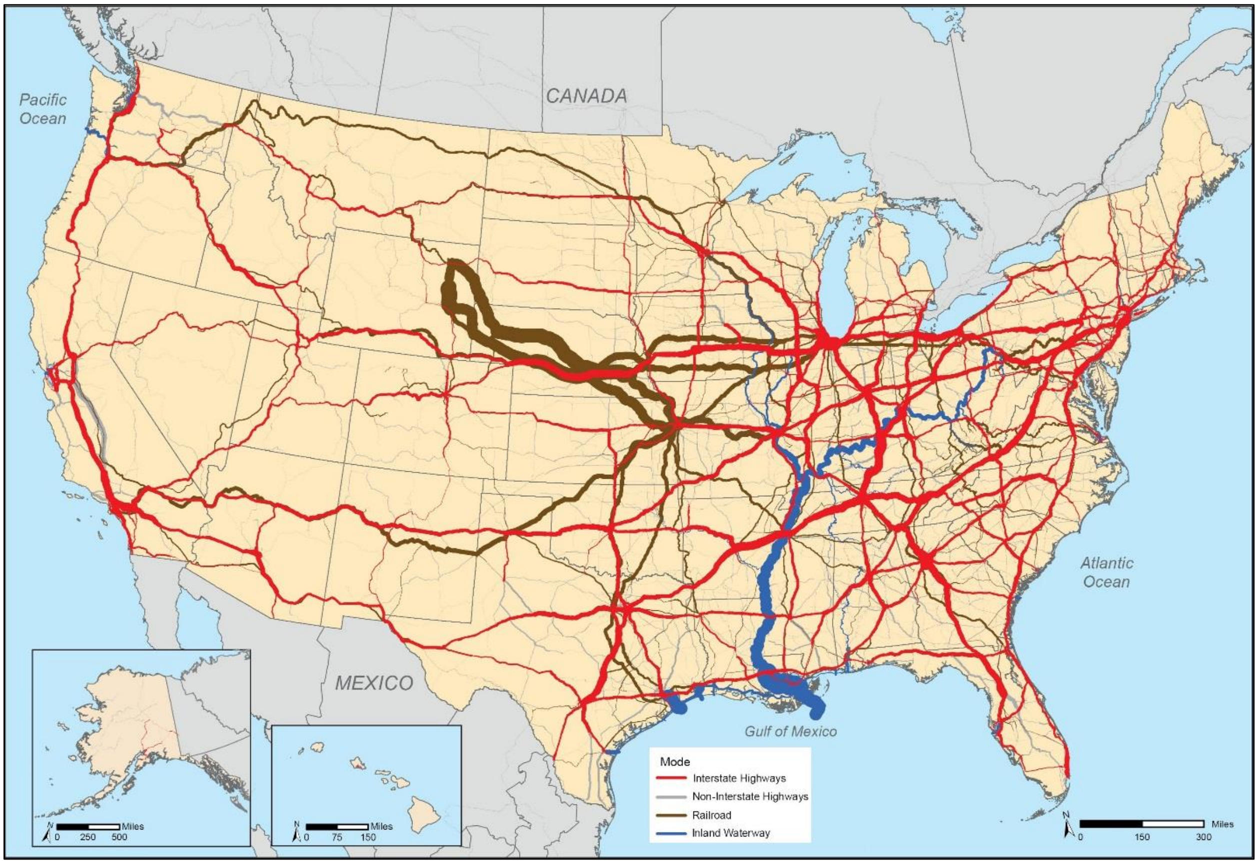


Figure C:1-3. Railroad Network

1.2.4 Freight

Additionally, convenient access to the Interstate Highway System provides advantageous transportation of goods from the PORT to locations throughout the country. I-10, stretching from the Atlantic Ocean to the Pacific Ocean, connects the east coast of the United States with the west coast. I-55 is a north-south route and connects the Great Lakes with the Gulf of Mexico. I-59 and I-49 are also easily accessible and provide further entrance to southern/midwestern markets.

As described previously, the PORT is truly in a unique position to act as a direct link between the states in the Mississippi valley as well as nearly any other part of the United States through its combination of waterway, rail, and highway access (Figure C:1-4).



U.S. Department of Transportation

Figure C:1-4. Freight Flows by Highway, Railroad, and Waterway

Section 2
Existing Conditions

2.1 SOCIOECONOMIC

The socioeconomics of the community area along the Mississippi River are summarized in this section. The study area includes four contiguous parishes that may be directly impacted by the project: Orleans, Jefferson, St. Bernard, and Plaquemines. The parameters used to describe the demographic and socioeconomic environment include recent trends in population, employment, and wage earnings by sectors. Other social characteristics such as race and age distribution and poverty are examined.

2.1.1 Population

Louisiana is ranked as the 25th largest state in the Union in terms of resident population as of July 1, 2018, with 4.7 million residents. Between the years of 1990 and 2018, Louisiana's population increased by 10 percent, from 4.2 million to 4.7 million persons, as shown in Table C:2-1. Across the four parishes during the same time period, a 14 percent decrease in growth was observed from 1.0 million to 900,000 persons. This is significantly lower than the observed national growth of 31 percent from 1990 to 2018, and is largely the result of permanent relocations from Hurricane Katrina in 2005.

Table C:2-1. Population Trends for Selected Louisiana Parishes – 1990 to 2018

Parish	Population				Percentage Change			
	1990	2000	2010	2018	1990 to 2000	2000 to 2010	2010 to 2018	1990 to 2018
Orleans	496,938	484,674	343,829	391,006	-2%	-29%	14%	-21%
Jefferson	448,306	455,466	432,552	434,051	2%	-5%	< 1%	-3%
St. Bernard	66,631	67,229	35,897	46,721	1%	-47%	30%	-30%
Plaquemines	25,575	26,757	23,042	23,410	5%	-14%	2%	-8%
Louisiana	4,219,973	4,468,976	4,533,372	4,659,690	6%	1%	3%	10%
United States	248,709,873	281,421,906	308,745,538	326,687,501	13%	10%	6%	31%

Source: Bureau of the Census, American Community Survey

2.1.2 Employment

Louisiana employment in 2018 totaled about 2 million, as shown in Table C:2-2. Of the major industry sectors within the state, the educational services and health care and social assistance sector employs the most persons at 479,000. This industry is followed by retail trade (235,000) and arts, entertainment and recreation, and accommodation and food services (219,000). The parishes in the study region yield fairly similar proportions of workers per sector compared to what was observed at the state level.

Table C:2-2. Employment by Industry – 2018

Industry	United States	Louisiana	Orleans	Jefferson	St. Bernard	Plaquemines
Agriculture, forestry, fishing and hunting, and mining	2,793,463	81,665	1,843	3,269	557	984
Construction	9,874,923	164,773	8,787	21,094	2,146	918
Manufacturing	15,550,889	157,532	6,821	11,248	1,559	806
Wholesale trade	4,025,876	52,216	3,249	7,264	381	350
Retail trade	17,240,297	235,202	16,862	22,698	1,981	678
Transportation and warehousing, and utilities	7,984,110	109,798	9,734	13,445	1,301	669
Information	3,164,287	31,635	3,702	3,283	221	95
Finance and insurance, and real estate and rental and leasing	10,015,304	102,298	8,998	14,128	953	359
Professional, scientific, and management, and administrative and waste management services	17,455,119	182,831	21,852	23,642	1,749	803
Educational services, and health care and social assistance	35,293,449	479,101	46,985	42,711	3,768	1,929
Arts, entertainment, and recreation, and accommodation and food services	14,800,927	218,585	30,887	25,250	2,184	962
Other services, except public administration	7,461,333	104,592	8,837	11,662	982	592
Public administration	7,079,907	110,887	9,818	10,204	1,064	891
TOTAL	**152,739,884**	**2,031,115**	**178,375**	**209,898**	**18,846**	**10,036**

Source: American Community Survey, Selected Economic Characteristics, 2018 5-Year Estimates

2.1.3 Median Household Income for Selected Parishes

Median household incomes for the four parishes in 2018 are shown in Table C:2-3. The average median household income across the four parishes is $48,100, which is slightly higher than the state median of $48,000, but less than the national median of $61,900. Plaquemines Parish has the highest median household income at $58,600 and Orleans Parish has the lowest median household income at $38,900. Median household income for Orleans and St. Bernard are lower than the state median, and all four parishes have median household income less than the national median.

Table C:2-3. Median Household Income – 2018

Geography	Median Household Income	% of State Median Household Income	% of National Median Household Income
Orleans	$ 38,855	81%	63%
Jefferson	$ 50,871	106%	82%
St. Bernard	$ 43,983	92%	71%
Plaquemines	$ 58,643	122%	95%
Louisiana	$ 48,021	-	78%
United States	$ 61,937	129%	-

Source: Bureau of the Census, Small Area Income and Poverty Estimates Program

As shown in Table C:2-4, the unemployment rate ranges from 4.4 percent (Jefferson) to 5.0 percent (both Orleans and St. Bernard). The average rate of 4.8 percent across the four parishes is slightly less than the rate of 4.9 percent for the state and nearly one percentage point higher than the national rate of 3.9 percent. Louisiana was ranked 47th out of the 50 states in 2018.

Table C:2-4. Unemployment Rate – 2018

Geography	Unemployment Rate
Orleans	5.0%
Jefferson	4.4%
St. Bernard	5.0%
Plaquemines	4.6%
Louisiana	4.9%
United States	3.9%

Source: Bureau of Labor Statistics, Local Area Unemployment Statistics (LAUS)

2.1.4 Race

In 2018 Louisiana and the parishes of Jefferson, St. Bernard, and Plaquemines all have a majority population characterized as “White,” though their percentages are slightly lower than the national average of 73 percent. The next largest population is the “Black or African American” population; however, both the state and these parishes have significantly higher percentages than the national average (13 percent), with both Louisiana and Jefferson Parish having over twice the “Black or African American” population at 32 percent and 27 percent, respectively. Orleans, at 60 percent, actually has a majority “Black or African American” population; the Orleans “White” population is 34 percent. “Asian” populations across the state and the four parishes are less than the national average of 5 percent. Additionally, the “Hispanic or Latino” population for the state and the four parishes are below the national average of 18 percent, although Jefferson is the closest with a “Hispanic or Latino’ population of 14 percent (Table C:2-5 and C:2-6).

Table C:2-5. Racial Composition (Number) – 2018

Race	United States	Louisiana	Orleans	Jefferson	St. Bernard	Plaquemines
White	234,904,818	2,901,106	132,423	273,395	31,838	15,871
Black or African American	40,916,113	1,502,916	232,789	116,621	10,445	4,786
American Indian & Alaska Native	2,699,073	26,272	632	1,694	172	308
Asian	17,574,550	79,872	11,294	18,131	1,076	850
Native Hawaiian & Other Pacific Islander	582,718	1,468	98	39	37	8
Some other race	15,789,961	60,419	5,297	15,996	862	610
Two or more races	10,435,797	91,563	7,115	9,424	1,264	940
Hispanic or Latino[3]	57,517,935	234,920	21,403	62,522	4,575	1,652
TOTAL	**322,903,030**	**4,663,616**	**389,648**	**435,300**	**45,694**	**23,373**

Source: American Community Survey, Demographic and Housing Estimates, 2018 5-Year Estimates

Table C:2-6. Racial Composition (Percentage) – 2018

Race	United States	Louisiana	Orleans	Jefferson	St. Bernard	Plaquemines
White	73%	62%	34%	63%	70%	68%
Black or African American	13%	32%	60%	27%	23%	20%
American Indian & Alaska Native	0.8%	0.6%	0.2%	0.4%	0.4%	1%
Asian	5%	2%	3%	4%	2%	4%
Native Hawaiian & Other Pacific Islander	0.2%	0.03%	0.03%	0.01%	0.1%	0.03%
Some other race	5%	1%	1%	4%	2%	3%
Two or more races	3%	2%	2%	2%	3%	4%
Hispanic or Latino[4]	18%	5%	5%	14%	10%	7%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: American Community Survey, Demographic and Housing Estimates, 2018 5-Year Estimates

[3] Hispanic or Latino numbers not included in TOTAL
[4] Hispanic or Latino numbers not included in TOTAL

2.1.5 Age Distribution

The age characteristics of the parishes are shown in Table C:2-7 and C:2-8. The average median age across all the parishes in the study area is 36.4 years and is nearly identical to the state median of 36.6 years. These values are slightly lower than the national median of 37.9 years.

Table C:2-7. Age Characteristics (Number) – 2018

Age	United States	Louisiana	Orleans	Jefferson	St. Bernard	Plaquemines
Under 18 years	73,553,240	1,108,474	78,740	95,809	12,322	6,134
18 - 65 years	200,111,209	2,878,435	258,372	269,230	28,503	14,360
65 years and older	49,238,581	676,707	52,536	70,261	4,869	2,879
Median age	37.9	36.6	36.3	39.2	33.7	36.2
Total population	322,903,030	4,663,616	389,648	435,300	45,694	23,373

Source: American Community Survey, Demographic and Housing Estimates, 2018 5-Year Estimates

Table C:2-8. Age Characteristics (Percent) – 2018

Age	United States	Louisiana	Orleans	Jefferson	St. Bernard	Plaquemines
Under 18 years	23%	24%	20%	22%	27%	26%
18 - 65 years	62%	62%	66%	62%	62%	61%
65 years and older	15%	15%	13%	16%	11%	12%
Total population	100%	100%	100%	100%	100%	100%

Source: American Community Survey, Demographic and Housing Estimates, 2018 5-Year Estimates

2.1.6 Income and Poverty

Income and poverty data for the four parishes are summarized in Table C:2-9 for 2018. All four parishes have median household income levels less than the national average of $60,293 as well as per capita income less than the national average of $32,621. Louisiana itself also has a median household income level and per capita income less than the national average at $47,942 and $27,027, respectively. All four parishes and the state have a greater percentage of persons below the poverty level compared to the national average of 14.1 percent. St. Bernard has the highest percentage at 19.7 percent followed by Plaquemines at 19.5 percent.

Table C:2-9. Income and Poverty Data – 2018

Income and Poverty	United States	Louisiana	Orleans	Jefferson	St. Bernard	Plaquemines
Persons per Household	2.73	2.68	2.54	2.57	3.11	2.66
Median Household Income	$60,293	$47,942	$39,576	$52,558	$46,011	$52,386
Per Capita Income	$32,621	$27,027	$30,177	$29,776	$21,217	$26,818
Persons Below Poverty Level	14.1%	19.4%	17.8%	15.5%	19.7%	19.5%

Source: American Community Survey, Economic Characteristics, 2018 5-Year Estimates

2.1.7 Education

The educational attainment levels for the four parishes, Louisiana, and the United States in 2018 are presented in Tables C:2-10 and C:2-11. On average across the parishes in the study area, 84.2 percent of persons age 25 years and older had completed high school, while 23.7 percent had a bachelor's degree or higher. These values are slightly lower than the state's high school graduate rate of 84.8 percent, but match the state's rate of 23.7 percent with a bachelor's degree or higher. The national statistics for both high school and college graduates are greater than those at the state and parish level at 87.7 percent and 31.5 percent, respectively. Of the four parishes, Orleans has the highest percentage of high school graduates at 86.2 percent as well as the highest rate of college graduates at 36.8 percent.

Table C:2-2. Educational Attainment for Persons 25 Years or Older (Number) – 2018

Education	United States	Louisiana	Orleans	Jefferson	St. Bernard	Plaquemines
High School Graduate or Higher	191,498,014	2,635,981	236,633	260,503	24,398	12,679
Bachelor's Degree or Higher	68,867,051	737,593	101,120	79,756	3,643	2,994

Source: American Community Survey, Social Characteristics, 2018 5-Year Estimates

Table C:2-3. Educational Attainment for Persons 25 Years or Older (Percent) – 2018

Education	United States	Louisiana	Orleans	Jefferson	St. Bernard	Plaquemines
High School Graduate or Higher	87.7%	84.8%	86.2%	85.4%	82.4%	82.9%
Bachelor's Degree or Higher	31.5%	23.7%	36.8%	26.1%	12.3%	19.6%

Source: American Community Survey, Social Characteristics, 2018 5-Year Estimates

2.2 FACILITIES AND INFRASTRUCTURE

The PORT hosts both cruise and cargo terminals and facilities, an industrial park, and a number of other service providers. Located on Louisiana's Lower Mississippi River, the PORT has connections to six Class One railroads and the interstate highway system. Primary inbound cargoes include steel, rubber, plywood, coffee, non-ferrous metals, and project cargo. Forest products, steel, foodstuff, chemicals, and frozen poultry represent the primary outbound cargoes.

On top of the PORT's cargo handling capacity, there is an industrial park of more than 1,000 acres under short and long-term leases that support a wide range of heavy and light industrial services as well as commercial services. Heavy and light industrial uses include: shipbuilding and repair; truck and container depots; steel distribution; warehouse and distribution; basic materials handling; refrigerated warehousing; cement handling; and manufacturing and packaging.

Other services include: bunkers/fuel; chandlery; cold storage; crane maintenance and repair; dry dock; environmental/waste services; marine equipment and supplies; oil spill response; shipyard/ship repair; towing and tug services; warehousing - bonded; SILO-CAF: bulk coffee storage & blending facility; bagging & drumming; container & chassis repair; heavy lift pilots; ship cleaning and fumigation; and inland cruising.

2.2.1 Cruise Terminal

<u>Julia Street Cruise Ship Terminal</u>

Operated by the PORT, Cruise & Tourism Division, this terminal, located at river mile 95.3, has one berth that is 1,250 feet long with a project depth of 35 feet. There is an air-conditioned gangway, covered drive-in, drop-off and pick-up areas and a secured passenger parking lot. Additional features include a 23,000 square foot embarkation deck and 23,000 square feet of luggage laydown area.

<u>Erato Street Cruise Terminal and Parking Garage</u>

Operated by the PORT, this terminal, located at river mile 95.6, has one berth that is 1,250 feet long and a project depth of 30 feet. Special features include a 60,000 square foot embarkation deck, a raised, passenger gangway and 28,000 square feet of luggage laydown area, a 1,000 vehicle-parking garage and an air-conditioned articulated passenger gangway.

2.2.2 Uptown River Cargo Terminals and Facilities

All cargo terminal facilities within the PORT are listed below. The analysis in this appendix will focus on the container terminals, which are Napoleon A and Nashville C (Dock Section 1) and Nashville B (Dock Section 2).

