

Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

NAVIGATION IMPACT REPORT

FINAL ENVIRONMENTAL IMPACT STATEMENT

APPENDIX F

OCTOBER 2026

MDTA Maryland Transportation Authority

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

Appendix F – Navigation Impact Report

Document	Page No.
Preliminary Navigation Clearance Determination	1
Maryland Department of Natural Resources Letter of Comment to the Coast Guard	3
Navigation Impact Report and Exhibits	4

U.S. Department of Homeland Security
United States Coast Guard

Commander
United States Coast Guard
Coast Guard East District

431 Crawford Street
Portsmouth, VA 23704-5004
Staff Symbol: dpb
Phone: (571) 607-8298
Fax: (757) 398-6334
Email: Hal.R.Pitts@uscg.mil

16591
28 NOV 2025

Ms. Melissa Williams
Director, Planning and Program Development
Maryland Transportation Authority (MDTA)
2310 Broening Highway
Baltimore, MD 21224

Dear Ms. Williams:

The Coast Guard has reviewed the Navigation Impact Report (NIR) dated April 8, 2025, for Chesapeake Bay (including Kent Narrows and Mezick Pond), between Sandy Point, and Kent Island, MD and at Kent Narrows, MD, respectively. Based on a preliminary review of this study and the information available as of the date of this letter, the Coast Guard does not foresee anything that would prevent a bridge permit from being issued. The Preliminary Navigation Clearance Determination (s) (PNCD (s)) and information below are provided to assist the MDTA in preparing and submitting bridge permit application (s).

The Coast Guard has made PNCD (s) that fixed bridge (s) that carry US50/301 from Sandy Point to Kent Island, MD across the Chesapeake Bay, at mile 138.0; over Kent Narrows, at mile 1.0; and may cross over the entrance to Mezick Pond Channel [1], will provide for the current and prospective reasonable needs of navigation.

The proposed fixed bridge (s) would replace the existing fixed bridge (s) immediately adjacent to the existing bridge (s), on an alignment either to the south or north of the present location. The existing fixed bridge over the western channel has a vertical clearance of 185 feet (north structure) and 182 feet (south structure) above mean high water and 1,500 (north structure) and 1,533 (south structure) feet of horizontal clearance through the main navigation span of the bridge (s). The existing fixed bridge (s) over the eastern channel have a vertical clearance of 58.0 feet above mean high water and 690 feet of horizontal clearance through the main navigation span of the bridge (S). The existing fixed bridge over Kent Narrows has a vertical clearance of 65 feet above mean high water and 75 feet of horizontal clearance centered on the axis of the channel.

The proposed fixed bridge over the western channel (both structures) should provide at least 230 feet of vertical clearance above mean high water and at least 1,500 feet of horizontal clearance through the main navigation span of the bridge. The proposed fixed bridge over the eastern channel (both structures) should provide at least 58.0 feet of vertical clearance above mean high water and at least 690 feet of horizontal clearance through the main navigation span of the bridge. The proposed fixed bridge over Kent Narrows should provide at least 65.0 feet of vertical clearance above mean high water and at least 75 feet of horizontal clearance through the main navigation span of the bridge.

If the Northern alignment alternative for the structures over Chesapeake Bay is selected, the proposed fixed bridge structure (s) over Mezick Pond Channel should provide at least 31.5 feet of vertical clearance above mean high water and at least 75 feet of horizontal clearance centered on the axis of the channel. It must be noted that the veracity of this finding is limited due to the following factors.

[1] Note qualification of PNCD concerning Mezick Pond Channel below.

a. The NIR dated April 8, 2025, provides insufficient data or information to determine the dimensions of the largest vessels that currently transit Mezick Pond Channel.

b. The Maryland Department of Natural Resources (MDDNR) submitted comments in response to the preliminary public notice (attached as enclosures (1) and (2)) related to the Northern alignment alternative.

c. The Coast Guard received only two comments, both from the MDDNR as noted above, in response to the preliminary public notice (PPN). The time of year (outside recreational boating season) in which the Coast Guard PPN was published may have limited comment by recreational mariners.

d. Given the foregoing concerning the Northern alignment alternative, it may be prudent to conduct further analysis and obtain comment from mariners and maritime stakeholders, specifically recreational mariners. The Coast Guard is amenable to issuing a targeted supplemental preliminary public notice (PPN) or email in support of the effort.

Please note that this PNCD is not binding, does not constitute an approval or final agency action, and **expires three (3) years from the date of this correspondence**. A final determination can only be made in accordance with regulation and after Maryland Transportation Authority submits a complete bridge permit application to the Coast Guard. If a complete bridge permit application is not submitted within three (3) years from the date of this correspondence, an updated Navigation Impact Report as described in appendix A of the Coast Guard's Bridge Permit Application Guide, COMDTPUB P16591.3E, should be prepared and submitted in order to obtain a new PNCD.

Mr. Hal R. Pitts, at the above listed address or telephone number, has been assigned as the Coast Guard's Bridge Permit project officer. Please maintain frequent and regular contact with the project officer to ensure efficient and effective project administration.