Nashville Avenue Wharf “A”

Operated by Ports America, this terminal, located at river mile 100.8, has four berths that total 2,159 feet in length and a project depth of 35 feet. Primary cargoes include palletized, containerized and breakbulk. Facilities include a 756,000 square foot shed with close proximity to 2,673,924 square feet of open storage, as well as a 62-foot apron. Both highway and railroad services are available.

Nashville Avenue Wharf “B”

Operated by Ports America, this terminal, located at river mile 100.1, has three berths that total 1,785 feet in length and a depth of 40 feet. Facilities include a 141,000 square foot shed with close proximity to 2,673,924 square feet of open storage and access to four gantry cranes with 40/70-ton capacity. There is also access to three mobile harbor cranes with up to 150-ton capacity and one floating crane with 25-metric-ton capacity. Both highway and railroad services are available.

Nashville Avenue Wharf “C”

Operated by Ports America, this terminal, located at river mile 99.8, has three berths that total 1,658 feet in length and a depth of 40 to 45 feet. Facilities include a 179,500 square foot shed with close proximity to 2,673,924 square feet of open storage and access to four gantry cranes with 40/70-ton capacity and a 100-foot wide front apron. Four additional 100-feet gauge cranes are on order that will be shared with the Napoleon A terminal. There is also access to three mobile harbor cranes with up to 150-ton capacity and one floating crane with 25-metric-ton capacity. Both highway and railroad services are available.

Napoleon Avenue Container Terminal Operators

Operated by Ports America, LLC and New Orleans Terminal, LLC; this terminal, located at river mile 99.5, has two berths (Napoleon A and Napoleon B) with a length of 2,000 feet and a depth of 45 feet. Primary cargoes are containers. The terminal has six gantry cranes, an 840,000 annual TEU capacity, 1,000 psf live load, and an area totaling 65 acres. Four additional 100-foot gauge cranes are on order that will be shared with the Nashville C terminal. Expansion footprint provides capacity up to 1.5 million TEUs per year. Both highway and railroad services are available.

Henry Clay Avenue Wharf

Operated by New Orleans Cold Storage, this terminal, located at river mile 101.1, has two berths of 1,441 feet in length and a project depth of 38 feet. Primary cargoes are refrigerated goods. Facilities include a 95,020 square foot refrigerated warehouse that includes a blast freezing system. Both highway and railroad services are available.

Milan Street Wharf

Operated by New Orleans Terminal LLC, this wharf, located at river mile 99.1, has two berths, one 772 feet in length and the other 1,263 feet in length with a project depth of 35 feet. Container freight is the primary cargo. Facilities and services include a 107,081 square feet of shed area, 232 foot wide front apron, 65,000 square feet of paved open area and 269,352 square feet of open wharf area. Both highway and railroad services are available.

Louisiana Avenue Wharf

Operated by Coastal Cargo Co., this wharf, located at river mile 98.3, has two berths with a total length of 1,590 feet and a project depth of 35 feet. Primary cargoes include palletized, containerized & breakbulk. Additional facilities include 178,360 square feet of covered area and 1,581,291 square feet of paved back-up area. Both highway and railroad services are available.

Harmony Street Wharf

Operated by Coastal Cargo Co., this wharf, located at river mile 98.1, has two berths with a total length of 1,231 feet and a project depth of 35 feet. Steel is the primary cargo. Facilities include a 125,653 square foot shed a 49 feet wide front apron and 114,380 square feet of open area. Both highway and railroad services are available.

Seventh Street Wharf

Operated by Coastal Cargo Co., this wharf, located at river mile 97.8, has two berths with a total length of 1,196 feet and a project depth of 35 feet. Primary cargoes include steel, palletized, and breakbulk. Facilities include 119,280 square foot shed a 50 feet wide front apron and 134,911 square feet of open area. Both highway and railroad services are available.

First Street Wharf

Operated by Empire Stevedoring, this wharf, located at river mile 97.3, has two berths with a total length of 1,275 feet and a project depth of 35 feet. Primary cargoes include palletized, containerized and breakbulk. Facilities include 140,655 square foot shed a 50 feet wide front apron and 99,440 square feet of open area. Both highway and railroad services are available.

2.2.3 Downtown River Cargo Terminals and Facilities

Poland Avenue Wharf

This wharf (under control of the PORT, but currently unassigned to an operator) is located at river mile 93.1 and has two berths with a total length of 932 feet and a project depth of 35 feet. Conventional and general containerized are the primary cargoes. Facilities include 84,328 square feet shed, a 35 feet wide front apron, and 96,257 square feet of open area. Both highway and railroad services are available.

Alabo Street Wharf

Operated by Seaonus, this wharf, located at river mile 92.0, has two berths with a total length of 1,732 feet and a project depth of 38 feet. Conventional and breakbulk are the primary cargoes. Facilities include 126,178 square feet of covered storage, 81 feet wide front apron, 182,821 square feet of open area and 207,849 square feet of marshalling area. Both highway and railroad services are available.

Perry Street Wharf

This wharf (under control of the PORT, but currently unassigned to an operator) is located at river mile 95.9 and has two berths with a total length of 1,009 feet and a project depth of 50 feet. Facilities include 160,000 square feet shed, a 40 feet wide front apron, and 33,368 square feet of open area. The wharf is currently being used as a ship repair facility.

Governor Nicholls Street Wharf

Operated by TCI, this wharf, located at river mile 94.6, has two berths with a total length of 1,210 feet and a project depth of 35 feet. Conventional and general containerized are the primary cargoes. Facilities include 156,617 square feet shed, 30 feet wide front apron and 37,694 square feet of open area. Both highway and railroad services are available.

2.2.4 Inner Harbor Cargo Terminals and Facilities

France Road Container Terminal

This wharf (under control of the PORT, but currently unassigned to an operator) is located at the IHNC and has one 830 foot berth and a project depth of 30 feet. Facilities include a 67,019 square foot shed, 2.6 million square feet of marshalling area and a 147 feet wide wharf. Both highway and railroad services are available.

Jourdan Road Terminal

Operated by New Orleans Cold Storage, this wharf, located at the IHNC, has two berths with a total length of 1,400 feet and a project depth of 29 feet. Facilities and services include 160,000 square feet refrigerated warehouse with a 55 million pound capacity and a blast freezing system.

2.3 HISTORICAL COMMERCE

2.3.1 Rankings

The PORT consistently places in the top 10 ranking of annual tonnage for U.S. ports. Based on WCSC data, the PORT handled a total of 93.3 million tons[5] of commerce in 2018, including 49.5 million tons of domestic commerce and 43.8 million tons of foreign commerce, ranking it as the 6th largest domestic port (Table C:2-12). For containership traffic, the Port of New Orleans ranked 17th in overall number of loaded containers in 2018. (Table C:2-13).

[5] All references to commodity shipments in “tons” refer to “short tons” of 2,000 pounds.

Table C:2-4. U.S. Ports Ranked by Tonnage

Rank	Port	Total Tons
1	South Louisiana, LA,	275,512,500
2	Houston, TX	268,930,047
3	New York, (NY and NJ)	140,281,992
4	Beaumont, TX	100,244,231
5	Corpus Christi, TX	93,468,323
6	New Orleans, LA	93,332,543
7	Long Beach, CA	86,536,154
8	Baton Rouge, LA	82,234,811
9	Virginia, VA, Port of	71,774,349
10	Los Angeles, CA	67,806,137

Source: WCSC

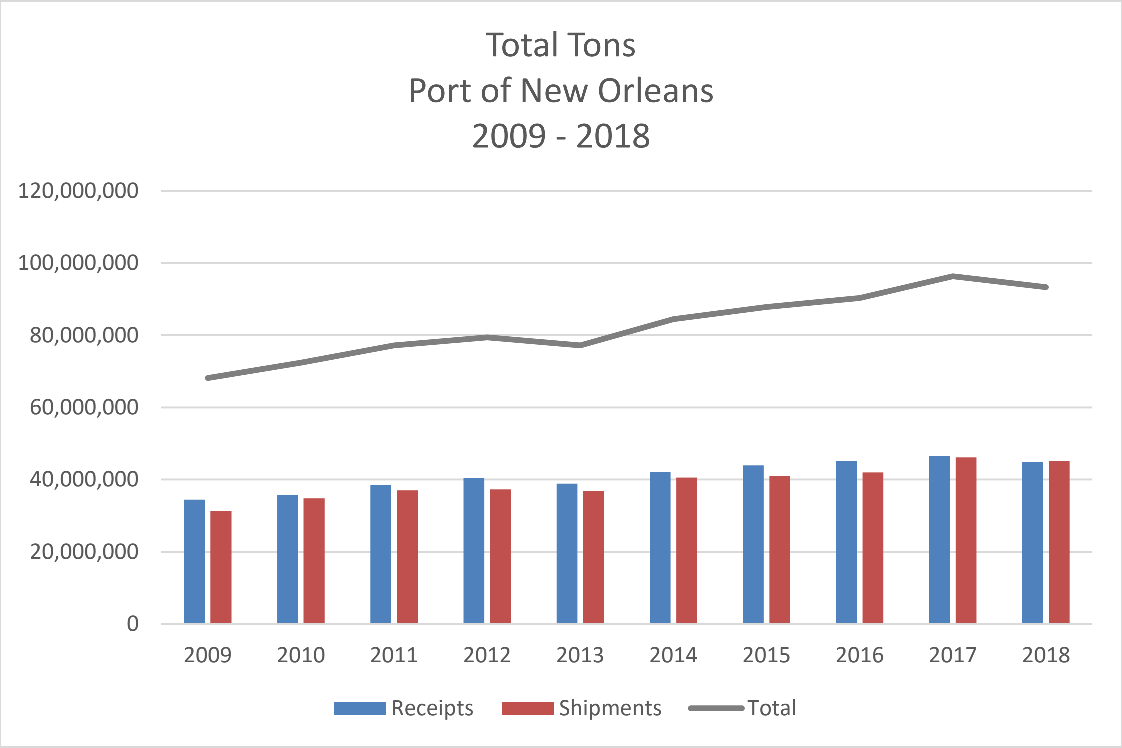
Table C:2-5. U.S. Ports Ranked by Loaded Containers

Rank	Port	Total Containers
1	Los Angeles, CA	6,627,292
2	Long Beach, CA	5,595,722
3	New York (NY and NJ)	5,282,491
4	Savannah, GA	3,386,858
5	Houston, TX	2,251,645
6	Port of Virginia	2,205,605
7	Oakland, CA	1,812,566
8	Charleston, SC	1,803,069
9	Tacoma, WA	1,552,151
10	Seattle, WA	1,315,345
11	Honolulu, HI	835,712
12	Miami, FL	803,750
13	Port Everglades, FL	795,043
14	Jacksonville, FL	774,484
15	Baltimore, MD	713,191
16	San Juan, PR	691,184
17	New Orleans, LA	400,198
18	Philadelphia, PA	376,600
19	Anchorage, AK	274,208
20	Mobile, AL	269,636

Source: WCSC

2.3.2 Total Tons and Loaded Containers

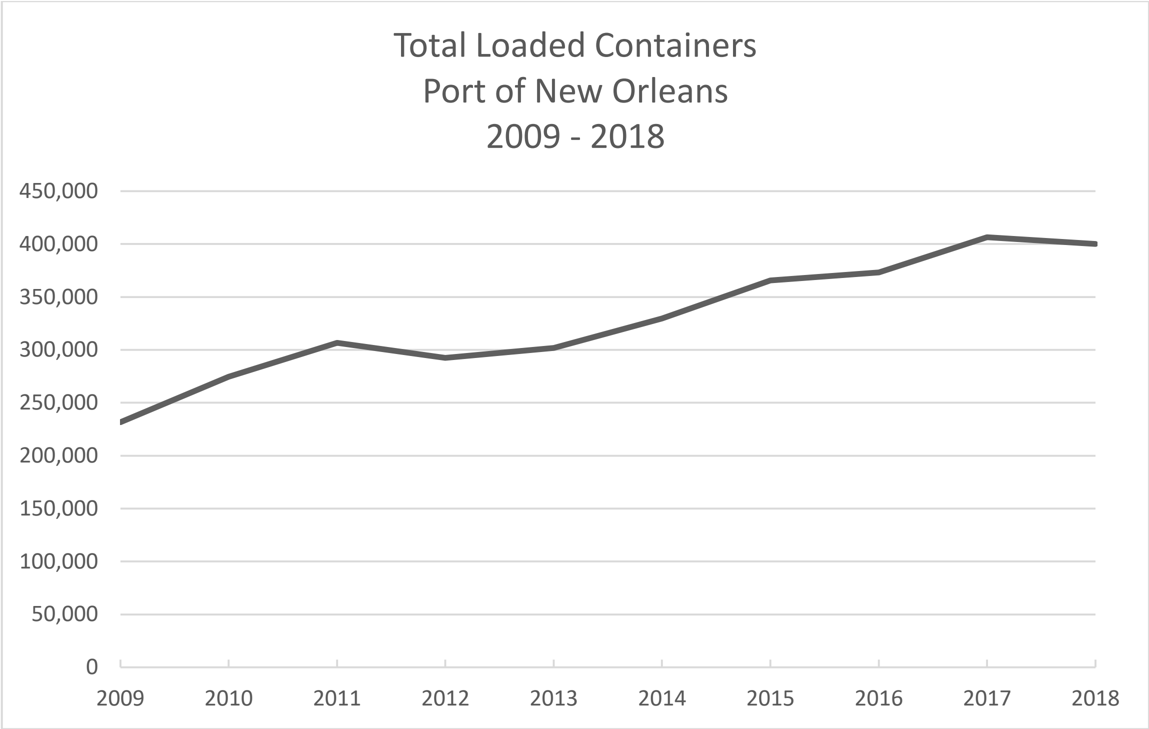
Except for slight bumps in 2013 and 2018, total tonnage has trended upward from 68.2 million tons in 2009 to 93.3million tons in 2018 (Figure C:2-1).[6] Containership traffic has also trended upward, reaching over 400,000 loaded containers in both 2017 and 2018 (Figure C:2-2).



Source: WCSC

Figure C:2-1. Total Tons New Orleans

[6] Total tons include intraport movements as well as receipts and shipments.

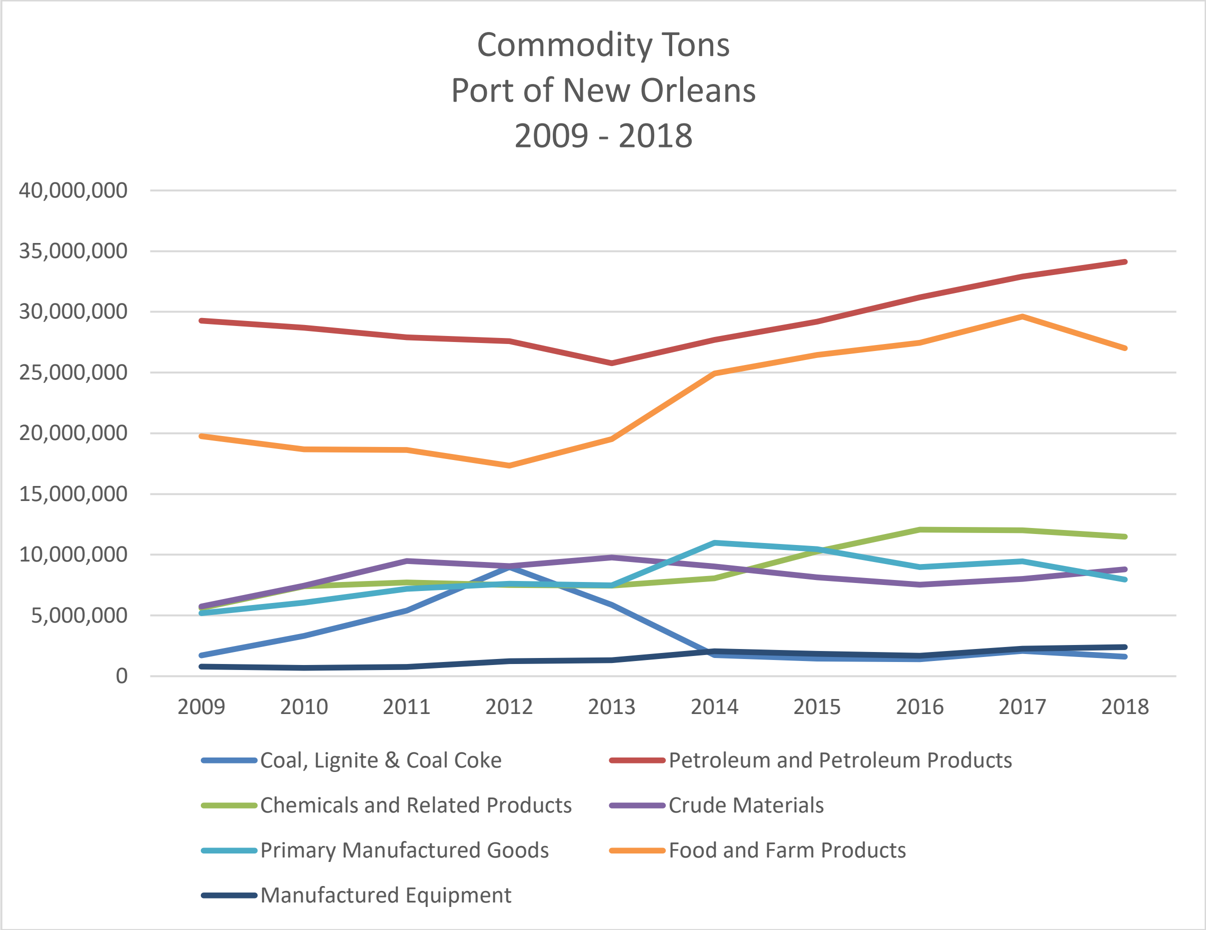


Source: WCSC

Figure C:2-2. Total Loaded Containers New Orleans

2.3.3 Commodity Tons and Distribution

Petroleum and petroleum products, food, and farm products dominate the commodity mix in terms of total tonnage passing through the PORT. A total of 294.3 million tons of petroleum and petroleum products moved through the PORT from 2009 – 2018 followed by 229.4 million tons of food and farm products. The next highest commodity group is chemicals and related products at 89.6 million tons; manufactured equipment and machinery round out the bottom at 15.0 million tons. For the most part, commodities seem to be trending upward or holding steady except for coal, which began to decrease rather sharply in 2012, likely due to the significant transformation from coal to natural gas and renewables for electricity generation in the U.S. (Figure C:2-3).

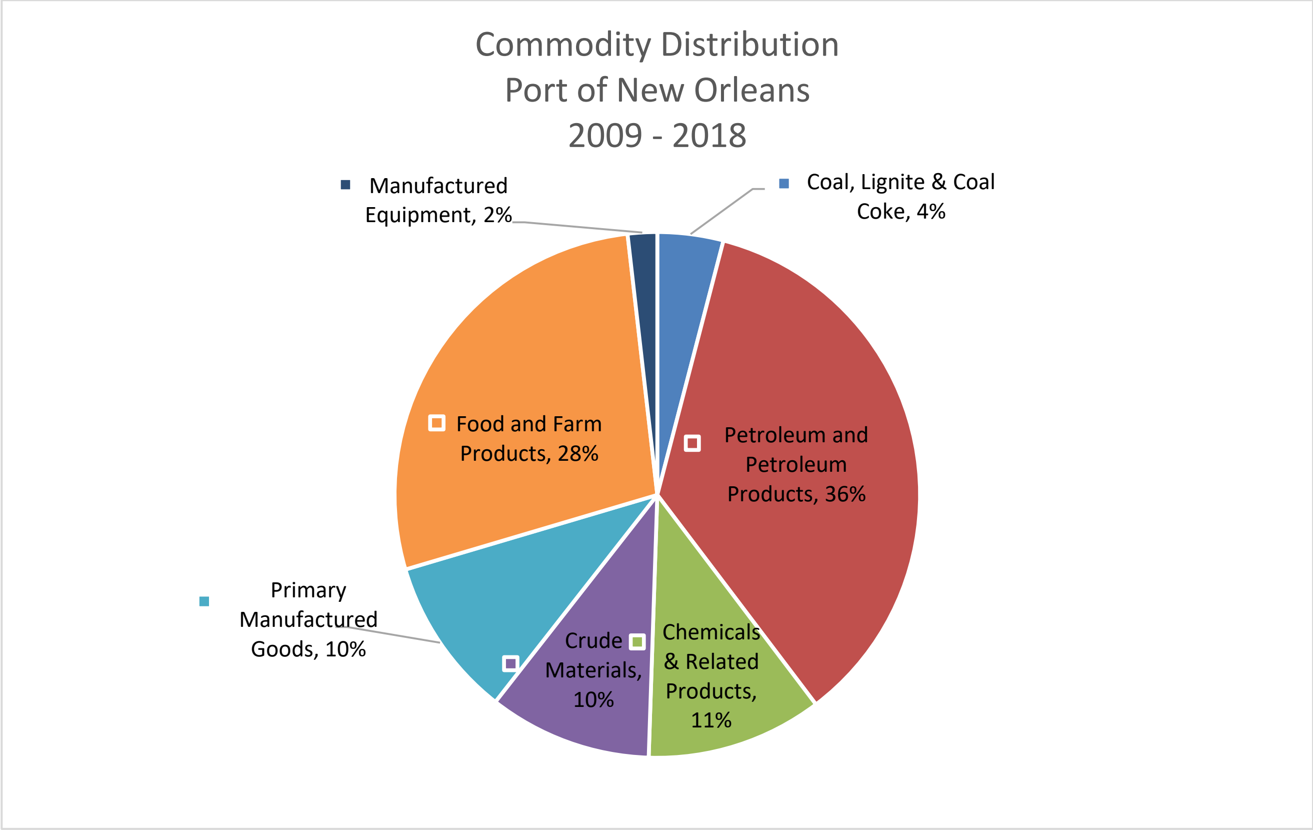


Source: WCSC

Figure C:2-3. Commodity Tons New Orleans

In terms of commodity distribution, petroleum and petroleum products make up the highest percentage at 36 percent; food and farm products are next at 28 percent. The remaining commodity group breakouts are chemical and related products at 11 percent, crude materials at 10 percent, primary manufactured goods at 10 percent, coal at 4 percent, and manufactured equipment and machinery at 2 percent (Figure C:2-4).

For containerized commodities in 2019, the largest imported good was coffee at 15.4 percent of total imported commodities followed by benzenoid chemicals at 11.9 percent; resin was by far the largest exported commodity at 30.6 percent followed by forest products at 9.1 percent (Figure C:2-5).



Source: WCSC

Figure C:2-4. Commodity Distribution New Orleans

PONO "Board Owned" Containerized Commodities
Fiscal Year 2019

RANK	IMPORTS	STONS	Pct Tot IMP
1	COFFEE	310,627	15.4%
2	BENZENOID CHEMICALS	238,568	11.9%
3	FOREST PRODUCTS	197,968	9.8%
4	ALUMINUM	117,074	5.8%
5	ORGANIC COMPOUNDS	116,289	5.8%
6	PESTICIDES	61,794	3.1%
7	STEEL (includes Ferrous Products)	53,115	2.6%
8	INORGANIC CHEMICALS	45,876	2.3%
9	SOYBEANS & PRODS	45,677	2.3%
10	SELENIUM, SILICON, STRONTIUM	40,216	2.0%
11	FURNITURE	36,087	1.8%
12	TEXTILE PRODUCTS	29,627	1.5%
13	GRANITE	28,955	1.4%
14	PETROLEUM PRODS & DERIVATIVES	27,460	1.4%
15	RESIN	26,171	1.3%
16	ABRASIVES, MISC	24,078	1.2%
17	RUBBER, NATURAL	22,699	1.1%
18	ALCOHOLIC BEVERAGES	21,337	1.1%
19	PLASTICS, SYNTHETIC RUBBER	18,553	0.9%
20	COPPER	16,627	0.8%
21	AUTO & TRUCK TIRES & TUBES	15,402	0.8%
22	ORES, SCRAP	15,401	0.8%
23	WEARING APPAREL, COTTON	15,282	0.8%
24	MARBLE, ONYX	14,029	0.7%
25	MACHNERY MISC	13,002	0.6%
	All Others	459,073	22.8%
	TOTAL	**2,010,987**	**100.0%**

RANK	EXPORTS	STONS	Pct Tot EXP
1	RESIN	1,250,564	30.6%
2	FOREST PRODUCTS	373,582	9.1%
3	ORGANIC COMPOUNDS	335,940	8.2%
4	PLASTICS, SYNTH RUBBER	274,499	6.7%
5	POULTRY, FRESH & FROZEN	247,922	6.1%
6	UNCLASSIFIABLE CHEMICALS	183,472	4.5%
7	PESTICIDES	176,485	4.3%
8	PETROLEUM PRODS, DERIVATIVES	135,287	3.3%
9	PIGMENTS	106,294	2.6%
10	COPPER	71,799	1.8%
11	RICE	54,957	1.3%
12	WEARING APPAREL, COTTON	44,761	1.1%
13	GROCERY PRODS, MISC	41,170	1.0%
14	CAMPHOR, CARBON, WAXES	32,390	0.8%
15	SILICA, SAND & GRIT	32,052	0.8%
16	PLASTIC PRODS, MISC	25,093	0.6%
17	NON ALCOHOLIC BEVERAGES	22,870	0.6%
18	PET & ANIMAL FEEDS	22,384	0.5%
19	MEAT, FRESH & FROZEN	20,243	0.5%
20	FISH MEAL	18,480	0.5%
21	INORGANIC CHEMICALS	18,458	0.5%
22	ALUMINUM	18,364	0.4%
23	FEATHERS, DOWN & HAIR	17,214	0.4%
24	BENZENOID CHEMICALS	15,497	0.4%
25	STEEL (includes Ferrous Products)	13,260	0.3%
	All Others	534,466	13.1%
	TOTAL	**4,087,500**	**100.0%**

Port of New Orleans

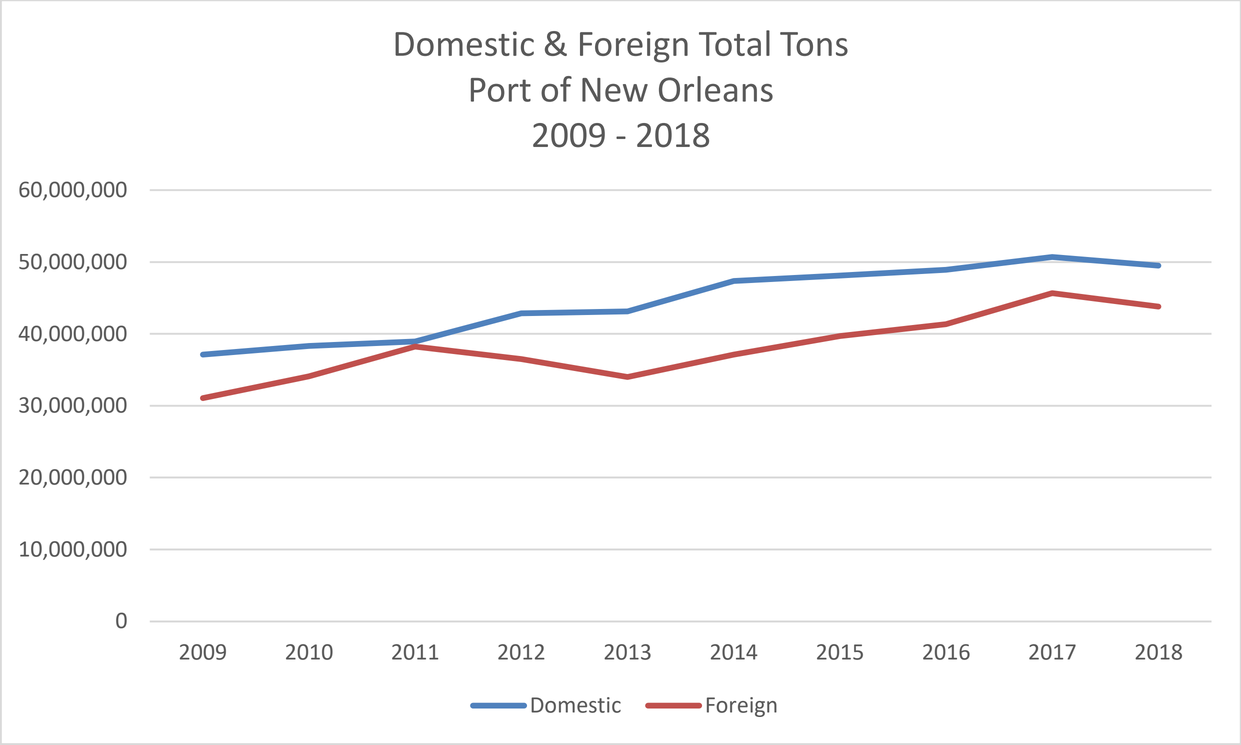
Figure C:2-5. Commodity Distribution New Orleans

2.3.4 Domestic and Foreign Tons and Loaded Containers

In terms of all cargo types moved at the PORT, foreign total tonnage has consistently lagged behind domestic total tonnage for the past 10 years for the PORT, albeit by a small margin. The percent of foreign total tonnage over this 10-year time period has averaged 46 percent, or a little less than half of all PORT tonnage. The closest foreign total tonnage ever came to equaling domestic total tonnage was in 2011, when the percent of foreign total tonnage reached 49.5 percent (Figure C:2-6). Petroleum and petroleum products and food and farm products have consistently been the drivers of most foreign commodity movements for the PORT.

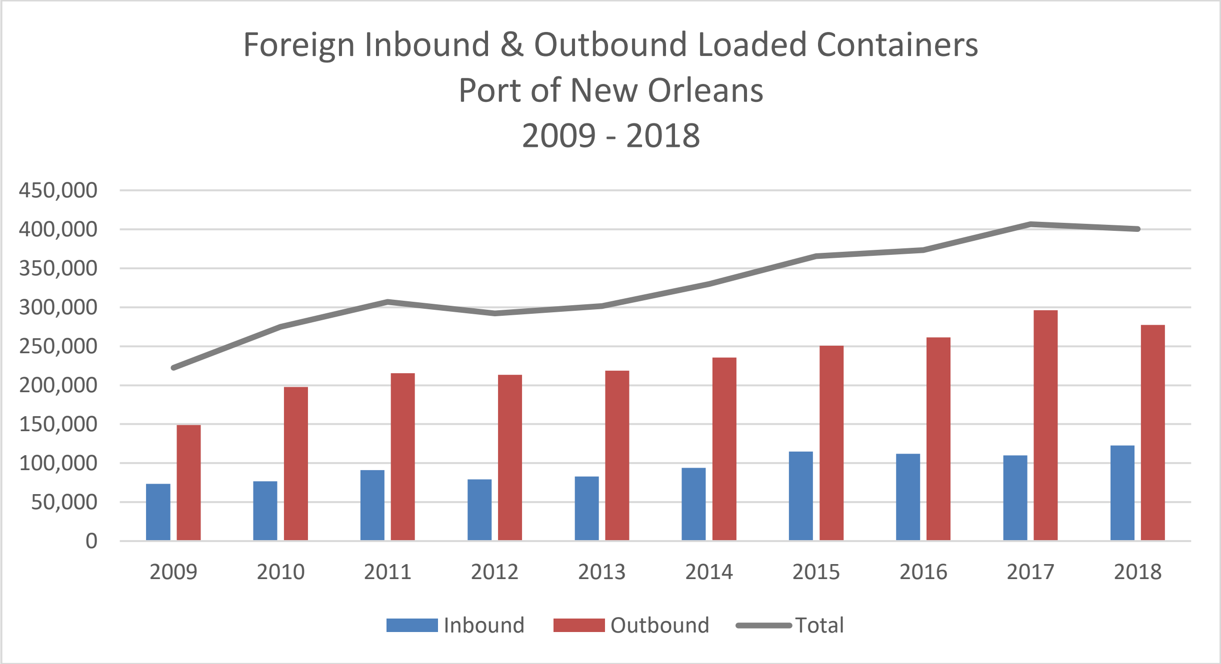
The analysis from this point forward will focus on containerized cargo, as it was determined that container ships and cargo has the need for a deeper channel at this time. Containerized traffic is all foreign, and outbound traffic has outpaced inbound traffic for the years 2009 –

2018 by a ratio of more than 2 to 1. The percent of outbound containerized traffic has been 70 percent or greater over the past 10 years except for 2009, 2015, and 2018 (67 percent, 69 percent, and 69 percent, respectively). See Figure C:2-7.



Source: WCSC

Figure C:2-6. Domestic and Foreign Tons New Orleans



Source: WCSC

Figure C:2-7. Foreign Inbound and Outbound Loaded Containers New Orleans

2.4 FLEET CHARACTERISTICS

2.4.1 Class Characteristics

The containerships currently using the Napoleon A, Nashville C, and Nashville B docks are categorized into five classes according to 20-feet equivalent unit (TEU) capacity and Deadweight tonnage (DWT). The Sub-Panamax vessel is the smallest class with a TEU capacity of 600 – 2,800 and a DWT range of 8,600 – 38,800. The Panamax is the next larger vessel followed by Post-Panamax Generation 1, 2, and 3 (Table C:2-14).

Table C:2-6. Containership Class Characteristics

	TEU Capacity	DWT	Max Draft (ft.)
Sub-Panamax (SPX)	600 - 2,800	8,600 - 38,800	38
Panamax (PX)	2,801 - 4,800	38,801 - 65,000	45
Post-Panamax Gen I (PPX Gen 1)	4,801 - 6,799	65,001 - 88,000	48
Post-Panamax Gen II (PPX Gen 2)	6,800 - 9,900	88,000 - 115,000	48
Post-Panamax Gen III (PPX Gen 3)	9,901 - 13,100	115,001 - 144,500	52

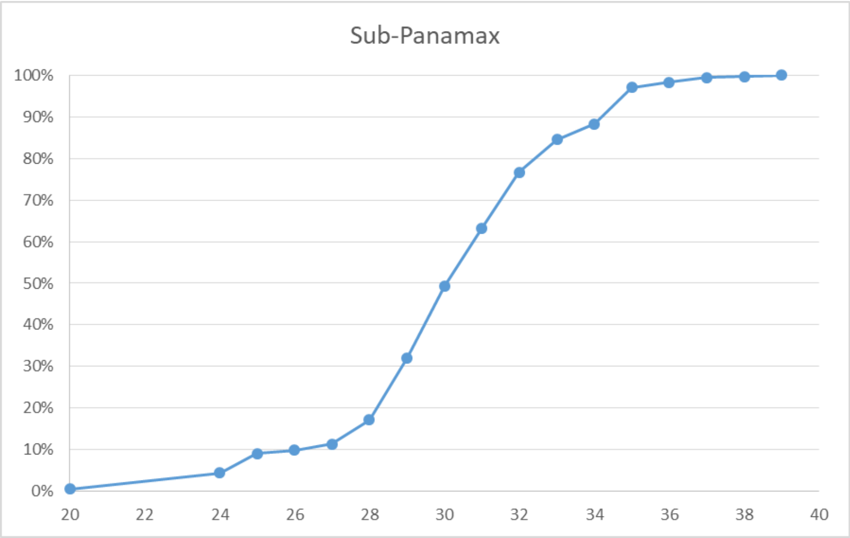
2.4.2 Arrival Draft Data

There were 1,180 containerships outbound to the Port of New Orleans from 2015 – 2017. Out of 343 Sub-Panamax trips, the most frequent arrival draft was 30 feet; out of 290 Panamax trips, the most frequent arrival draft was 35 feet. PPX Gen 1 and PPX Gen 2's most frequent arrival drafts were 37 feet (out of 519 trips) and 36 feet (out of 28 trips), respectively.[7]

Eighty six percent of Sub-Panamax trips drafted between 28 and 35 feet; 3 percent drafted between 36 and 39 feet. For Panamax vessels, 81 percent drafted between 30 and 38 feet; 10 percent drafted at 39 and 40 feet. For PPX Gen 1 vessels, 90 percent drafted between 33 and 40 feet; 2 percent drafted at 41 and 42 feet. For PPX Gen 2 vessels, 86 percent drafted between 32 and 38 feet; 7 percent drafted at 40 or 42 feet.