Sincerely,

HAL R. PITTS
Bridge Program Manager
By direction

Encl: (1) MDDNR letter dated August 6, 2025
(2) MDDNR letter dated October 8, 2025
(3) Bridge Permit Application Guide, COMDTPUB P16591.3E and BPAG Applicant Template located at (https://go.usa.gov/xRFk2)

Copy: Coast Guard Sector Maryland-National Capital Region, Waterways Management
Federal Highways Administration, Baltimore Division Office
U. S. Army Corps of Engineers, Baltimore District Office
Maryland Department of Natural Resources

MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

Wes Moore, Governor
Aruna Miller, Lt. Governor
Josh Kurtz, Secretary
David Goshorn, Deputy Secretary

October 8, 2025

Subject: Maryland DNR comments on PRELIMINARY PUBLIC NOTICE D05PPN-08-2025

To Office of Commander;

The Maryland Department of Natural Resources (DNR) has previously communicated to the MDTA Bay Crossing Study team that any proposed vertical clearance restriction at the entrance to Mezick Pond is not acceptable. A 31.5 foot clearance would significantly impede emergency response capabilities and restrict public access to one of the most popular recreational and boating areas within Sandy Point State Park.

DNR's position remains that impacts to park operations and visitor access should be minimized, and maintaining unrestricted access to Mezick Pond is essential to that objective. As stated in DNR's official correspondence to the Bay Crossing Study team submitted in August 2025, DNR expects that any vertical clearance restriction at Mezick Pond be removed from further consideration.

We appreciate your attention to this matter and request confirmation that the proposed restriction has been withdrawn from the current plan.

Sincerely,



Tony Redman, Director
DNR Environmental Review Program

Attachment: DNR Official Response Letter dated August 6, 2025

CC: Rich Ortt, Bob Sadzinski, Jonas Williams, Curtis Dale, Gwen Gibson, Melissa Day

Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

NAVIGATION IMPACT REPORT

Maryland Transportation Authority
MDTA

APRIL 2025

WATERWAY DATA REQUIREMENTS (per Appendix A of the July 2016 Bridge Permit Application Guide (BPAG)).

Contents

A. Means of Data Collection: 1

B. Present governing bridge(s) or aerial structure(s) on the waterway: 1

C. Waterway characteristics: 3

D. Do vessels that engage in emergency operations (i.e., law enforcement, fire, rescue, emergency dam repair, etc.), national defense activities (i.e. cruisers, fuel barges, munitions ships, etc.) or channel maintenance (i.e., dredges, dam and levee repair, etc.) operate on the waterway? 5

E. Has the United States Corps of Engineers (USACE) completed or does it plan to complete a federal navigation project on the waterway? 8

F. Describe the present and prospective recreational navigation: 9

G. Describe the present and waterway and prospective commercial navigation and the cargoes moved on the waterway: 11

H. Identify the name and contact information for marine facilities located within a 3-mile radius of the proposed project (public boat ramps, marinas or major docking facilities, boat repair facilities, etc.: 16

I. Will the proposed bridge(s) block access of any vessel presently using local service facilities (i.e., repair shops, parts distributors, fuel stations)? 17

J. Are alternate routes bypassing the proposed bridge(s) available for use by vessels unable to pass the proposed bridge(s)? 18

K. Will the bridge(s) prohibit the entry of any vessels to the local harbor of refuge? 19

L. Will the proposed bridge(s) be located within one-half mile of a bend in a waterway? 20

M. Are there other factors (i.e., dockages, lightering areas, existing bridges, etc.) located within one-half mile of the proposed bridge(s), which would create hazardous passage through the proposed structure? 20

N. Do local hydraulic conditions (i.e., wave chop, cross currents, tides, shoals, etc.) increase the hazard of passage through the proposed bridge(s)? 21

O. Do local atmospheric conditions (i.e., strong, prevailing winds, fog, rapidly developing storms, etc.) increase the hazard of passage through the proposed bridge(s)? 21

P. Have guide clearances been established for the waterway? 21

Q. Are there other natural or man-made conditions that affect navigation (atmospherics, exclusion zones, etc.)? 21

R. State any other factors considered necessary for the safe, efficient passage of vessels through the proposed bridge(s)? Are clearance gauges needed? 22

S. Include a description of the impacts to navigation caused or which could be reasonably caused by the proposed bridge(s) including but not limited to: proposed construction methodology, proposed or prospective changes to the existing bridge(s) operating schedule (for movable bridges), and any proposed mitigation to all unavoidable impacts to navigation. 22

T. Is there any proposed or completed mitigation for impacted waterway users? Are there any impacts that cannot be mitigated? 23

Table of Exhibits

Exhibit B – Location Map

Exhibit B – Concept Alignments

Exhibit D - Specialized Operation Vessel Examples

NAVFAC - Homeporting Criteria

USCG - The Cutters, Boats, and Aircraft of the U.S. Coast Guard

Hockema Group - A design overview of … the Frederick Paup

Exhibit G - Present and Prospective Commercial Navigation and Cargo

Port of Baltimore Cargo and Vessel Planning Projections

MPA Memo, 2023

Port of Baltimore data

Existing Vessels That Cannot Access the Port of Baltimore

Future Vessels That Will Not Have Access to the Port of Baltimore

Cruise Line Fleet

Bayonne Bridge Air Draft Analysis

Savannah River Crossing

A. Means of Data Collection:

Data were collected from federal, state, and local agencies and organizations, including:

- Referenced data: National Oceanic and Atmospheric Administration (NOAA) Navigation Charts 12270, 12272, 12278, 12282, and 12283.
- Reviewed bridge As-Built plans and current waterway properties to calculate existing horizontal and vertical navigational clearances.
- Reviewed NOAA Gage Data to find current bay tidal characteristics and waterway stages (https://tidesandcurrents.noaa.gov/map/index.html?region=Maryland and https://tidesandcurrents.noaa.gov/ofs/cbofs/cbofs.html)
- Review of project documents from the U.S. Army Corps of Engineers (USACE) Civil Works program (https://usace.contentdm.oclc.org/digital/collection/p16021coll11/id/7053)
- U.S. Coast Guard (USCG) Guide Clearance (https://www.dco.uscg.mil/Our-Organization/Assistant-Commandant-for-Prevention-Policy-CG-5P/Marine-Transportation-Systems-CG-5PW/Office-of-Bridge-Programs/Bridge-Guide-Clearances/)
- Baltimore Maritime Exchange (BME) database records for 2023
- USCG's National Vessel Documentation Database Queries via NOAA website
- Google aerial maps
- Maryland Port Administration documents and correspondence
- Outreach to various government, private, and public stakeholders

B. Present governing bridge(s) or aerial structure(s) on the waterway:

1. Identify all bridges upstream and downstream of the proposed bridge site and their existing horizontal and vertical clearances to determine the existing minimum horizontal and vertical clearances (including overhead transmission line clearances). Provide in table format. (If all bridges downstream have the same minimum clearance, state instead of the above requested information.)

The William Preston Lane Jr. Memorial Bridge (Bay Bridge) is in an area of complex navigation lanes into and out of the Port of Baltimore. There is no restriction along the main navigation channels from the Atlantic Ocean to the Bay Bridge. From the Bay Bridge to the Port of Baltimore along the Patapsco River, navigation is restricted only by the Aerial Power Line and the proposed Francis Scott Key Bridge. From the Bay Bridge to Delaware Bay, navigation is restricted by the bridges that cross the Chesapeake and Delaware Canal. The Kent Narrows channel and the highway bridges on US 50/301 and MD 18 restrict passage to small vessels that would traverse between the Chester River and Eastern Bay.

Bridges and clearances[1] listed in the table below are representative of the navigation patterns for various vessel classes that may utilize the channels near or under the Bay Bridge. See **Exhibit B** for the Location Map.

Bridge	Roadway	Feature Intersected	Vertical Clearance (FT)*	Horizontal Clearance (FT)
Francis Scott Key Bridge (Replacement)	I-695	Patapsco River	230	1,100
Aerial Power Line	Utility	Patapsco River	215	2,200
Kent Narrows Bridge (Fixed)	US 50/301	Kent Narrows	65	182
Kent Narrows Bridge (Bascule)	MD 18	Kent Narrows	18 (closed)	48
Aerial Power Line	Utility	Kent Narrows	85	Full Width
William Preston Lane Jr. Memorial Bridge (Chesapeake Bay Bridge Channel)	US 50/301	Chesapeake Bay	182	1,500
William Preston Lane Jr. Memorial Bridge (Eastern Channel)	US 50/301	Chesapeake Bay	58	690
St. Georges Bridge E	US 13	Chesapeake and Delaware Canal	132	520
Chesapeake City Bridge	MD 213	Chesapeake and Delaware Canal	135	540

* Vertical Clearance at Mean Higher-High Water (MHHW)

2. Does the proposed bridge(s) match (or is greater than) the navigational clearance of existing structures on the waterway?

   Yes, the proposed bridge would match or provide for greater navigational clearances than the most restricting clearances on the waterway. There are proposed northern alternatives and southern alternatives being considered as part of the Chesapeake Bay Crossing Study: Tier 2 NEPA (Tier 2 Study). See **Exhibit B** for the concept alignments for each alternative. Both alternatives would provide increased vertical clearance over the Chesapeake Bay Bridge Channel and the same vertical and horizontal clearances over the Eastern Channel. The northern alternative also crosses the Mezick Pond Entrance Channel. For the purposes of this Navigational Impact Report, the Maryland Transportation Authority (MDTA) proposes the following navigational clearances be considered as reasonably meeting the navigational needs of the waterway:

Bridge	Vertical Clearance (FT)*	Horizontal Clearance (FT)**
Proposed Bay Bridge over the Chesapeake Bay Bridge Channel	230	1,500
Proposed Bay Bridge over the Eastern Channel	58	690
Proposed Bay Bridge over the Mezick Pond Entrance Channel***	31.5	75

* Vertical Clearance at MHHW
** Horizontal Clearance normal to the channel
***Proposed Bay Bridge – Northern Alignment alternative

[1] NOAA Navigation Charts 12270, 12272, 12278, 12282, and 12283

3. What is the most restrictive horizontal clearance on the waterway? (This may be a fixed bridge downstream/upstream of the proposed structure, a low hanging power line downstream/upstream of the bridge(s), or it may be some other structure that limits horizontal clearance. Sometimes the existing to-be-replaced bridge(s) is the most restrictive structure.)

   The proposed Francis Scott Key Bridge will be the most horizontally restrictive bridge for vessels traveling to or from the Port of Baltimore with a 1,100-foot horizontal clearance. The existing Bay Bridge is the most restrictive horizontal clearance on Chesapeake Bay near the proposed Bay Bridge.
   a. Milepoint: 145 [2]
   b. Horizontal clearance: 1,500 feet

4. What is the most restrictive vertical clearance on the waterway? (This may be a fixed bridge downstream/upstream of the proposed structure, a low hanging power line downstream/upstream of the bridge(s), or it may be some other structure which limits vertical clearance. Sometimes the existing to-be-replaced bridge(s) is the most restrictive structure.)