Figures C:2-8 through C:2-11 show arrival draft data and cumulative distribution functions (CDF) for these vessel classes. Figures C:2-12 through C:2-14 show fleet distribution by year for arrivals to the PORT.

Vessel Class	Draft	Count	CDF
Sub Panamax	0	0	0.00%
Sub Panamax	1	1	0.29%
Sub Panamax	20	1	0.58%
Sub Panamax	24	13	4.37%
Sub Panamax	25	16	9.04%
Sub Panamax	26	3	9.91%
Sub Panamax	27	5	11.37%
Sub Panamax	28	20	17.20%
Sub Panamax	29	51	32.07%
Sub Panamax	30	59	49.27%
Sub Panamax	31	48	63.27%
Sub Panamax	32	46	76.68%
Sub Panamax	33	27	84.55%
Sub Panamax	34	13	88.34%
Sub Panamax	35	30	97.08%
Sub Panamax	36	4	98.25%
Sub Panamax	37	4	99.42%
Sub Panamax	38	1	99.71%
Sub Panamax	39	1	100.00%

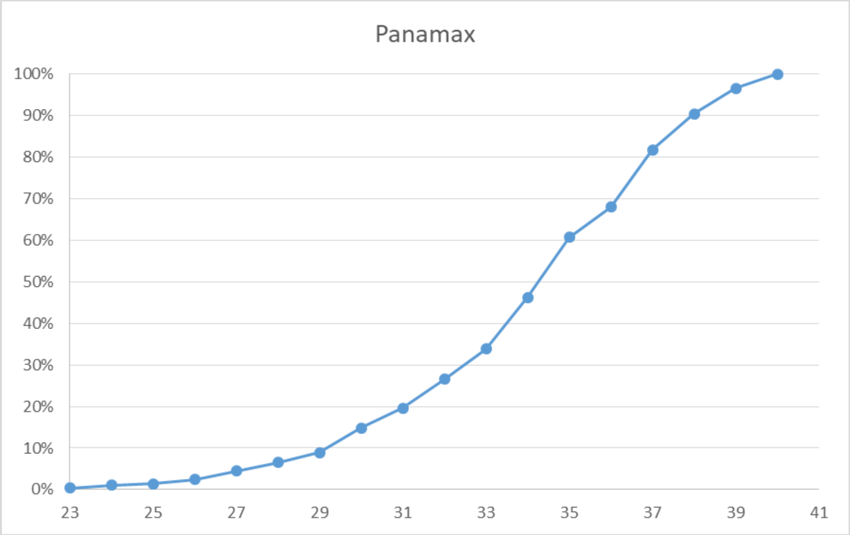


Source: WCSC

Figure C:2-8. Arrival Draft Data for Sub-Panamax (2015 – 2017)

[7] PPX Gen 3 vessels did not call on the Port during this period.

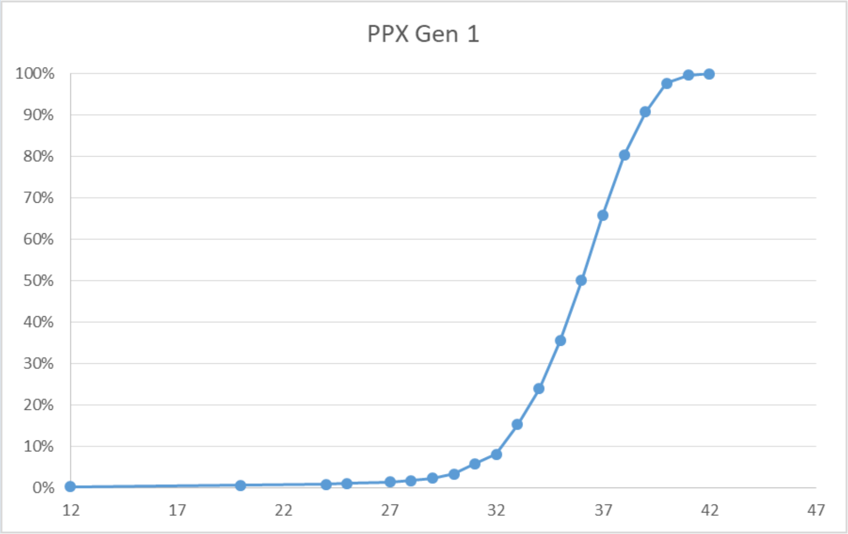
Vessel Class	Draft	Count	CDF
Panamax	0	0	0.00%
Panamax	23	1	0.34%
Panamax	24	2	1.03%
Panamax	25	1	1.38%
Panamax	26	3	2.41%
Panamax	27	6	4.48%
Panamax	28	6	6.55%
Panamax	29	7	8.97%
Panamax	30	17	14.83%
Panamax	31	14	19.66%
Panamax	32	20	26.55%
Panamax	33	21	33.79%
Panamax	34	36	46.21%
Panamax	35	42	60.69%
Panamax	36	21	67.93%
Panamax	37	40	81.72%
Panamax	38	25	90.34%
Panamax	39	18	96.55%
Panamax	40	10	100.00%



Source: WCSC

Figure C:2-9. Arrival Draft Data for Panamax (2015 – 2017)

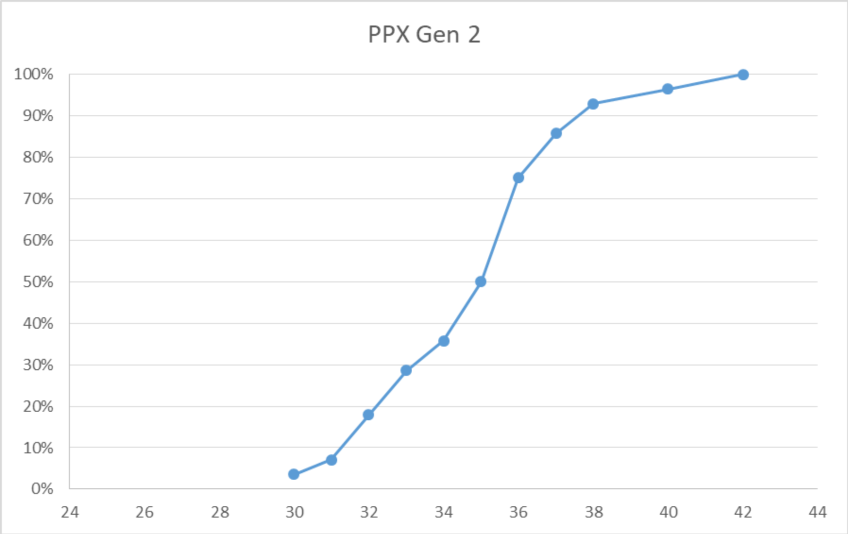
Vessel Class	Draft	Count	CDF
Gen I	0	0	0.00%
Gen I	12	1	0.19%
Gen I	20	2	0.58%
Gen I	24	1	0.77%
Gen I	25	1	0.96%
Gen I	27	2	1.35%
Gen I	28	2	1.73%
Gen I	29	3	2.31%
Gen I	30	5	3.28%
Gen I	31	13	5.78%
Gen I	32	12	8.09%
Gen I	33	37	15.22%
Gen I	34	45	23.89%
Gen I	35	60	35.45%
Gen I	36	76	50.10%
Gen I	37	81	65.70%
Gen I	38	76	80.35%
Gen I	39	54	90.75%
Gen I	40	36	97.69%
Gen I	41	10	99.61%
Gen I	42	2	100.00%



Source: WCSC

Figure C:2-10. Arrival Draft Data for PPX Gen 1 (2015 – 2017)

Vessel Class	Draft	Count	CDF
Gen II	0	0	0.00%
Gen II	30	1	3.57%
Gen II	31	1	7.14%
Gen II	32	3	17.86%
Gen II	33	3	28.57%
Gen II	34	2	35.71%
Gen II	35	4	50.00%
Gen II	36	7	75.00%
Gen II	37	3	85.71%
Gen II	38	2	92.86%
Gen II	40	1	96.43%
Gen II	42	1	100.00%



Source: WCSC

Figure C:2-11. Arrival Draft Data for PPX Gen 2 (2015 – 2017)

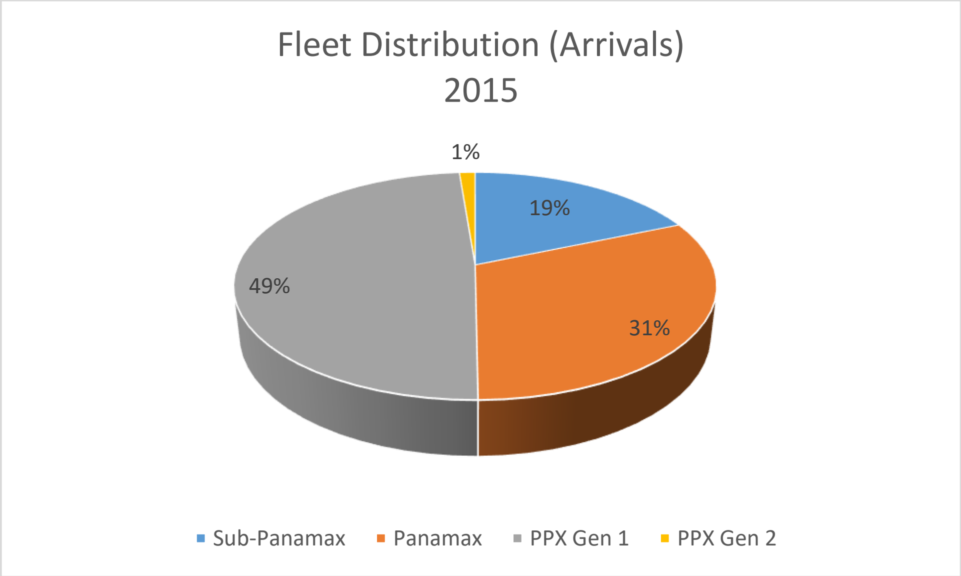


Figure C:2-12. Fleet Distribution (2015)

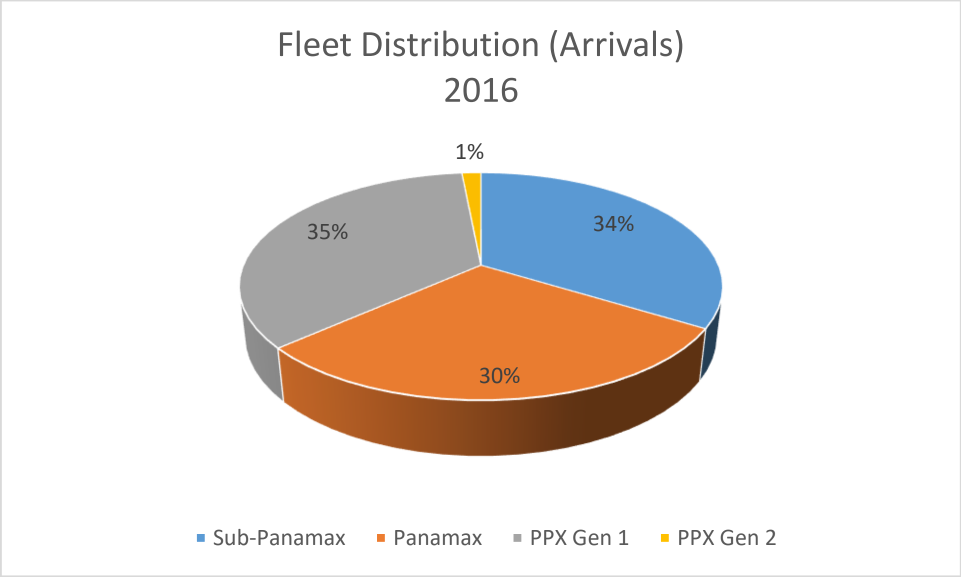


Figure C:2-13. Fleet Distribution (2016)

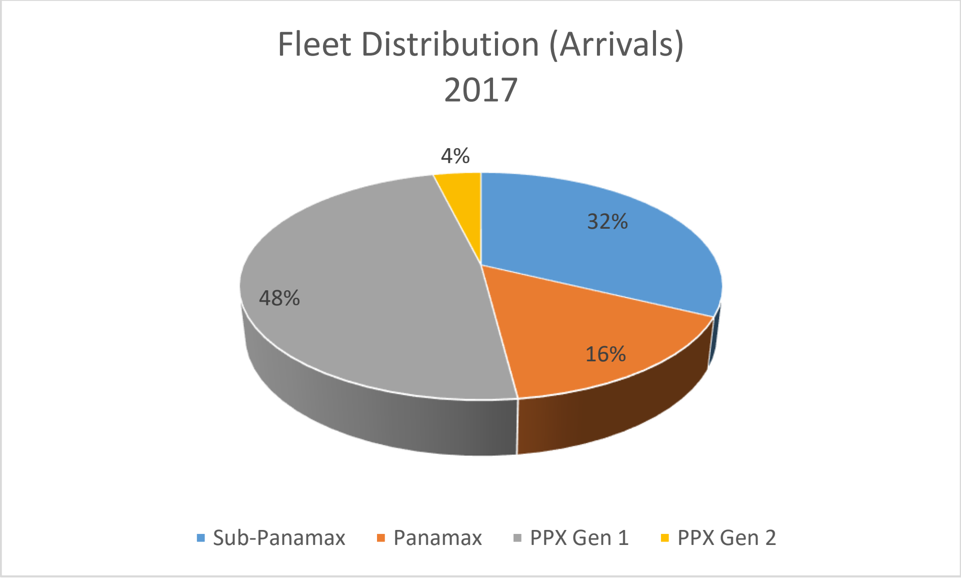


Figure C:2-14. Fleet Distribution (2017)

2.4.3 Design Vessel

For deep-draft projects, the design vessel for economics purposes is the largest vessel in the fleet expected to use the proposed channel over the project life.

The channel can accommodate vessels with beams of 160 feet, and these are the largest vessels that are projected to call on the port in the with- and without-project condition. The design vessel characteristics used for the economic analysis are displayed in Table C:2-.

Table C:2-7. Design Vessel Characteristics

Vessel Type	DWT	Beam	LOA	Design Draft	TEUs
Containership	119,000	158	1,100	50.8	10,100

2.5 SHIPPING OPERATIONS

Shipping operations are important in a deepening study to determine how the vessels are loaded and operating within the channel. There are no proposed channel modifications with respect to vessels operating differently than existing condition outside of being able to load vessels deeper. Therefore, it is assumed there is no change to the operating practices in the without- and with-project condition.

2.5.1 Underkeel Clearance

The measure of underkeel clearance (UKC) for economic studies is applied according to planning guidance. According to this guidance, UKC is evaluated based on actual operator and pilot practice within a harbor and subject to present conditions, with adjustment as appropriate or practical for with-project conditions. Generally, practices for UKC are determined through review of written pilotage rules and guidelines, interviews with pilots and vessel operators and analysis of actual past and present practices based on relevant data for vessel movements. Typically, UKC is measured relative to immersed vessel draft in the static condition.

In the analysis, it is assumed the underkeel clearance used in the existing condition is applied to the future without-project condition and the future with-project conditions. The PORT indicated that the typical UKC requirement is 3 feet or 10 percent of the vessels loaded draft, not to exceed 3 feet. The empirical data confirms this assumption.

2.5.2 Pilot Rules

In regard to Pilot's Rules, it is assumed that no changes will take place in the with-project condition compared to the existing condition. Vessels do not currently have passing restrictions in the channel, and the Crescent City Pilots make the necessary arrangements for meeting, passing and overtaking vessels. As such, this was assumed to be the case in the future without- and future with-project conditions.

2.6 TRADE ROUTES

Origin and destination countries were grouped into trade routes using WCSC data and service data provided by the port. The route groups used in this study and the associated abbreviations are displayed in **Error! Reference source not found.** below. The service guide provided by the Port indicated that all Far East trade was on the Panama Canal route (as opposed to utilizing the Suez Canal).

Table C:2-8. Route Groups

Route Group	HarborSym Abbreviation
Caribbean, Central America, North Coast South America to North America	CAR-CA-NCSA
East Coast South America to North America	ECSA-NA
Far East to North America	FE-NA
Mediterranean to North America	MED-NA
Northern Europe to North America	NEU-NA

Section 3
Future Conditions

3.1 COMMODITY FORECAST

An essential step when evaluating navigation improvements is to analyze the types and volumes of cargo moving through the ports. Trends in cargo history can offer insights into a port's long-term trade forecasts and thus the estimated cargo volume upon which future vessel calls are based. Under future without- and with-project conditions, the same volume of cargo is assumed to move through the PORT. However, a deepening project will allow shippers to load their vessels more efficiently or take advantage of larger vessels. This efficiency translates to transportation cost savings and is the main driver of NED (National Economic Development) benefits.

An in-depth container and fleet forecast for the Gulf Coast was completed for the Houston 204(f) Assumption of Maintenance Report in 2013. Given the PORT's proximity to Houston and the fact that it utilizes most of the same container services as the Port of Houston, it was determined that this existing forecast information could be leveraged for this study.

This study uses the growth rates developed in coordination with Maritime Strategies Inc. (MSI) for the 204(f) Assumption of Maintenance Report Container Forecast for all containerized cargo for the years 2019 through 2035. Growth rates were not available after the year 2035 and thus were held constant from 2035 until 2045, at which point tonnage growth was capped (Table C:3-1)

Table C:3-9. Growth Rates by Trade Route

	Inbound						Outbound				
Year	**CAR-CA-NCSA**	**ECSA-NA**	**FE-NA**	**MED-NA**	**NEU-NA**		**CAR-CA-NCSA**	**ECSA-NA**	**FE-NA**	**MED-NA**	**NEU-NA**
2019	3.56%	4.18%	5.43%	3.17%	3.14%		4.53%	4.83%	7.31%	5.22%	5.42%
2020	3.55%	4.20%	5.46%	3.14%	3.19%		4.33%	4.72%	7.14%	4.99%	5.21%
2021	3.73%	4.48%	5.68%	3.28%	3.38%		3.89%	4.35%	6.92%	4.52%	4.82%
2022	4.01%	4.82%	5.93%	3.56%	3.65%		3.79%	4.34%	6.75%	4.39%	4.65%
2023	3.86%	4.77%	5.61%	3.49%	3.49%		3.72%	4.29%	6.69%	4.35%	4.55%
2024	3.74%	4.74%	5.39%	3.44%	3.46%		3.53%	4.09%	6.55%	4.16%	4.43%
2025	3.83%	4.93%	5.52%	3.60%	3.62%		3.36%	3.93%	6.53%	4.00%	4.27%
2026	3.71%	4.80%	5.33%	3.47%	3.50%		3.35%	3.88%	6.45%	3.93%	4.20%
2027	3.44%	4.52%	4.91%	3.19%	3.28%		3.17%	3.76%	6.31%	3.74%	4.03%
2028	3.39%	4.48%	4.81%	3.12%	3.27%		3.18%	3.80%	6.24%	3.73%	4.02%
2029	3.33%	4.41%	4.67%	3.10%	3.23%		3.16%	3.83%	6.19%	3.72%	3.97%
2030	3.14%	4.22%	4.39%	2.89%	3.08%		3.07%	3.76%	6.08%	3.59%	3.87%
2031	3.01%	4.08%	4.17%	2.75%	2.98%		3.02%	3.73%	5.99%	3.52%	3.79%
2032	2.88%	3.95%	3.95%	2.62%	2.88%		2.96%	3.70%	5.90%	3.44%	3.71%
2033	2.75%	3.81%	3.73%	2.48%	2.77%		2.90%	3.68%	5.81%	3.36%	3.63%
2034	2.62%	3.68%	3.51%	2.35%	2.67%		2.85%	3.65%	5.73%	3.29%	3.56%
2035	2.49%	3.54%	3.29%	2.21%	2.57%		2.79%	3.62%	5.63%	3.21%	3.48%
2036	2.49%	3.54%	3.29%	2.21%	2.57%		2.79%	3.62%	5.63%	3.21%	3.48%
2037	2.49%	3.54%	3.29%	2.21%	2.57%		2.79%	3.62%	5.63%	3.21%	3.48%
2038	2.49%	3.54%	3.29%	2.21%	2.57%		2.79%	3.62%	5.63%	3.21%	3.48%
2039	2.49%	3.54%	3.29%	2.21%	2.57%		2.79%	3.62%	5.63%	3.21%	3.48%
2040	2.49%	3.54%	3.29%	2.21%	2.57%		2.79%	3.62%	5.63%	3.21%	3.48%
2041	2.49%	3.54%	3.29%	2.21%	2.57%		2.79%	3.62%	5.63%	3.21%	3.48%
2042	2.49%	3.54%	3.29%	2.21%	2.57%		2.79%	3.62%	5.63%	3.21%	3.48%
2043	2.49%	3.54%	3.29%	2.21%	2.57%		2.79%	3.62%	5.63%	3.21%	3.48%
2044	2.49%	3.54%	3.29%	2.21%	2.57%		2.79%	3.62%	5.63%	3.21%	3.48%
2045	2.49%	3.54%	3.29%	2.21%	2.57%		2.79%	3.62%	5.63%	3.21%	3.48%

To develop a baseline upon which to forecast, the latest 3 years of available data was used. Historic WCSC tonnage data from 2016 and 2017 was averaged with the PORT's tonnage data from 2018 to develop the baseline forecast. Then, using empirical data, the baseline forecast was divided into imports/exports and route groups based on the historic trends observed at the PORT, which tended to be relatively consistent year-to-year. The growth rates in Table C:3-1, were applied to the baseline tonnage level to develop the commodity forecast displayed in Table C:3-2. As stated previously, tonnage was capped at 2045 levels.

Table C:3-10. Commodity Forecast (Metric Tons)

Route – Tons	Baseline	2025	2035	2045
Import Total	**1,847,029**	**2,410,299**	**3,318,334**	**4,318,343**
CAR-CA-NCSA	1,246,744	1,613,676	2,184,557	2,793,691
ECSA-NA	203,173	278,128	417,605	591,354
FE-NA	83,116	121,486	184,555	254,975
MED-NA	92,351	116,568	153,901	191,502
NEU-NA	221,643	280,440	377,716	486,820
Export Total	**3,688,902**	**5,021,926**	**7,217,386**	**10,140,599**
CAR-CA-NCSA	1,169,147	1,525,913	2,059,650	2,712,078
ECSA-NA	574,029	774,078	1,117,603	1,594,864
FE-NA	217,840	346,133	621,640	1,075,009
MED-NA	772,282	1,052,221	1,491,847	2,046,171
NEU-NA	955,605	1,323,581	1,926,646	2,712,477
Grand Total	***5,535,930***	***7,393,855***	***10,535,720***	***14,458,941***

The commodity forecast by dock is provided in Table C:3-3. In the most recent data provided by the PORT, the Nashville B dock accounted for approximately 12 percent of overall container tonnage. It was assumed that this distribution would remain constant in the future with- and without-project conditions.

Table C:3-11. Commodity Forecast (Metric Tons)

	Napoleon A and Nashville C (Dock Section 1)					
	2025		**2035**		**2045**	
Route	Import	Export	Import	Export	Import	Export
CAR-CA-NCSA	1,420,035	1,342,804	1,922,410	1,812,492	2,458,448	2,386,628
ECSA-NA	244,753	681,189	367,493	983,491	520,392	1,403,480
FE-NA	106,908	304,597	162,408	547,043	224,378	946,008
MED-NA	102,580	925,954	135,432	1,312,825	168,522	1,800,631
NEU-NA	246,787	1,164,751	332,390	1,695,448	428,402	2,386,980
Total	2,121,063	4,419,295	2,920,133	6,351,300	3,800,142	8,923,727
	Nashville B (Dock Section 2)					
	2025		**2035**		**2045**	
	Import	Export	Import	Export	Import	Export
CAR-CA-NCSA	193,641	183,110	262,147	247,158	335,243	325,449
ECSA-NA	33,375	92,889	50,113	134,112	70,962	191,384
FE-NA	14,578	41,536	22,147	74,597	30,597	129,001
MED-NA	13,988	126,267	18,468	179,022	22,980	245,541
NEU-NA	33,653	158,830	45,326	231,197	58,418	325,497
Total	289,236	602,631	398,200	866,086	518,201	1,216,872

Table C:3-12 uses the commodity forecast to estimate inbound and outbound TEUs by forecast year. The number of TEUs are capped in 2045 at 1.1 million. That capacity level is in line with a capacity analysis provided by the Port for Dock Sections 1 & 2.

Table C:3-12. TEU Forecast

Year	Inbound	Outbound	Total
2025	188,078	401,909	589,987
2026	195,372	417,865	613,238
2027	202,416	433,773	636,190
2028	209,621	450,308	659,929
2029	216,957	467,406	684,363
2030	224,135	484,711	708,846
2031	231,255	502,381	733,636
2032	238,298	520,385	758,683
2033	245,237	538,719	783,956
2034	252,056	557,407	809,464
2035	258,730	576,395	835,125
2036	265,584	596,058	861,643
2037	272,624	616,424	889,047
2038	279,853	637,517	917,370
2039	287,278	659,366	946,644
2040	294,904	681,999	976,903
2041	302,736	705,447	1,008,183
2042	310,781	729,740	1,040,521
2043	319,043	754,911	1,073,954
2044	327,530	780,993	1,108,523
2045-2074	336,247	808,021	1,144,268

3.2 VESSEL FLEET FORECAST

In addition to a commodity forecast, a forecast of the future fleet is required to evaluate channel modifications. Table C:3-5 shows the fleet subdivision for containership vessels used for this study. The fleet anticipated to call at the PORT is the same in both the future without-project (FWOP) and future with-project (FWP) conditions. These vessels currently make up a large portion of the existing world fleet.

Following the opening of the expanded Panama Canal in 2016, larger container vessels have been calling to U.S. Ports, particularly to the East Coast of the United States from Asia. As larger vessels are being built and deployed to the U.S. East Coast, more of the PPX Gen 2 and 3 vessels are available to call along the U.S. Gulf Coast, including the PORT. It is assumed that these classes of vessels will replace smaller vessels in the future.

Table C:3-13. Fleet Subdivision for Containership Vessels

Vessel Type	Vessel Class	Beam		Design Draft		LOA		TEU Capacity
		Min	Max	Min	Max	Min	Max	
Containership	Sub-Panamax	70	100	24	38	405	676	600 - 2,800
Containership	Panamax	101	106	38	45	760	960	2,801 - 4,800
Containership	PPX Gen 1	107	132	39	48	920	1,020	4,801 - 6,799
Containership	PPX Gen 2	133	147	41	48	980	1,140	6,800 - 9,900
Containership	PPX Gen 3	148	160	48	52	1,100	1,200	9,901 - 13,100

3.2.1 World Fleet

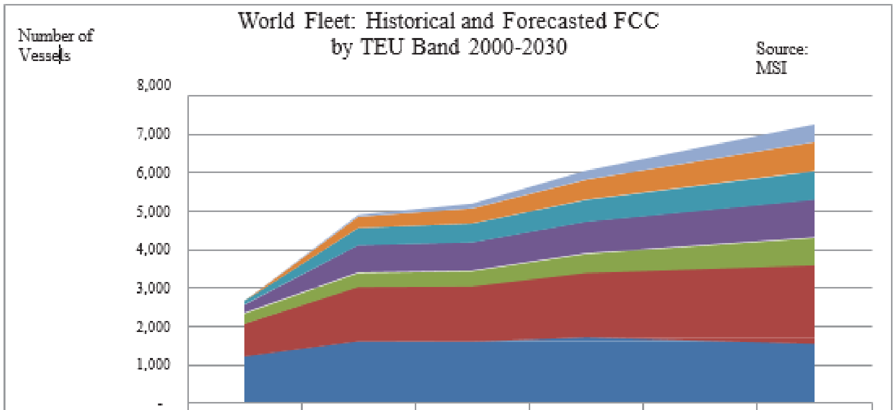
To develop projections of the future fleet calling at PORT, the study team made use of World Fleet forecasts of containerships and other vessels developed by MSI for Port Houston (2013), Port of Charleston (2015), and Port of Seattle (2016).

MSI's forecasting technique begins with performing a detailed review of the current world fleet and how it is deployed on the trade routes of the world. Forecasting of the world fleet was made possible through MSI's proprietary Container Shipping Planning Service (CSPS) model, which applies historical and forecasted time series data from 1980–2030 for:

- Macroeconomic and trade variables including:
    - Annual GDP growth rates by region
    - Industrial production
    - Population growth
    - Inflation and interest rates
    - Currency exchange
- Global container trade and movements in TEU lifts by region including:
    - Primary lifts
    - Transshipment lifts
    - Loaded/Empty lifts
- Sector-specific fleet dynamics including:
    - Fleet nominal capacity by vessel size and age
    - Contracting, order book, deliveries, cancellations, slippage and scrapping
    - Container fleet by size
    - Sector-specific supply/demand balances
    - Time charter rates and vessel operating costs
- Freight rates including:
    - Headhaul rates
    - Backhaul rates
    - New building, second-hand (by age) and scrap prices for standard sizes
- Data sources for the CSPS model include:
    - Macroeconomics: Oxford Economics, leading investment banks

- World Trade: United Nations Conference of Trade and Development, Drewry Shipping Consultants, Containerization International
- Fleet Supply: LR-Fairplay, Worldyards, Howe Robinson
- Charter Rates, Freight Rates and Vessel Prices: Drewry Shipping Consultants, Howe Robinson, Clarksons, and various contacts at shipping lines

When evaluating data on vessel composition, vessel age, and container markets, MSI then considered the "order book" to estimate new deliveries to the fleet into the future. Vessel scrapping is accounted for based on historical scrapping rates by vessel class and age. Containerships, particularly the largest ones, are relatively new, so widespread scrapping is not expected to take place until well in the future. Likewise, when economies are strong, vessel owners are more likely to hold onto their existing vessels (or build new ones) and less likely to scrap them. Figure C:3-1 provides an overview of the world containership fleet used in this study.



	2000	2011	2015	2020	2025	2030
12 k TEU +	-	47	124	232	348	458
7.6 k to 12 k TEU	-	291	388	515	632	742
5.2 k to 7.6 k TEU	104	456	498	577	654	747
3.9 k to 5.2 k TEU	203	707	735	826	905	991
2.9 k to 3.9 k TEU	272	364	393	497	600	708
1.3 k to 2.9 k TEU	850	1,420	1,446	1,684	1,869	2,051
0.1 k to 1.3k TEU	1,214	1,604	1,596	1,706	1,633	1,537

Figure C:3-5. World Fleet: Historical and Forecasted FCC[8] by TEU Band (2000-2030)

3.2.2 Port of New Orleans Container Fleet Forecast

The MSI forecast adapted for this study used the world fleet forecast to determine the expected fleet composition at the PORT over the study period. In combination with the MSI forecast, this study assumed a similar tonnage distribution across PPX Gen 2 and PPX Gen 3 vessels as was used for Charleston Harbor and Seattle Harbor Navigation Improvement Project. For all other vessel classes, the Port Houston MSI forecast (2013) was used as the starting point to forecast future container traffic. Distributions in the MSI forecast were modified where the most recent empirical data from the PORT showed

[8] Fully Cellular Container

that the fleet distribution by route group at the PORT diverged from the MSI forecast. These adjustments were necessary to accurately reflect the number of calls required to satisfy the commodity forecast. The results of the fleet distribution forecast are provided in Table C:3-14. Fleet Distribution Forecast

These percentages were held constant among deepening alternatives. In reviews prior to draft report release, it was recognized that this assumption was inconsistent with other USACE deep draft navigation studies involving container ships. The fleet forecast is currently being refined, and these updates will be completed prior to the release of the final report.

Table C:3-14. Fleet Distribution Forecast

Service and Vessel Class	2025	2035	2045
FE-NA-PAN SPX	0%	0%	0%
FE-NA-PAN PX	47%	23%	9%
FE-NA-PAN PPX1	29%	32%	22%
FE-NA-PAN PPX2	11%	19%	27%
FE-NA-PAN PPX3	13%	27%	41%
MED-NA SPX	5%	5%	3%
MED-NA PX	26%	25%	11%
MED-NA PPX1	30%	33%	25%
MED-NA PPX2	16%	15%	24%
MED-NA PPX3	23%	22%	36%
NEU-NA SPX	1%	1%	0%
NEU-NA PX	25%	25%	11%
NEU-NA PPX1	31%	31%	22%
NEU-NA PPX2	18%	18%	27%
NEU-NA PPX3	25%	25%	40%
ECSA-NA SPX	6%	6%	6%
ECSA-NA PX	11%	11%	11%
ECSA-NA PPX1	83%	83%	83%
ECSA-NA PPX2	0%	0%	0%
ECSA-NA PPX3	0%	0%	0%
CAR-CA-NCSA SPX	22%	22%	22%
CAR-CA-NCSA PX	15%	15%	15%
CAR-CA-NCSA PPX1	36%	36%	36%
CAR-CA-NCSA PPX2	27%	27%	27%
CAR-CA-NCSA PPX3	0%	0%	0%

Section 4
Transportation Cost Savings Benefit Analysis

For the purposes of Deep Draft Navigation Economic Analysis per ER 1105-2-100, an NED benefit may include:

- Reduced cost of transportation through use of vessels (modal shift), through safer or more efficient operation of vessels and/or use of larger and more efficient vessels (channel enlargement), and through use of new or alternate vessel routes (new channels or port shift)
- Increased net return to producers from access to new sources of lower cost materials, or access to new and more profitable markets (shift of origin or destination)
- Increased production through new or greater production opportunity (commercial fishing and offshore minerals), or new economic activities involving new commodity movements (induced movements)

The benefits described previously are meant to increase shipping efficiency, leading to a reduction in the total cost of commodity transit. The reduction in transportation costs becomes a national economic benefit when the savings are passed on to the consumer.

The purpose of this analysis is to describe the benefits associated with the channel deepening alternatives under consideration for the PORT. NED benefits were estimated by calculating the reduction in transportation cost for each alternative depth using the HarborSym Modeling Suite of Tools (HMST, or HarborSym) developed by the Institute for Water Resources (IWR). The HMST reflects USACE guidance on transportation cost savings analysis.

4.1 METHODOLOGY

Access channel improvements result in reduced transportation cost by allowing a more efficient future fleet mix when traversing the port, resulting in at-sea and in-port cost savings. HarborSym was designed to allow users to model these benefits. With a deepened access channel, there is an increase in a vessel’s maximum practicable loading capacity. Access channel restrictions limit a vessel’s capacity by limiting its draft. Deepening the access channel reduces this constraint and the vessel’s maximum practicable capacity increases towards its design capacity. This increase in vessel capacity results in fewer vessel trips being required to transport the forecasted cargo.

HarborSym was used to estimate origin-destination (OD) cost saving benefits (or the reduction in transit costs associated with a drop in the total number of port calls caused by deeper loading or the use of a more efficient fleet mix). The commodity and fleet forecasts detailed in the previous section were entered into the Container Loading Tool (CLT), a module within HarborSym. The vessel traffic resulting from the commodity and fleet forecast was simulated using HarborSym to average annual vessel OD transportation costs.

Model runs were completed for the deepening benefits associated with depths of 43 feet, 45 feet, 48 feet, and 50 feet Low Water Reference Plain (LWRP). The resulting benefits are described in Section 4.5. The Tentatively Selected Plan (TSP) was identified by considering the highest net benefit based on the OD transportation cost saving benefits.

4.2 HARBORSYM MODEL OVERVIEW

IWR developed HarborSym as a planning level, general-purpose model to analyze the transportation costs of various waterway modifications within a harbor. HarborSym is a Monte Carlo simulation model of vessel movements at a port for use in economic analyses. While many harbor simulation models focus on landside operations, such as detailed terminal management, HarborSym instead concentrates on specific vessel movements and transit rules on the waterway, fleet and loading changes, as well as incorporating calculations for both within harbor costs and costs associated with the ocean voyage. Because this study does not include improvements within the Mississippi River Ship Channel nor the PORT access channel other than deepening, this analysis focuses on the costs savings associated with the ocean voyage.

HarborSym represents a port as a tree-structured network of reaches, docks, anchorages, and turning areas. Vessel movements are simulated along the reaches, moving from the bar to one or more docks, and then exiting the port. Features of the model include intra-harbor vessel movements, tidal influence, the ability to model complex shipments, incorporation of turning areas and anchorages, and within-simulation visualization. The driving parameter for the HarborSym model is a vessel call at the port. A HarborSym analysis revolves around the factors that characterize or affect a vessel movement within the harbor.