   The existing Bay Bridge is the most restrictive vertical clearance near the proposed Bay Bridge.
   a. Milepoint: 145
   b. Vertical clearance: 182 feet

5. Will the proposed bridge(s) become the most restrictive/obstructive structure across the waterway?

   No. The proposed bridge will match or exceed the clearances of the proposed Key Bridge, the most restrictive structure to commercial navigation traveling to the Port of Baltimore.

C. Waterway characteristics:

(All domestic bridge navigational clearances should be stated in linear feet in decimal form vs. feet and inches. All international bridge navigational clearances should be stated in linear unit of measure as well as the metric equivalent.)

The alternatives for the proposed Bay Bridge are approximately parallel to the existing Bay Bridge but may be aligned either just north or just south of the existing Bay Bridge. The northern and southern alternatives will cross the Chesapeake Bay Bridge Channel and the Eastern Channel. The northern alternatives will also cross the Mezick Pond Entrance Channel.

[2] Measured from the mouth of Chesapeake Bay in statutory miles.

1. Various waterway stages: (Datum that is used).

Station 8575512, Annapolis MD[3]		
Waterway Stage	**Elevation (Feet) (NAVD 88)**	**Description**
MHHW	1.43	Mean Higher-High Water
MHW	1.19	Mean High Water
MTL	0.70	Mean Tide Level
MSL	0.72	Mean Sea Level
DTL	0.72	Mean Diurnal Tide Level
MLW	0.22	Mean Low Water
MLLW	0.00	Mean Lower-Low Water
Max Tide	7.16	Highest Observed Tide
NAVD 88	0.77	North American Vertical Datum of 1988

2. Natural flow of the waterway including currents, waterway velocity, water direction, and velocity fluctuations (seasonal, daily, hourly, etc.), that might affect navigation.

   Chesapeake Bay currents are primarily derived from tidal flow. Tides are semi-diurnal (2 low, 2 high daily cycles on average), with a micro-tidal range of 1.4 feet. The waterway experiences both ebb and flood tidal currents, with direction and velocity of flow varying with tidal cycles. Rivers discharge to the Bay giving the Bay a net-flow from north to south. Tidal flow rates are typically less than 0.5 knots.

3. Width of the waterway at bridge site:

   The width of the Chesapeake Bay, between Sandy Point and Kent Island, at the proposed bridge, is approximately 4.1 miles. The Chesapeake Bay Bridge Channel is 990 feet wide, extending 3,700 feet north and 16,500 feet south of the existing Bay Bridge. The Eastern Channel is approximately 700 feet wide, with no defined limits north and south of the existing Bay Bridge. The Mezick Pond Entrance Channel is approximately 1,000 feet long parallel to the proposed bridge and 70 feet wide perpendicular to the proposed bridge.

4. Depth of the waterway and elevation fluctuations at bridge site: [List the depth at each waterway bridge stage (ex. Range of tides, average high-water elevation, etc.)].

   The Chesapeake Bay Bridge Channel depth is maintained by the USACE at 50 feet at MLLW. The Eastern Channel depth is approximately 90 feet. The Mezick Pond Entrance Channel depth is maintained by the Maryland Department of Natural Resources (DNR) at approximately 5 feet. Water depth varies by approximately 1.43 feet from MLLW to MHHW.

[3] NOAA. Tides and Currents: Datums for 8575512, Annapolis MD. https://tidesandcurrents.noaa.gov/datums.html?id=8575512

5. Waterway layout and geometry: (For example, is there a dam or lock; does the elevation of the approach impact the required bridge(s) clearance?)

   The Chesapeake Bay is a tidal estuary both upstream and downstream of the Bay Bridge. The Chesapeake Bay opens to the Atlantic Ocean between Cape Henry, Virginia and Cape Charles, Virginia. The Chesapeake Bay begins at the mouth of the Susquehanna River near Havre de Grace, Maryland. The Chesapeake Bay is generally open water with maintained navigation channels throughout. The project will not modify the navigation channels or the open water characteristics.

   There are no hydrologic constrictions from the mouth of the Chesapeake Bay, north to the Bay Bridge. The Chesapeake Bay Bridge-Tunnel does not pose a restriction. There are no constrictions between the Chesapeake and Delaware Canal and the Bay Bridge. Even though the Chesapeake and Delaware Canal is a constriction with multiple bridges and narrow horizontal clearance, vessels traveling from the northeast U.S. ports can access the Chesapeake Bay from the Atlantic Ocean with no constriction.

6. Channel and waterway alignment: Location of the channel(s)

   The Chesapeake Bay Bridge Channel is located approximately 1 mile from the western shoreline of the Chesapeake Bay at a bearing of 25º. The Eastern Channel is located approximately 1.3 miles from the eastern shoreline at a bearing of 20º but is not federally maintained. The Mezick Pond Entrance Channel connects the Sandy Point State Park boat launch to the Chesapeake Bay immediately adjacent to the north side of the western terminus of the existing Bay Bridge at a bearing of 331º but is not federally maintained.

7. Other limiting factors: *(*For example, bends in the waterway within one-half mile of project site, hindrances to free navigation, fog, hydraulics, etc.)

   There are no other limiting factors.

D. Do vessels that engage in emergency operations (i.e., law enforcement, fire, rescue, emergency dam repair, etc.), national defense activities (i.e. cruisers, fuel barges, munitions ships, etc.) or channel maintenance (i.e., dredges, dam and levee repair, etc.) operate on the waterway?

Yes.

If yes, describe the vessels and provide the following information:

1. Does levee maintenance, bridge work (other bridges), channel maintenance and emergency operations upstream of bridge require certain vessels to transit the waterway?

   Yes. A northern and a southern alignment of the proposed bridge are currently under consideration with the Tier 2 Study alternatives. The northern alignment alternatives

will construct the proposed bridge roughly parallel to, and just north of, the existing bridge. The southern alignment will construct the proposed bridge roughly parallel to, and just south of, the existing bridge. The northern alignment would span the Mezick Pond Entrance Channel, which is used by DNR and the MDTA Police vessels. The Mezick Pond Entrance Channel is generally too small to accommodate large work or emergency response vessels. Large vessels come from other ports and traverse the area using the Chesapeake Bay Bridge Channel or Eastern Channel. The proposed Bay Bridge spans over the Chesapeake Bay Bridge Channel and Eastern Channel will be the same as or less restrictive than the existing bridge.

2. Does the proposed bridge(s) impact USCG and/or other government vessels' ability to transit the bridge(s) to conduct mission essential functions (icebreakers, patrols, etc.)?

   No. The proposed bridge will not impact USCG or other government agency functions or missions. The proposed vertical and horizontal clearances will provide for passage of all anticipated government vessels performing expected functions, such as dredging, USCG patrol, icebreaking, and emergency response. *Cape Washington and Cape Wrath*, are the largest defense vessels with homeports in Baltimore, belonging to the US Department of Transportation Maritime Administration's National Defense Reserve Fleet.[4] Both are 697 feet long, with a 106-foot beam and 160-foot air draft. The proposed bridge would not limit the movement of these vessels and their support ships. It is not expected that any significant military vessels, such as the Nimitz or Ford Class carriers, would come to the Port of Baltimore, due to the highly specific homeporting criteria, which require an air draft clearance of 250 feet. (Exhibit D-NAVFAC).

   The northern alignment would allow for a 31.5-foot vertical and 75-foot horizontal clearance, which is unlikely to impact vessels that access the Mezick Pond Entrance Channel.

3. Vessels using the waterway during the proposed bridge(s) lifespan (should include):

   Current and future vessels similar to the existing classes will not be more restricted by the proposed bridge. The largest emergency vessels that could call on the Port of Baltimore during emergency scenarios are part of the federal fleet. Federal vessels could consist of USCG, Navy, USACE, U.S. Geological Survey (USGS) and agency fleet vessels. USCG vessels range from the Legend, Heritage and Sentinel-Class Cutters, Marine Protector-class Patrol Boats, Harbor Tugboats, Buoy Tenders, as well as smaller Response and Aid Boats. In special cases, the Port of Baltimore may even see Icebreaker-class vessels and the USCG *Eagle*, if they were dispatched to the Coast Guard Yard for maintenance or repair. The USCG *Eagle* is the tallest ship in the USCG fleet,[5] with a 150-foot-tall mast and measuring 295 feet in length, and the USCG *Healy* icebreaker is 420 feet in length, has a beam width of 82 feet, and a draft

[4] https://www.maritime.dot.gov/sites/marad.dot.gov/files/2025-2/2025_01%20Public%20NDRF%20Inventory.pdf
[5] USCG Academy. *About Eagle*. https://uscga.edu/mission/eagle/about-eagle/

depth of 29 feet at full load (Exhibit D-USCG). The overall largest emergency vessels to use the waterway and proposed crossing are the two Algol class cargo ships of the Military Sealift Command's Ready Reserve Force, both measuring 946 feet in length, with a beam width of 106 feet and a draft depth of 36 feet at full load. Other various government service vehicles, such as fire and rescue, survey, and research, USACE dredge, and recovery fleet vessels, could also make use of the proposed bridge crossing. However, even the largest USACE ship, Dredge *Wheeler*, with its keel to mast height of 156 feet and maximum draft of approximately 30 feet (USACE, 2024) and the privately contracted Dredge *Frederick Paup*, which is 420 feet in length (Exhibit D-Hockema), are dwarfed in comparison to the ships of the Military Sea Lift Command.

Future vessels with air draft up to 230 feet, including post-Panamax class ships (e.g., Ultra-Large Container Vessels), may traverse the Chesapeake Bay during the lifespan of the proposed new Bay Bridge.

The northern alignment will allow for a 31.5-foot vertical and 75-foot horizontal clearance, which is unlikely to impact vessels that access the Mezick Pond Entrance Channel.

4. Will the proposed bridge(s) provide the horizontal and vertical clearances for the safe, efficient passage of the largest of these vessels? Why?

   Yes, the proposed bridge will provide adequate horizontal and vertical clearances on the waterway by providing increased vertical clearance at the Chesapeake Bay Bridge Channel compared with the existing Bay Bridge.

   The proposed vertical clearance at the Eastern Channel would be the same height or higher than the existing Bay Bridge.

   The proposed horizontal clearances at the Chesapeake Bay Bridge Channel and the Eastern Channel will be the same as the existing Bay Bridge.

   In all cases, the necessary federal emergency vessels will pass the proposed bridge safely and efficiently. USCG *Eagle*, the tallest of these ships, has made multiple stops at the USCG Yard in the past three decades, traveling under both the Francis Scott Key Bridge and the Bay Bridge.