4.3 HARBORSYM MODEL BEHAVIOR

HarborSym is an event driven model. Vessel calls are processed individually and the interactions with other vessels are taken into account. For each iteration, the vessel calls for an iteration that falls within the simulation period are accumulated and placed in a queue based on arrival time. When a vessel arrives at the port, the route to all of the docks in the vessel call is determined. This route is comprised of discrete legs (contiguous sets of reaches, from the entry to the dock, from a dock to another dock, and from the final dock to the exit). The vessel attempts to move along the initial leg of the route. Potential conflicts with other vessels that have previously entered the system are evaluated according to the user-defined set of rules for each reach within the current leg, based on information maintained by the simulation as to the current and projected future state of each reach. If a rule activation occurs, such as no passing allowed in a given reach, the arriving vessel must either delay entry or proceed as far as possible to an available anchorage, waiting there until it can attempt to continue the journey. Vessels move from reach to reach, eventually arriving at the dock that is the terminus of the leg.

After the cargo exchange calculations are completed and the time the vessel spends at the dock has been determined, the vessel attempts to exit the dock, starting a new leg of the vessel call; rules for moving to the next destination (another dock or an exit of the harbor) are checked in a similar manner to the rule checking on arrival, before it is determined that the vessel can proceed on the next leg. As with the entry into the system, the vessel may need to delay departure and re-try at a later time to avoid rule violations and, similarly, the waiting time at the dock is recorded.

A vessel encountering rule conflicts that would prevent it from completely traversing a leg may be able to move partially along the leg, to an anchorage or mooring. If so, and if the vessel can use the anchorage (which may be impossible due to size constraints or the fact that the anchorage is filled by other vessels), then HarborSym will direct the vessel to proceed along the leg to the anchorage, where it will stay and attempt to depart periodically, until it can do so without causing rule conflicts in the remainder of the leg. The determination of the total time a vessel spends within the system is the summation of time waiting at entry, time transiting the reaches, time turning, time transferring cargo, and time waiting at docks or anchorages. HarborSym collects and reports statistics on individual vessel movements, including time in system, as well as overall summations for all movements in an iteration.

HarborSym was initially developed as a tool for analyzing channel widening projects, which were oriented toward determining time savings for vessels transiting within a harbor. It did not allow for assessing changes in vessel loading or in shipping patterns. The most recent release of HarborSym was designed to assist analysts in evaluating channel-deepening projects, in addition to the original model capabilities. The deepening features consider fleet and loading changes, as well as incorporating calculations for both within harbor costs and costs associated with ocean voyage.

Each vessel call has a known (calculated) associated cost, based on time spent in the harbor and ocean voyage and cost per hour. Also for each vessel call, the total quantity of commodity transferred to the port (both import and export) is known, in terms of commodity category, quantity, tonnage and value. The basic problem is to allocate the total cost of the call to the various commodity transfers that are made. Each vessel call may have multiple dock visits and multiple commodity transfers at each visit, but each commodity transfer record refers to a single commodity and specifies the import and export tonnage. Also, at the commodity level, the “tons per unit” for the commodity is known, so that each commodity transfer can be associated with an export and import tonnage. As noted above, the process is greatly simplified if all commodity transfers within a call are for categories that are measured in the same unit, but that need not be the case.

When a vessel leaves the system, the total tonnage, export tonnage, and import tonnage transferred by the call are available, as is the total cost of the call. The cost per ton can be calculated at the call level (divide total cost by respective total of tonnage). Once these values are available, it is possible to cycle through all of the commodity transfers for the vessel call. Each commodity transfer for a call is associated with a single vessel class and unit of measure. Multiplying the tons or value in the transfer by the appropriate per ton cost, the cost totals by class and unit for the iteration can be incremented. In this fashion, the total cost of each vessel call is allocated proportionately to the units of measure that are carried by the call, both on a tonnage and a value basis. Note that this approach does not require that each class or call carry only a commensurate unit of measure.

The model calculates import and export tons, import and export value, and import and export allocated cost. This information allows for the calculation of total tons and total cost, allowing for the derivation of the desired metrics at the class and total level. The model can thus deliver a high level of detail on individual vessel, class, and commodity level totals and costs.

Either all or a portion of the at-sea costs are associated with the subject port, depending on whether the vessel call is a partial or full load. The at-sea cost allocation procedure is implemented within the HarborSym Monte-Carlo processing and utilizes the estimate total trip cargo (ETTC) field from the vessel call information along with import tonnage and export tonnage. In all cases the ETTC is the user's best estimate of total trip cargo. Within the CLT, the ETTC field is estimated as cargo on board the vessel at arrival plus cargo on board the vessel at departure, in tons. ETTC can also be expressed as:

ETTC = 2*Cargo on Board at Arrival – Import tons + Export tons

There is a basic algorithm implemented to determine the fraction of at-sea costs to be allocated to the subject port. First, if ETTC for a vessel call is equal to zero or null, then none of the at-sea costs are associated with the port. The algorithm then checks if import or export tons are zero for a vessel call. If either are zero, then the following equation is applied to determine the at-sea cost allocation fraction associated with the subject port:

At-Sea Cost Allocation Fraction = (Import tons + Export tons)/ETTC

Finally, when both import and export tons are greater than zero, the following equation is applied to determine the at-sea cost allocation fraction associated with the subject port:

At-Sea Cost Allocation Fraction = 0.5 * (Import tons/Tonnage on board at arrival)

+ 0.5 * (Export tons/Tonnage on board at departure)

Where:

Tonnage on board at arrival = (ETTC + Imports – Exports)/2

Tonnage on board at departure = Tonnage on board at arrival – Imports + Exports

4.4 HARBORSYM DATA INPUTS

The data required to run HarborSym are separated into six categories, as described below. Key data for the PORT study are provided.

4.4.1 Simulation Parameters

Parameters include start date, the duration of the iteration, the number of iterations, the level of detail of the result output, and the wait time before rechecking rule violations when a vessel experiences a delay. The base year for the model was 2025. A model run was performed for the following years: 2025 and 2045, and 50 iterations were ran for each year. For the final report, a model run will be added for the year 2035 to increase the accuracy of interpolation between modeled years.

4.4.2 Physical and Descriptive Harbor Characteristics

These data inputs include the specific network of the PORT, such as the node location and type, reach length, width, and depth, in addition to tide and current stations. This also includes information about the docks in the harbor such as length and the maximum number of vessels the dock can accommodate at any given time.

4.4.3 General Information

General information used as inputs to the model include: specific vessel and commodity classes, route groups, specifications of turning area usage at each dock, and specifications of anchorage use within the harbor. Distances between the route groups were developed by evaluating the trade routes calling on the PORT. Those routes were separated into trade lanes based on their world region. The route group distance used in the analysis for each trade lane was calculated from the typical distance for each trade route that was identified for the specific trade lane, as shown in Table C:4-1. This data was taken from container services calling the PORT between 2014 and 2017. Distances were calculated using sea-distances.org. Values are in nautical miles.

Table C:4-15. Route Group Distances

Region	Total Sea Distance		
	Min	Most Likely	Max
Caribbean-Central America North Coast South America (CAR-CA-NCSA)	1,466	1,898	9,778
East Coast South America - North America (ECSA-NA)	6,756	11,886	13,710
Far East - North America (FE-NA)	19,076	21,235	28,806
Mediterranean – North America (MED-NA)	8,804	9,204	20,010
Northern Europe - North America (NEU-NA)	9,206	10,980	12,096

4.4.4 Vessel Speeds

Table C:4- presents the average vessel speed by reach for all vessels.

Table C:4-2. Average Vessel Speed by Reach

Reach	Speed in Reach, Light (knots)	Speed in Reach, Loaded (knots)
Reach - 1 (RM 98.3)	10.0	8.0
Reach - 2	5.0	3.0
Reach - 3	10.0	8.0
Reach - 4	5.0	3.0

4.4.5 Vessel Operations

Hourly operating costs while in-port and at-sea were determined for all vessels. These are based on the most recent vessel operating costs developed by IWR. These operating costs are proprietary to the USACE and can be provided upon request. The IWR data also includes inputs for at-sea speed by vessel class. These values are entered as a triangular distribution and presented in Table C:4-3.

Table C:4-3. Vessel Operating Costs

Vessel Type	Class	At-Sea Speed		
		Min	Most Likely	Max
Containership	SPX	16	18	19
	PX	19	20	20
	PPX I	21	22	22
	PPX II	20	21	21
	PPX III	20	21	21

4.4.6 Reach Transit Rules

Vessel transit rules reflect restrictions on meeting, daylight restrictions, vessel size limitations, underkeel clearance requirements, and other pilot working rules. The only transit rule applied to this study was the underkeel clearance described in Section 2.5.1.

4.4.7 Vessel Calls

Vessel call lists were generated for each project depth for years 2025 and 2045. (Note: the vessel call lists for 2035 will be developed prior to the final report). Each vessel call list contains the following information: arrival date, arrival time, vessel name, entry point, exit point, arrival draft, import/export, dock name, dock order, commodity, units, origin/destination, vessel type, Lloyds Registry, net registered tons, gross registered tons, dead weight tons, capacity, length overall, beam, draft, flag, tons per inch immersion factor, ETTC, and the route group for which it belongs.

4.4.8 Vessel Call Lists

To develop vessel call lists for use in HarborSym, the forecasted tonnage levels were allocated to the future fleet using extensive data inputs that are used by the CLT.

To begin, tentative arrival draft is determined for each generated vessel based on user-provided cumulative distribution functions. A random draw is made from that CDF and the arrival draft is initially set to that value. The maximum allowable arrival draft is then determined as the minimum of:

1. Prior port limiting depth
2. Design draft
3. Limiting depth at the dock + underkeel clearance + sinkage adjustment + tidal availability + sea level change

The tentative arrival draft is then compared to the maximum allowable arrival draft, and set to the lesser value, that is, either the statistically estimated value or the constrained value.

Next, a load factor analysis (LFA) is conducted given the physical characteristics of each generated vessel. LFA explores the relationships between a ships physical attributes, considerations for operations and attributes of the trade route cargo to evaluate the operating efficiencies of vessel classes at alternative sailing drafts. Several intermediate calculations are required. The following variables are used by the LFA algorithm, but are calculated from the inputs:

- Vessel operating cost per 1000 miles is calculated as 1000 miles divided by the applied speed times the hourly at sea cost = 1000 miles / (Applied Speed x Hourly Cost)
- The allocation of vessel space to vacant slots, empty and loaded containers is calculated by adding the cargo weight per box plus the box weight plus an allowance for the empty
- Total weight per loaded container =
- Average Lading Weight per Loaded TEU by Route (tonnes)
- + Average Container (Box only) Weight per TEU (tonnes)
- + (Average Container (Box only) Weight per TEU (tonnes)*(Percent Empty TEUs))
- Shares of vessel capacity are then calculated as:
- Cargo Share = Average Lading Weight per Loaded TEU by Route (tonnes)
- Total weight per loaded container in tonnes
- Laden Container Share = Average Container (Box only) Weight per TEU (tonnes)
- Total weight per loaded container in tonnes
- Empty Container Share = ((Average Container (Box only) Weight per TEU (tonnes))*(Percent Empty TEUs)) Total weight per loaded container in tonnes
- Volume capacity limits are calculated as follows:
- Number of vacant slots = Nominal TEU Rating * Percent vacant slots
- Max Occupied Slots = Nominal TEU Rating - Number of vacant slots

- Max Laden TEUs = Occupied Slots/(1+Percent Empties)
- Max Empty TEUs = Occupied Slots - Laden TEUs
- Maximum Volume Restricted Tonnage is then calculated as:
- Max weight for cargo (tonnes) = Max Laden TEUs * Average Lading Weight per Loaded TEU by Route (tonnes)
- Max weight for laden boxes (tonnes) = Max Laden TEUs * Average Container (Box only) Weight per TEU (tonnes)
- Max weight for empties(tonnes) = Max Empty TEUs * Average Container (Box only) Weight per TEU (tonnes)
- Total volume restricted tonnage (cubed out tonnage)(tonnes) = Max weight for cargo + Max weight for laden boxes + Max weight for empties

The LFA proceeds as follows:

- The initial draft is varied from the vessels maximum (loaded) to minimum (empty). At each sailing draft the total tonnage that can be carried is calculated using the Tons Per Inch Immersion (TPI) rating for the vessel.
- DWT Available for Vessel Draft = DWT Rating (tonnes) – [(Aggregate Maximum Summer Load Line Draft – Sailing Draft)*12 inches*TPI]
- This capacity is then allocated, first to ballast and operations to yield capacity available for cargo.
- Approximate Variable Ballast = DWT Available for Vessel Draft * Percent Assumption for Variable Ballast
- Allowance for Operations in tonnes = DWT Rating (tonnes) * Percent Allowance for Operations
- Available for Cargo = (DWT Available for Vessel Draft)- (Approximate Variable Ballast) - (Allowance for Operations)
- The capacity available for cargo is restricted if the vessel has “cubed” or “volumed” out:
- Available for Cargo adjusted for volume restriction if any (tonnes) = the lesser of Available for Cargo and Total volume restricted tonnage (cubed out tonnage)
- The tonnage available for cargo is then allocated to cargo, laden and empty containers based on the shares of vessel capacity:
- Distribution of Space Available for Cargo (tonnes) = Available for Cargo adjusted for volume restriction if any in tonnes * Cargo Share in percent
- Distribution of Space Available for Laden TEUs (tones) = Available for Cargo adjusted for volume restriction if any in tonnes * Laden Container Share in percent
- Distribution of Space Available for Empty TEUs (tonnes) = Available for Cargo adjusted for volume restriction if any * Empty Container Share
- The number of TEUs is then estimated for each share use:
- Number of Laden TEUs = Distribution of Space Available for Cargo/Average Lading Weight per Loaded TEU by Route (tonnes)
- Number Empty TEUs = Distribution of Space Available for Empty TEUs /Average Container (Box only) Weight per TEU (tonnes)

- Occupied TEU Slots on Vessel = Number of Laden TEUs + Number Empty TEUs
- Vacant Slots = Nominal TEU Rating − Occupied TEU Slots
- ETTC for each vessel call as the cargo on board the vessel at arrival plus the cargo on board the vessel at departure, in tons.

This process is repeated for each vessel available to carry the commodity on the given route until the forecast is satisfied.

4.4.9 Container Loading Tool Inputs

Table C:4-164 provides the vessel class assumptions used in the LFA described previously, such as average lading weight per TEU, container weight, vacant slot allotment, variable ballast, import/export fraction (cargo share), etc. These inputs were developed using data from the National Navigation Operation & Management Performance Evaluation & Assessment System (NNOMPEAS) for the years 2014-2017.

Table C:4-16. Vessel Class Loading Assumptions

Service	Vessel Class	Avg. Lading Weight Per TEU (tonne)	Avg. Tare Weight Per TEU (tonne)	Empty TEU Allotment	Vacant Slot Allotment	Operations Allowance (% DWT)	Variable Ballast (%DWT)	Import Fraction	Export Fraction
CAR-CA-NCSA	SPX	10.9	2	21.0%	7.7%	6.7%	11%	9%	19%
CAR-CA-NCSA	PX	13.71	2	21.0%	7.7%	6.7%	11%	9%	19%
CAR-CA-NCSA	PPX Gen I	14.78	2	21.0%	7.7%	6.7%	11%	9%	19%
CAR-CA-NCSA	PPX Gen II	15.07	2	21.0%	7.7%	6.7%	11%	9%	19%
CAR-CA-NCSA	PPX Gen III	15.07	2	21.0%	7.7%	6.7%	11%	9%	19%
ECSA-NA	SPX	13.83	2	24.0%	6.2%	6.7%	11%	13%	19%
ECSA-NA	PX	13.68	2	24.0%	6.2%	6.7%	11%	13%	19%
ECSA-NA	PPX Gen I	14.08	2	24.0%	6.2%	6.7%	11%	13%	19%
ECSA-NA	PPX Gen II	12.48	2	24.0%	6.2%	6.7%	11%	13%	19%
ECSA-NA	PPX Gen III	12.48	2	24.0%	6.2%	6.7%	11%	13%	19%
FE-NA	PX	13.23	2	24.0%	7.7%	6.7%	11%	4%	16%
FE-NA	PPX Gen I	12.23	2	24.0%	7.7%	6.7%	11%	4%	16%
FE-NA	PPX Gen II	13.21	2	24.0%	7.7%	6.7%	11%	4%	16%
FE-NA	PPX Gen III	13.21	2	24.0%	7.7%	6.7%	11%	4%	16%
MED-NA	SPX	15.76	2	14.0%	4.7%	6.7%	11%	4%	15%
MED-NA	PX	12.69	2	14.0%	4.7%	6.7%	11%	4%	15%
MED-NA	PPX Gen I	12.76	2	14.0%	4.7%	6.7%	11%	4%	15%
MED-NA	PPX Gen II	12.67	2	14.0%	4.7%	6.7%	11%	4%	15%
MED-NA	PPX Gen III	12.67	2	14.0%	4.7%	6.7%	11%	4%	15%
NEU-NA	SPX	11.42	2	10.0%	4.7%	6.7%	11%	5%	15%
NEU-NA	PX	13.65	2	10.0%	4.7%	6.7%	11%	5%	15%
NEU-NA	PPX Gen I	12.33	2	10.0%	4.7%	6.7%	11%	5%	15%
NEU-NA	PPX Gen II	14.01	2	10.0%	4.7%	6.7%	11%	5%	15%
NEU-NA	PPX Gen III	14.01	2	10.0%	4.7%	6.7%	11%	5%	15%

Table C:4-17 provides details on the vessel subclasses vessels used to satisfy the commodity forecast. The user provides the linkage between the HarborSym vessel class and the IWR-defined vessel subclass. The percentage share of each subclass was defined by historical NNOMPEAS data.