   Future vessels capable of using the Mezick Pond Entrance Channel will not be impacted if the southern alignment is selected. The northern alignment may impact vessel access to Mezick Pond Entrance Channel if the bridge configuration limits horizontal or vertical clearance. The largest police vessels are approximately 38 feet long with a 12-foot beam and 12-foot air draft. These vessels are by function shallow draft and low air draft. DNR estimates their largest vessels are work boats that are 65 feet long and have a 3-foot draft. DNR's RV *Kerhin* measures 51 feet long with a 16-foot beam, 4-foot draft, and 28-foot air draft. RV *Kerhin* has a deck-mounted crane.

5. If no, estimate the number of vessels in each of the above categories unable to pass through the proposed bridge(s). Give the name, length overall (LOA), beam, draft and height of highest fixed point above the waterline for vessels affected by the bridge(s). N/A

6. Can these vessels be modified (i.e., folding mast, relocation or equipment, etc.) without decreasing their respective response times? If so, name the vessels. N/A

7. If modifications are feasible, state the name of the vessel(s), their trip frequency, the necessary modifications, the cost of the modification(s) and who will pay for them (i.e., vessel owner, applicant, other). N/A

8. Provide any additional information concerning the potentially impacted or burdened users of the waterway as well as the future use of the waterway. N/A

E. Has the United States Corps of Engineers (USACE) completed or does it plan to complete a federal navigation project on the waterway?

The USACE has a history of funding and executing significant navigation projects on the waterway commensurate with the Port of Baltimore's status as a vital East Coast port. In 1990, the USACE completed the initial portion of the 50-Foot Project, dredging a 50-foot channel through the Chesapeake Bay from the Virginia Capes to Fort McHenry in the Port of Baltimore, totaling 175 miles (USACE, 2023). The 50-Foot Project is in the engineering and design phase for the Baltimore Harbor approach channels, including and upstream of the Craighill channel. Maintenance dredging is scheduled for the Brewerton Eastern Extension channel. Both projects are north/upstream of the proposed Bay Bridge. The Chesapeake Bay Bridge Channel is federally maintained, but there are no Civil Works projects planned for it at this time.

If yes, provide the following information:

1. Project name, downstream/upstream mile points, depth, type of project, scope, status of project and other limiting factors. N/A

2. Whether there is/was a "design vessel" used in planning the channel? What is/was the design vessel? Was the design vessel reviewed by the Coast Guard? N/A

3. The following specifications of the vessel for which the navigation project is or will be designed: LOA, beam, draft and height of highest fixed point above the waterline. N/A

4. Will the proposed bridge(s) provide the horizontal and vertical clearances necessary for the safe, efficient passage of the vessel for which the navigation project was designed? N/A

5. If so, can the vessel be modified to clear the proposed bridge(s) without substantially increasing operating costs? N/A

6. If modifications are feasible, state the necessary modifications, costs of any modification(s), and who will pay for the modifications. N/A

7. Are there projected changes in waterway usage based upon anticipated waterway improvement projects? N/A

8. Does the proposed bridge(s) impact USACE ability to transit the bridge(s) in a Federal project channel? N/A

F. Describe the present and prospective recreational navigation:

Will the proposed bridge(s) affect the safe, efficient movement of any segment of the present or prospective recreational fleet operation on the waterway?

No. The proposed bridge will not affect the safe and efficient movement of any segment of the present or prospective recreational fleet operation since it will be designed to accommodate the existing and future commercial traffic needs of the Port of Baltimore. The commercial traffic navigation clearance needs are significantly greater than the recreational needs.

Aerial imagery from May 2023 was interpreted to characterize the potential recreational fleet. There are numerous marinas, public launches, and private properties that accommodate recreational vessels. Regularly present vessels at area marinas average less than a 40-foot length and 15-foot beam, with the upper range at approximately a 75-foot length.

Vessels using the Sandy Point State Park (SPSP) boat ramps and Mezick Pond are generally small watercraft, ranging from canoes/kayaks to trailered powerboats and sailboats. The largest recreational vessels capable of using the boat ramps and Mezick Pond are trailered sailboats that would be similar to, or smaller than, a Catalina 22, which has a 23.9-foot length, 7.7-foot beam, 28.5-foot air draft, and a 1.7 foot- to 5 foot-draft. The northern alignments which cross the Mezick Pond entrance channel would allow for a 31.5-foot vertical and 75-foot horizontal clearance, which is unlikely to impact vessels that access the Mezick Pond Entrance Channel.

Recreation Vessels adjacent to Chesapeake Bay Bridge and Eastern Channels[6]

Vessel Type	*Number of Vessels Present in May 2023*	*Percent of Vessels Present in May 2023*
Small Powerboat (< 25-foot length)	10	24%
Powerboat (25 – 40-foot length)	11	27%
Motor Yacht/Workboat (40 – 78-foot length)	6	15%
Super Yacht (> 78-foot length)	0	0%
Small Sailboat (< 30-foot length)	2	5%
Sailboat (> 30-foot length)	12	29%

[6] Google Maps May 2023

Vessels at SPSP Boat Ramp and in Mezick Pond

Vessel Type	*Number of Vessels Present in May 2023*	*Percent of Vessels Present in May 2023*
Small Powerboat (< 25-foot length)	5	31%
Powerboat (25 – 40-foot length)	5	31%
Motor Yacht/Workboat (40 – 78-foot length)	6	38%
Small Sailboat (< 30-foot length)	0	0%
Sailboat (> 30-foot length)	0	0%
Empty Boat Trailers	37	---

If yes, provide the following information:

1. Vessels utilizing the waterway during the proposed bridge(s) lifespan. (Information in this bullet should include:) N/A
    a. Vessel name;
    b. Registration/documentation numbers;
    c. Vessel type;
    d. Vessel owner contact information (company/individual name, address, contact info.);
    e. Primary vessel mooring location (include waterway milepoint, if known);
    f. Vessel overall length;
    g. Vessel beam;
    h. Vessel draft (depth of hull below waterline at full load);
    i. Vessel air draft (height of the highest fixed point of the vessel above the waterline, when empty);
    j. Specialized vessels that use the waterway (e.g., vessels which have limited maneuverability due to inherent design or mode of operation);
    k. Safety margin required by vessel to navigate through the bridge(s);
    l. Vessel transit frequencies under proposed bridge(s), transit speeds, and load configurations; and
    m. Vessel traffic characteristics (to include if tug assist is required for transit through the bridge(s) due to limited horizontal clearance).

2. What is the estimated percentage of the recreational fleet, which may be affected by the proposed bridge(s)? N/A

3. Will the proposed bridge(s) eliminate the access of these vessels to existing or planned commercial, water-oriented facilities (i.e., restaurants, shops, recreational areas, marinas, etc.) in the vicinity of the proposed bridge(s)? If yes, describe these facilities. N/A

4. Is it feasible to modify the affected segments of the fleet to clear the proposed bridge(s) without substantially increasing operating costs? If yes, name the vessel(s), state the necessary modifications, cost of modifying each vessel and person or entity responsible for financing the modifications. N/A

5. Provide any additional information concerning the potentially impacted or burdened users of the waterway as well as the future use of the waterway. N/A

NOTE: Check with local USACE District Office, Chamber of Commerce or other organizations for proposed marinas, recreational areas, shops, etc.

G. Describe the present and prospective commercial navigation and the cargoes moved on the waterway:

Will the proposed bridge(s) affect the safe, efficient movement of any segment of the present or prospective commercial fleet operating on the waterway?

No. The freight, crabbing, and fishing vessels currently traversing the Chesapeake Bay will not be negatively affected by the proposed bridge. The proposed bridge, with a main span 230-foot vertical clearance, will meet or exceed the vertical clearance of the existing Bay Bridge. The proposed bridge will also match the 1,500-foot horizontal clearance of the existing Bay Bridge.

The Chesapeake Bay is used by a wide variety of maritime vessels including skiffs, sailboats, fishing boats, research vessels, schooners, and other pleasure watercraft. Additionally, it serves as a significant maritime transportation route for cargo and cruise ships accessing Maryland's Port of Baltimore. The Port of Baltimore is recognized as an ideal location for international trade as one of the furthest inland ports on the East Coast of the United States, providing efficient access to nearby metropolitan areas and trade routes to the Midwest. In addition, the Port of Baltimore is one of only four East Coast ports with both a 50-foot-deep channel and two 50-foot-deep berths, allowing accommodation for some of the largest container ships in the world. The Port of Baltimore contributes significantly to the local, regional, and national economy. There is an anchorage area between the existing Bay Bridge and the Thomas Point Shoal Lighthouse that allows large freighter vessels to wait for access to the Port of Baltimore.

The U.S. Department of Transportation (USDOT) profile on the Port of Baltimore's tonnage, commodities,[7] and vessels and the Port of Baltimore's development plan[8] were reviewed to obtain the following information.

The freight vessels that represent existing and forecasted vessels calling at Seagirt Marine Terminal are shown in Table 4. Post-Panamax Generation III Max ships are forecasted to be the dominant container ship class calling to port at Seagirt Marine Terminal by 2040 and were represented by the CMA CGM *Marco Polo*. The specifications of the selected vessels are as follows:

[7] USDOT (2023). *Port Profiles: Baltimore, MD*. Port Performance Freight Statistics Program. https://explore.dot.gov/views/PortProfiles2024/ProfileDashboard?%3Aembed=y&%3AisGuestRedirectFromVizportal=y&Port_ID=700

[8] MPA (Spring 2007). *Vision 2025*. https://mpa.maryland.gov/Documents/VisionPlan2025.pdf

Existing and forecasted vessels calling at Seagirt Marine Terminal

Vessel	*MSC Beatrice*	*CMA CGM Marco Polo*
Class	PPX III	PPX III Max
Length Overall (LOA)	1,200 feet	1,299 feet
Beam	168.0 feet	175.9 feet
Design Draft	47.6 feet	46 feet
Air Draft	168.8-174.4 feet	175.4-181.9 feet

The increased vertical navigational clearance of the proposed Bay Bridge would accommodate trends in the shipping and tourism industries towards larger, more efficient vessels and would ensure the long-term vitality and efficiency of the Port of Baltimore.

In 2022, the Port of Baltimore's cargo vessel import and export totaled 43.3 million tons, and the value of foreign cargo marked a record year with a value of $74.3 billion. Most of the domestic waterborne cargo within the Port of Baltimore consists of coal, petroleum products, sand and gravel that is moving within the Chesapeake Bay or to nearby ports along the U.S. East Coast. While bulk products make up approximately 66% of the Port's total international cargo, general cargo products account for 95% of its value. General cargo is defined as containerized cargo, automobiles, agriculture/construction machinery (Roll on/Roll off) and break-bulk shipments of forest products and steel. Several cruise lines also utilize the Port of Baltimore, including Royal Caribbean, Carnival, American Cruise Lines, Phoenix Reisen, and Norwegian Cruise Line (Exhibit G - MPA Memo, 2023).