Table C:4-17. Vessel Subclass Assumptions

Vessel Class	LOA	Beam	Max SLLD	Capacity (DWT)	TEU Rating	TPI Factor	Sinkage	% of Class
SPX	466.44	72.89	26.23	11,726	907	59.2	0.7	0.1
SPX	499.19	79.36	28.93	14,924	1,090	68.8	0.8	0.1
SPX	534.64	84.96	30.35	18,438	1,388	78.5	0.8	0.1
SPX	570.65	87.03	31.28	20,643	1,447	87.1	0.8	0.1
SPX	576.4	84.24	32.49	22,184	1,529	87.2	0.9	0.1
SPX	585.46	89.72	33.46	24,283	1,618	93.6	0.9	0.1
SPX	596.1	91.57	34.57	24,812	1,778	96.3	0.9	0.1
SPX	603.19	91.64	35.56	25,370	1,894	97.1	0.9	0.1
SPX	657.08	97.69	36.21	31,139	2,267	113.8	1	0.1
SPX	675.57	98.84	37.58	33,887	2,469	117.7	1	0.1
PX	901	105.01	38.46	42,183	3,083	146	1	0.1
PX	901	103.87	39.41	43,311	3,188	142.8	1	0.1
PX	901	105.57	40.34	44,991	3,389	150.2	1.1	0.1
PX	901	105.67	41.22	50,070	3,841	162.7	1.1	0.1
PX	901	105.67	42.53	56,792	4,125	176.7	1.1	0.2
PX	901	104.2	43.41	54,885	3,992	170.4	1.2	0.2
PX	959.01	105.6	44.39	64,956	4,729	192.7	1.2	0.2
PPX1	1013.63	131.6	39.37	74,070	5,918	240.9	1	0.1
PPX1	928.08	131.47	41.44	75,623	5,534	214.7	1.1	0.1
PPX1	972.01	123.45	42.81	77,149	4,857	219	1.1	0.1
PPX1	899.88	130.32	44.36	78,284	4,912	208	1.2	0.1
PPX1	934.79	131.44	46.01	78,618	5,792	215.1	1.2	0.1
PPX1	949.07	131.78	46.02	79,891	6,050	221.6	1.2	0.1
PPX1	953.76	131.75	46.05	80,651	6,185	222.3	1.2	0.05
PPX1	964.84	131.69	46.07	80,504	6,294	225.4	1.2	0.05
PPX1	974.7	131.73	46.09	81,237	6,387	228.7	1.2	0.05
PPX1	981.28	131.74	46.1	110,448	6,441	230.7	1.2	0.05
PPX1	984.04	131.77	46.13	75,898	6,505	230.9	1.2	0.05
PPX1	988.83	131.8	46.17	86,060	6,549	233.1	1.2	0.05
PPX1	991.62	131.85	46.23	102,179	6,599	233.7	1.2	0.05
PPX1	991.57	131.91	46.34	102,871	6,662	233.5	1.2	0.03
PPX1	969.88	131.7	47.6	103,817	6,328	229.4	1.3	0.02
PPX2	1101.16	146.37	42.65	104,549	9,148	290.3	1.1	0.1
PPX2	984.3	140.99	44.29	104,104	6,332	244.6	1.2	0.1
PPX2	1017.74	142.79	46.13	103,865	7,200	260.3	1.2	0.1
PPX2	1089.65	142.26	47.61	104,657	8,212	284.9	1.3	0.1
PPX2	1099.37	142.89	47.63	105,458	8,527	289.2	1.3	0.05
PPX2	1106.31	142.86	47.64	106,737	8,669	291.5	1.3	0.05
PPX2	1108.61	143.35	47.65	108,348	8,786	292	1.3	0.05
PPX2	1112.32	143.63	47.67	92,498	8,874	292.6	1.3	0.05
PPX2	1114.13	143.78	47.66	92,875	8,916	293.5	1.3	0.05
PPX2	1117.73	144.44	47.66	93,905	9,018	295.3	1.3	0.05
PPX2	1122.37	144.96	47.67	95,169	9,144	297.7	1.3	0.1
PPX2	1127.25	145.01	47.66	96,687	9,294	300.3	1.3	0.1
PPX2	1138.59	145.16	47.6	98,893	9,513	303.4	1.3	0.1
PPX3	1200	140	48.6	118,908	10,100	315	1.3	0.5
PPX3	1100	158	50.9	115,700	10,888	315	1.3	0.5

Figure C:4-1 through Figure C:4-2. Future With-Project Arrival Draft CDF for PPX Gen II and III (All Docks)

3 display the arrival draft CDFs by channel depth for those vessel classes that would benefit from a channel deepening. To simulate the effects that a deepened channel will have on vessel loading, the arrival draft CDFs by vessel class were adjusted for each of the with-project conditions. The existing condition arrival draft CDFs are displayed in Section 2.4.2. The existing CDFs were developed by evaluating Entrances and Clearances data compiled by the WCSC for the years 2015 through 2017. Each call was separated into a container vessel class depending on the vessel characteristics of each call. For the purposes of the arrival draft CDF, the vessel TEU capacity was used to assign vessels to a class. Because the design drafts of Sub-Panamax and Panamax vessels could be fully accommodated under existing conditions, these arrival draft were not adjusted in the with-project conditions.

To evaluate the with-project condition of deepening to depths between 40 feet through 45 feet, the second dock section (Nashville B) was separated from the aggregated arrival draft CDFs. Nashville B has historically maintained a depth of 40 feet and accounted for approximately 12 percent of container tonnage in recent years, according to PORT data.

The probability curves for the arrival drafts of the vessels in future project conditions was developed with the assistance of IWR. The assumption was made that for each additional foot of channel depth available to carriers, the average PPX container vessel would use approximately 0.6 to 0.8 feet of that depth. Therefore, for the analysis, it was assumed that each PPX container vessel would sail with an additional 0.7 feet for each one-foot increment of channel depth evaluated. Regardless of channel depth, the SPX and PX vessel arrival draft curves do not shift. Because the PPX Gen 3 vessels are a new type of traffic to the PORT, there was not enough historical data upon which to build the arrival draft. It is assumed that the PPX Gen 3 will load similarly to the PPX Gen 2 class. Therefore, the CDF for the PPX Gen 2 vessel class was used for the PPX Gen 3 class. Similarly, the Nashville B dock did not have a large history of PPX Gen 2 vessels calling. It is assumed that PPX Gen 2 and Gen 3 vessels will call to this dock in the future without- and future with-project conditions (because there is nothing to preclude them from doing so), although it might be with limited frequency. Due to the limited data points for PPX Gen 2 vessels calling at the second dock section, the PPX Gen 1 arrival draft CDF was applied to both PPX Gen 2 and PPX Gen 3 for the Nashville B dock.

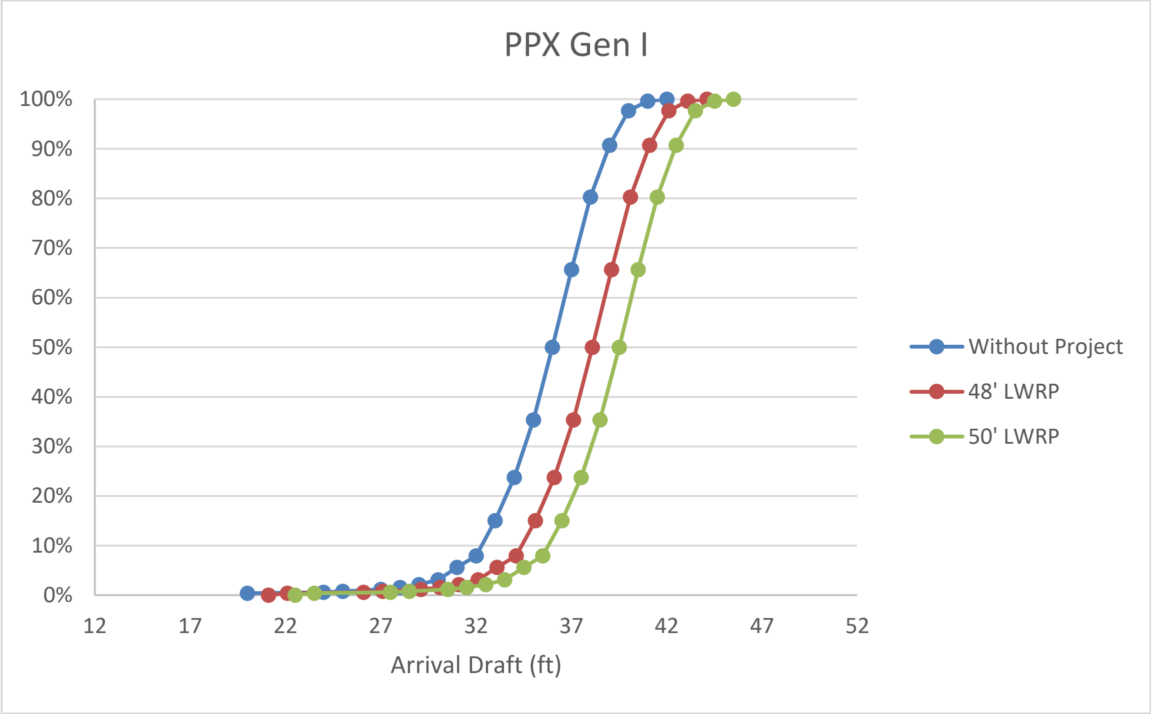


Figure C:4-1. Future With-Project Arrival Draft CDF for PPX Gen I (All Docks)

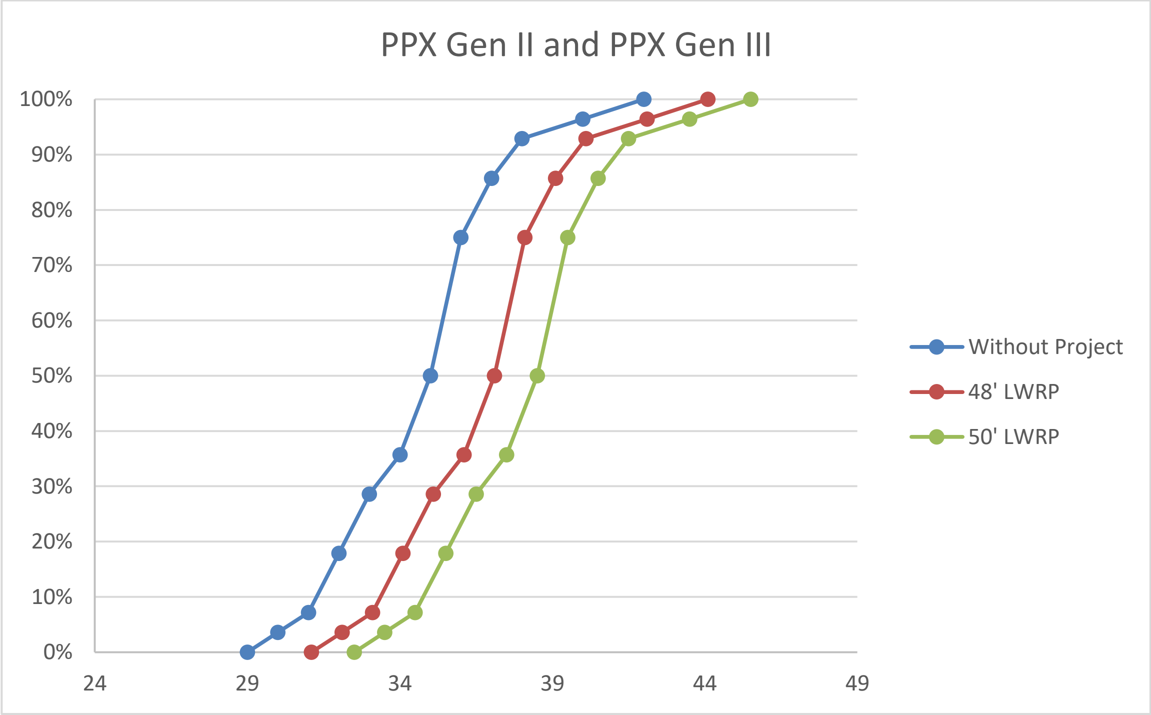


Figure C:4-2. Future With-Project Arrival Draft CDF for PPX Gen II and III (All Docks)

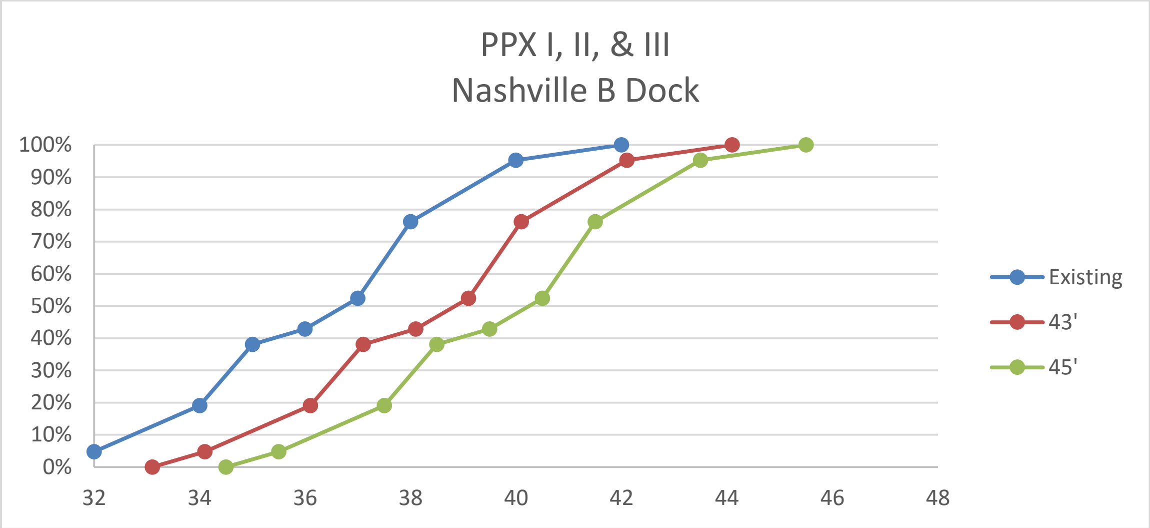


Figure C:4-6. Future With-Project Arrival Draft CDF for PPX Gen I, II and III (Nashville B)

Table C:4-6 and Figure C:4-4 displays the total number of calls in 2025 and 2045 by vessel class from the vessel call lists resulting from the forecasting and load factor analysis described in this section. As the table shows, the total number of calls are reduced as the channel is deepened. The number of calls reduced between depths of 45 feet and 50 feet is much greater than those reduced between 40 feet and 45 feet, because all dock sections benefit from a deepening from 45 feet to 50 feet, whereas only the smaller dock section (Nashville B, which accounts for approximately 12 percent of container tonnage) benefits from the deepening from 40 feet to 45 feet.

When developing the fleet forecast in Table C:4-6 , the percentage distribution of the vessels within the fleet were held constant among deepening alternatives. In reviews prior to draft report release, it was recognized that this assumption was inconsistent with other USACE deep draft navigation studies involving container ships. The fleet forecast is currently being refined, and these updates will be completed prior to the release of the final report.

Table C:4-18. Containerized Vessel Calls by Year and Project Depth (LWRP)

	FWOP		43'		45'		48'		50'	
Vessel Class	2025	2045	2025	2045	2025	2045	2025	2045	2025	2045
Sub-Panamax	204	330	202	329	201	329	202	338	200	337
Panamax	242	254	240	254	235	253	238	247	238	255
PPX Gen 1	230	431	227	426	227	421	215	392	202	373
PPX Gen 2	97	305	95	307	94	307	83	269	80	251
PPX Gen 3	43	187	43	186	43	184	40	169	39	157
Total	816	1507	807	1502	800	1494	778	1415	759	1373

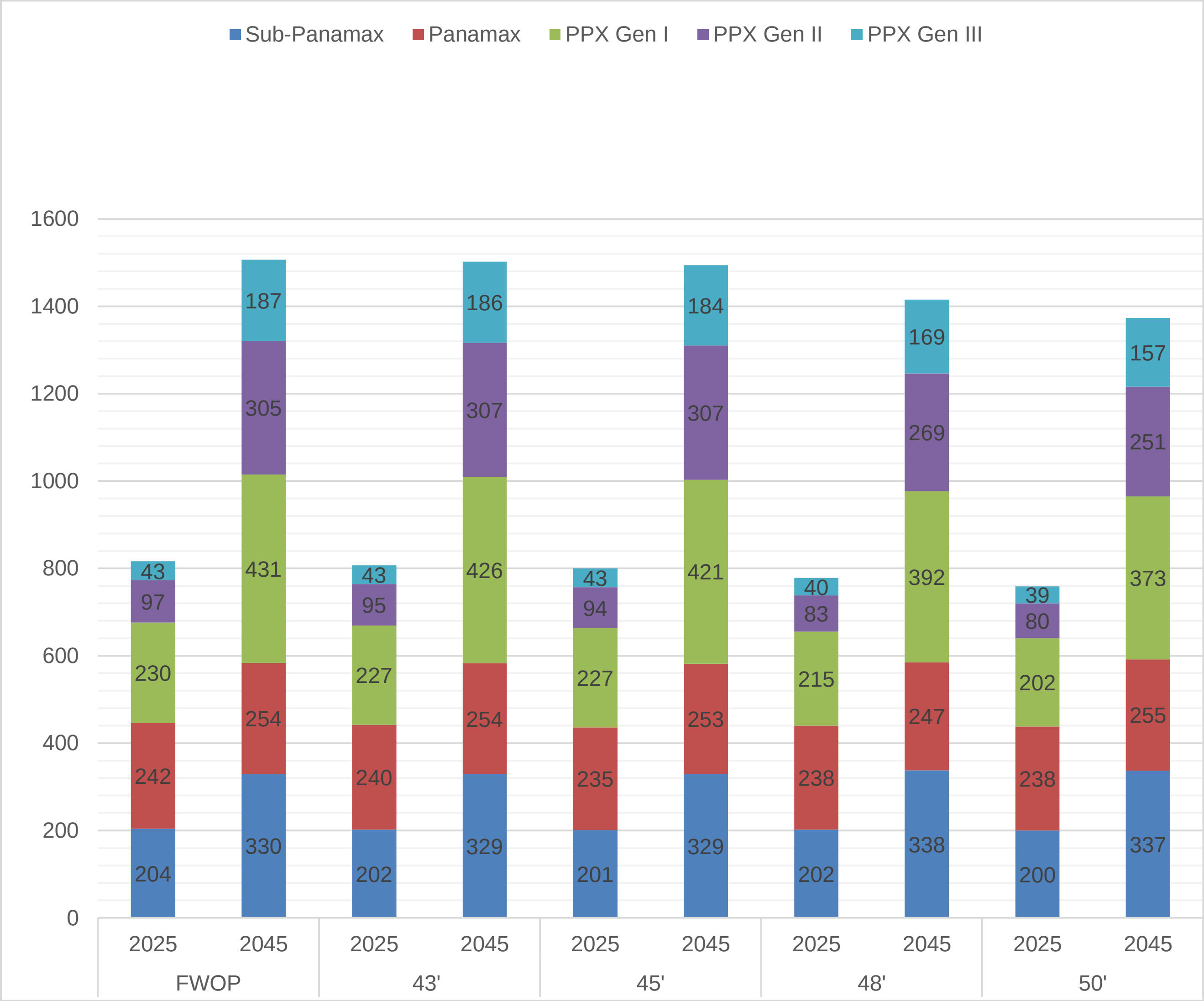


Figure C:4-7. Vessel Fleet Forecast (2025, 2045)

4.5 TRANSPORTATION COST SAVINGS BENEFITS ANALYSIS

Transportation cost benefits were estimated using the HarborSym Economic Reporter, a tool developed by IWR that summarizes and annualizes HarborSym results from multiple simulations. This tool collects the transportation costs from various model run output files and generates the transportation cost reduction for all project years, then produces an Average Annual Equivalent (AAEQ).

Transportation costs were estimated for a 50-year period beginning in 2025 and ending in 2074. Transportation costs were estimated using HarborSym for the years 2025 and 2045, and costs were held constant beyond 2045. The present value was estimated by interpolating between the modeled years and discounting at the current FY 2020 Federal Discount rate of 2.75 percent.

Table C:4-19 provides the annual transportation costs for the total (in-port and at-sea) voyage that are allocated to the PORT. The annual transportation cost saving benefits for each of the with-project alternative depths are provided in

Table C:4-20. The AAEQ transportation costs and cost saving benefits are provided in Table C:4-21. AAEQ cost statistics are provided in

Table C:4-22.

Table C:4-19. Total Transportation Cost Allocated to Port ($1000s)

Year	FWOP	43’	45’	48’	50’
2025	**$173,476**	**$171,437**	**$170,423**	**$164,200**	**$160,470**
2026	$183,047	$181,023	$179,936	$172,493	$168,393
2027	$192,618	$190,609	$189,449	$180,786	$176,315
2028	$202,189	$200,195	$198,962	$189,080	$184,238
2029	$211,760	$209,782	$208,475	$197,373	$192,161
2030	$221,331	$219,368	$217,988	$205,666	$200,083
2031	$230,902	$228,954	$227,501	$213,960	$208,006
2032	$240,473	$238,540	$237,014	$222,253	$215,928
2033	$250,044	$248,126	$246,527	$230,546	$223,851
2034	$259,615	$257,712	$256,040	$238,840	$231,774
2035	$269,186	$267,298	$265,553	$247,133	$239,696
2036	$278,757	$276,884	$275,066	$255,426	$247,619
2037	$288,328	$286,471	$284,579	$263,720	$255,542
2038	$297,899	$296,057	$294,092	$272,013	$263,464
2039	$307,470	$305,643	$303,605	$280,306	$271,387
2040	$317,041	$315,229	$313,118	$288,600	$279,309
2041	$326,612	$324,815	$322,631	$296,893	$287,232
2042	$336,183	$334,401	$332,144	$305,186	$295,155
2043	$345,754	$343,987	$341,657	$313,480	$303,077
2044	$355,325	$353,574	$351,170	$321,773	$311,000
2045-2074	**$364,897**	**$363,160**	**$360,683**	**$330,066**	**$318,922**

Table C:4-20. Total Transportation Cost Savings by Alternative Depth ($1000s)

Year	43’	45’	48’	50’
2025	**$2,039**	**$3,053**	**$9,277**	**$13,006**
2026	$2,024	$3,111	$10,554	$14,654
2027	$2,009	$3,169	$11,832	$16,303
2028	$1,994	$3,227	$13,110	$17,951
2029	$1,979	$3,285	$14,387	$19,600
2030	$1,964	$3,343	$15,665	$21,248
2031	$1,949	$3,401	$16,943	$22,896
2032	$1,933	$3,459	$18,220	$24,545
2033	$1,918	$3,517	$19,498	$26,193
2034	$1,903	$3,575	$20,776	$27,842
2035	$1,888	$3,633	$22,053	$29,490
2036	$1,873	$3,691	$23,331	$31,139
2037	$1,858	$3,749	$24,609	$32,787
2038	$1,843	$3,807	$25,886	$34,435
2039	$1,828	$3,865	$27,164	$36,084
2040	$1,812	$3,923	$28,442	$37,732
2041	$1,797	$3,982	$29,719	$39,381
2042	$1,782	$4,040	$30,997	$41,029
2043	$1,767	$4,098	$32,275	$42,677
2044	$1,752	$4,156	$33,553	$44,326
2045-2074	**$1,737**	**$4,214**	**$34,830**	**$45,974**

Table C:4-21. AAEQ Transportation Costs and Benefits

Alternative	AAEQ Transportation Cost	AAEQ Transportation Cost Reduction Benefit
FWOP	$303,368,000	-
43	$301,534,000	$1,834,000
45	$299,528,000	$3,841,000
48	$276,752,000	$26,616,000
50	$267,991,000	$35,377,000

Table C:4-22. AAEQ Transportation Cost Statistics

Statistic	FWOP	43’	45’	48’	50’
Mean	$303,368,136	$301,534,100	$299,527,537	$276,751,641	$267,990,945
SD	$1,633,282	$1,746,036	$1,480,215	$1,545,758	$1,356,690
Median	$303,582,599	$301,780,346	$299,431,696	$276,585,122	$268,241,575
Min	$297,953,944	$294,975,980	$296,092,801	$273,289,928	$264,846,712
Max	$308,093,611	$304,747,517	$302,952,953	$280,519,889	$271,484,748
Range	$10,139,667	$9,771,537	$6,860,152	$7,229,961	$6,638,036
Confidence of Mean +/-	$452,723	$483,976	$410,295	$428,462	$376,055

Section 5
NED Benefits and Costs

5.1 BENEFIT/COST ANALYSIS

In the evaluation and comparison of project depth alternatives, which is necessary to arrive at the selected plan, NED costs play a critical role. NED costs include both the financial and economic costs associated with a project throughout its lifecycle. Each of these types of costs and their sources are discussed in this section of the report. Additionally, the NED costs for the depth alternatives being considered in this analysis will be identified.

5.2 NED COSTS

Financial costs of the proposed project consist of the construction and mitigation costs accrued during construction of the project and over its lifecycle. New Orleans District cost engineers prepared the cost estimate for each of the proposed deepening alternatives for use in the economic analysis. The sum of these costs is used to determine Interest During Construction (IDC), which represents the economic cost of building a project. Together, these costs represent the estimated first cost of construction.

Another financial cost not included previously is the annual cost accrued over the life of a project due to Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) activities that represent an increase over the current OMRR&R costs to maintain the entrance channel. OMRR&R was excluded from the list of financial costs above because it is not included in the calculation of IDC. IDC takes into account only those costs incurred during construction.

IDC represents an economic cost of building a project that is considered in the selection of the recommended plan, but does not factor in as a paid cost. IDC is the cost of the foregone opportunity to invest the money required to construct a project for another use. The hypothetical return on another investment, measured as IDC, is counted as an NED cost. As an economic, rather than a financial, cost, IDC is not considered in the determination of cost-sharing responsibilities.

IDC reflects that project construction costs are not incurred in one lump sum, but as a flow over the construction period. This analysis assumes that construction expenditures are incurred at a constant rate over the period of construction, an assumption which is supported by the *NED Manual for Deep Draft Navigation*.

The calculation of IDC is summarized in the *NED Manual for Deep Draft Navigation* as:

> If B is the project base year (the year in which construction costs end and the project begins to derive benefits), then the total cost incurred during construction, including

actual expenditures and implicit interest payment, is the equivalent lump-sum expenditure in the base year, C_B, which is computed as:

$C_B = \Sigma_{t\ i=1}\ C_i\ (1+r)_{t-1}$; where

C_i construction expenditures in period i

r per unit interest rate; and

t number of construction periods up to the year that the project is implemented, which is the start of the period of analysis

Therefore, IDC = C_B – Estimated First Cost of Construction

In this analysis, the IDC is evaluated using a flow of constant monthly construction expenditures. Calculating the hypothetical interest earned on each monthly construction payment and summing them to arrive at the total construction investment cost (C_B) enables the calculation of IDC by taking the difference between C_B and estimated construction cost. IDC is, therefore, a function of both estimated total construction cost and construction time. The longer it takes to construct a project, the larger the hypothetical alternative investment grows. The implication behind this fact is that IDC accounts for a larger proportion of NED Costs the larger the project and the longer it takes to construct. Total present value is the sum of the present value of first cost (construction and real estate costs) and annual O&M costs over the 50-year period of analysis; average annual cost is calculated by multiplying total present value by the 50 year amortization factor.

Tables C:5-1 through C:5-5 show the NED costs for the 40-feet through 50-feet alternatives. Values are at 2020 price levels and amortized at the 2020 Federal discount rate of 2.75 percent.

Table C:5-23. 40 Feet Costs

Year	Year[9]	Construction	Port Costs[10]	Annual O&M	Present Value of Costs
2020	-4.5	-	-	-	-
2021	-3.5	-	-	-	-
2022	-2.5	-	-	-	-
2023	-1.5	-	-	-	-
2024	-0.5	$3,454,000	$2,003,000	-	$5,532,000
TOTAL		$3,454,000	$2,003,000	-	$5,532,000
TOTAL PRESENT VALUE ==>					$8,998,000
FIRST COST ==>					$5,457,000
INTEREST DURING CONSTRUCTION ==>					$75,000
AVERAGE ANNUAL COST ==>					$333,000

Note: Annual O&M costs over the 50-year period of analysis are $127,000 and begin in year 2025. They are included in the total present value costs.

Table C:5-24. 43 Feet Costs

Year	Year	Construction	Port Costs	Annual O&M	Present Value of Costs
2020	-4.5	-	-	-	-
2021	-3.5	-	-	-	-
2022	-2.5	-	-	-	-
2023	-1.5	-	-	-	-
2024	-0.5	$3,910,000	$2,008,000	-	$5,999,000
TOTAL		$3,910,000	$2,008,000	-	$5,999,000
TOTAL PRESENT VALUE ==>					$9,465,000
FIRST COST ==>					$5,918,000
INTEREST DURING CONSTRUCTION ==>					$81,000
AVERAGE ANNUAL COST ==>					$351,000

Note: Annual O&M costs over the 50-year period of analysis are $127,000 and begin in year 2025. They are included in the total present value costs.

[9] Years are expressed as -4.5, –3.5, etc., as opposed to whole numbers because mid-period interest calculation is used.
[10] Required costs paid by the Port of New Orleans to stabilize docks.

Table C:5-25. 45 Feet Costs

Year	Year	Construction	Port Costs	Annual O&M	Present Value of Costs
2020	-4.5	-	-	-	-
2021	-3.5	-	-	-	-
2022	-2.5	-	-	-	-
2023	-1.5	-	-	-	-
2024	-0.5	$4,870,000	$2,015,000	-	$6,979,000
TOTAL		$4,870,000	$2,015,000	-	$6,979,000
TOTAL PRESENT VALUE ==>					$10,763,000
FIRST COST ==>					$6,885,000
INTEREST DURING CONSTRUCTION ==>					$94,000
AVERAGE ANNUAL COST ==>					$399,000

Note: Annual O&M costs over the 50-year period of analysis are $138,000 and begin in year 2025. They are included in the total present value costs.

Table C:5-26. 48 Feet Costs

Year	Year	Construction	Port Costs	Annual O&M	Present Value of Costs
2020	-4.5	-	-	-	-
2021	-3.5	-	-	-	-
2022	-2.5	-	-	-	-
2023	-1.5	-	-	-	-
2024	-0.5	$6,426,000	$2,025,000	-	$8,567,000
TOTAL		$6,426,000	$2,025,000	-	$8,567,000
TOTAL PRESENT VALUE ==>					$15,659,000
FIRST COST ==>					$8,451,000
INTEREST DURING CONSTRUCTION ==>					$115,000
AVERAGE ANNUAL COST ==>					$580,000

Note: Annual O&M costs over the 50-year period of analysis are $259,000 and begin in year 2025. They are included in the total present value costs.

Table C:5-27. 50 Feet Costs

Year	Year	Construction	Port Costs	Annual O&M	Present Value of Costs
2020	-4.5	-	-	-	-
2021	-3.5	-	-	-	-
2022	-2.5	-	-	-	-
2023	-1.5	-	-	-	-
2024	-0.5	$6,878,000	$2,031,000	-	$9,031,000
TOTAL		$6,878,000	$2,031,000	-	$9,031,000
TOTAL PRESENT VALUE ==>					$19,746,000
FIRST COST ==>					$8,909,000
INTEREST DURING CONSTRUCTION ==>					$122,000
AVERAGE ANNUAL COST ==>					$731,000

Note: Annual O&M costs over the 50-year period of analysis are $392,000 and begin in year 2025. They are included in the total present value costs.

5.3 NET BENEFITS AND BENEFIT-COST (B/C) RATIO

Having identified the costs and benefits associated with the deepening of the PORT's access channel, identification of the proposed alternative requires a comparison of the average annual net benefits resulting from each project depth. Table C:5-6 contains the NED annual costs and benefits for incremental depths and the resulting net benefit and benefit-cost ratios at the 2020 Federal discount rate of 2.75 percent.

It should be noted that the benefit-to-cost ratios for all alternatives are notably high because the construction and O&M costs are so low (total annual average costs range from $333,000 to $731,000). Additionally, there is a large jump in benefits from 45 feet to 48 feet because benefits at 45 feet and lower are attributed only to the Nashville B dock, which currently has a depth of 40 feet. The two alternatives at 48 feet and 50 feet encompass benefits for all three docks (Napoleon A, Nashville C, and Nashville B).

Table C:5-28. Average Annual Costs and Benefits

Channel Alternative	Alternative 2 40'	Alternative 2a 43'	Alternative 3 45'	Alternative 3a 48'	Alternative 4 50'
First Cost of Construction	$ 5,457,000	$ 5,918,000	$ 6,885,000	$ 8,451,000	$ 8,909,000
Interest During Construction	$ 75,000	$ 81,000	$ 94,000	$ 115,000	$ 122,000
Total Investment	$ 5,532,000	$ 5,999,000	$ 6,979,000	$ 8,567,000	$ 9,031,000
Average Annual Const. Cost	$ 207,000	$ 224,000	$ 260,000	$ 321,000	$ 340,000
Average Annual Increm. O&M	$ 127,000	$ 127,000	$ 138,000	$ 259,000	$ 392,000
Total Average Annual Cost	$ 333,000	$ 351,000	$ 399,000	$ 580,000	$ 731,000
Total Average Annual Benefits	$ -	$ 1,859,000	$ 3,893,000	$ 26,980,000	$ 35,860,000
Net Excess Benefits	$ -	**$ 1,508,000**	**$ 3,494,000**	**$ 26,400,000**	**$ 35,129,000**
B/C Ratio	-	**5.3**	**9.8**	**46.5**	**49.1**

Note: Because all the docks in question are currently being utilized at a depth of 40' or greater (according to empirical data from the Port of New Orleans as well as WCSC), there are no benefits associated with Alternative 2.

5.4 RECOMMENDED PLAN

Alternative 4, at a depth of 50 feet is the recommended plan with net excess benefits of $35.1 million and a B/C ratio of 49.1 to 1 (Table C:5-7).

Table C:5-29. Recommended Plan

Alternative 4 (50 feet)		
Investment Cost		
First Cost of Construction	$	8,909,000
Interest During Construction	$	122,000
Total Investment Cost	$	9,031,000
Average Annual Cost	$	
Average Annual Construction Cost	$	340,000
Average Annual Incremental OMRR&R	$	392,000
Total Average Annual Cost	$	731,000
Benefits		
Average Annual Benefits	$	35,860,000
Net Annual Benefits	$	35,129,000
B/C Ratio (computed at 2.75%)		49.1

7 percent OMB rate: At this discount rate, the recommended plan average annual costs are $1.1 million and average annual benefits are $31.0 million. Average annual net benefits are $29.9 million, and the B/C ratio is 28.8 to 1.

5.5 SENSITIVITY ANALYSIS

(Will be added at a later date).

Section 6
Regional Economic Development

6.1 REGIONAL ANALYSIS

(Will be added at a later date).

List of Acronyms and Abbreviations

ACS	American Community Survey
AAEQ	Average Annual Equivalent
BCR	Benefit to Cost Ratio
CAR-CA-NCSA	Caribbean, Central America, North Coast South America to North America
CDF	Cumulative Distribution Function
CEMVN	USACE New Orleans District
CLT	Container Loading Tool
CSPS	Container Shipping Planning Service
DWT	Deadweight Tonnage
ECSA-NA	East Coast South America to North America
ER	Engineer Regulation
ETTC	Estimate Total Trip Cargo
FCC	Fully Cellular Container
FE-NA	Far East to North America
FWP	Future With Project
FWOP	Future With Out Project
HMST	HarborSym Modeling Suite of Tools
IDC	Interest During Construction
IWR	Institute for Water Resources
LFA	Load Factor Analysis
LWRP	Low Water Reference Plain
MED-NA	Mediterranean to North America
MRSC	Mississippi River Ship Channel

MSI	Maritime Strategies Inc.
NED	National Economic Development
NEU-NA	Northern Europe to North America
NNOMPEAS	National Navigation Operation & Management Performance Evaluation & Assessment System
O&M	Operation and Maintenance
OD	Origin-Destination
OMRR&R	Operations, Maintenance, Repair, Rehabilitation, and Replacement
PED	Planning, Engineering and Design
PPX Gen 1	Post-Panamax Generation 1
PPX Gen 2	Post-Panamax Generation 2
PPX Gen 3	Post-Panamax Generation 3
PX	Panamax
RED	Regional Economic Development
RM	River Mile
SPX	Sub-Panamax
TEU	Twenty-Foot Equivalent Unit
TPI	Tons Per Inch Immersion
TSP	Tentatively Selected Plan
UKC	Underkeel Clearance
USACE	United States Army Corps of Engineers
WCSC	Waterborne Commerce Statistics Center