The largest class of cargo vessel currently able to call at the Port of Baltimore with the existing 182-foot air draft clearance is the Post Panamax (PPX) Generation III Max, which has the following dimensions:

- 16,000 twenty-foot equivalent units (TEU) capacity
- 1,299-foot length overall (LOA)
- 175.6-foot beam
- 52.5-foot design draft
- 175.4 – 181.9-foot air draft

Twenty-Foot Equivalent Units (TEUs) are standard shipping containers that are 20 feet long, 8 feet wide, and 8.6 feet tall. Studies show a continued increase in total TEUs and an expected increase in the number of PPX III and larger vessels calling at the Port of Baltimore. The estimated number of PPX III calls at Seagirt Marine Terminal, within the Port, is expected to increase from 549 in 2030 to 701 by 2040. The total forecasted TEU increase is displayed in the following table.

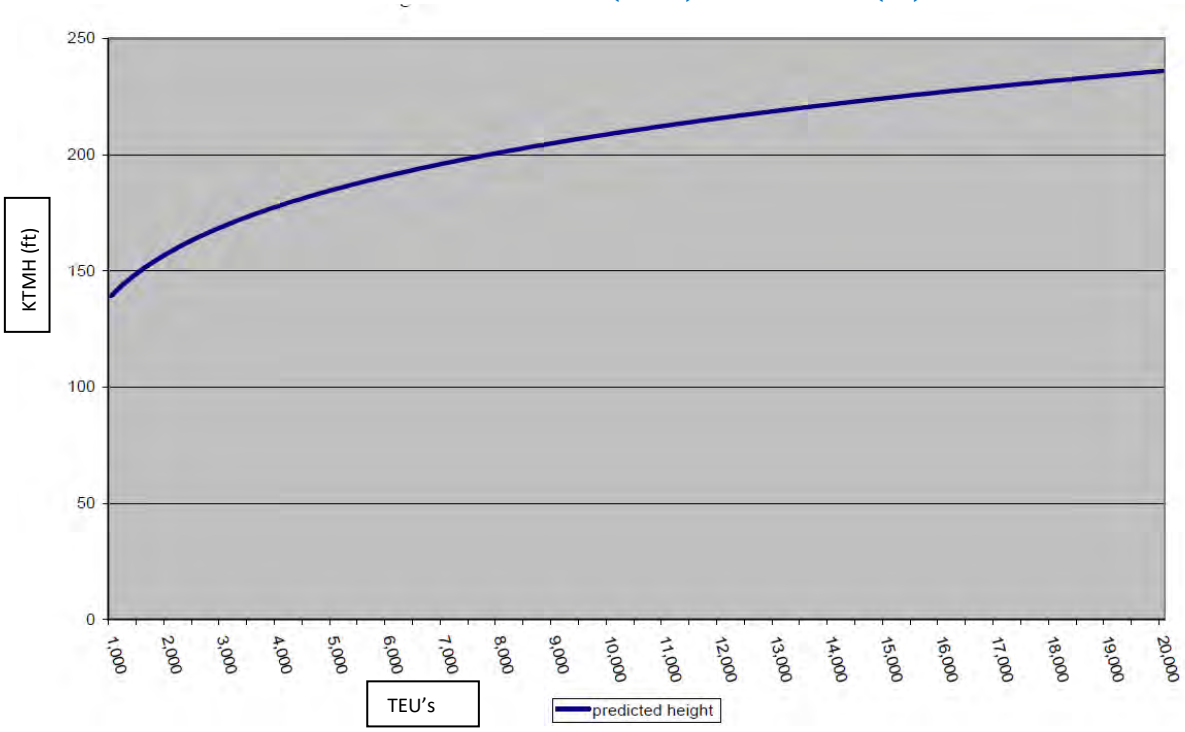
Twenty-Foot Equivalent Unit (TEU) Forecast for Port of Baltimore

	2030	*2035*	*2040*

Forecasted Import TEU	859,531	940,512	1,174,405
Forecasted Export TEU	940,512	1,077,154	1,221,111
Forecasted Total TEU	1,800,043	2,017,666	2,395,516

The most relevant dimension of the future fleet is the air draft and keel to mast height (KTMH). The air draft is calculated by subtracting the design draft from the KTMH. To relate TEUs to air draft, KTMH information provided by shipping carriers was analyzed to determine trends in vessel height and correlations with vessel size and capacity. Plotting KTMH against the most reported dimension of size of a container ship, nominal TEU capacity, reveals a clear positive correlation between increasing size in terms of TEU capacity and corresponding overall vessel height (Exhibit G-Bayonne Bridge Air Draft Analysis). See graph below.

Correlation of Vessel Size (TEU) and KTMH (ft.)[9]



Currently, there are 12 regularly scheduled container services calling on the Port of Baltimore. Of these services, there are five dedicated to the Asia and South Asia trade routes, four to the Europe/Mediterranean region, two to the Americas, and one to Africa. The largest vessels currently calling on the Port are approaching the PPX III (14,000 TEU) vessel class. However, Port estimates show that to meet growing demand, three of these

[9] Exhibit G-Bayonne Bridge Air Draft Analysis

services will likely see future upgrades to the average and maximum vessel sizes, including 16,000 TEUs (Exhibit G-MPA Memo, 2023).

The Maryland Port Administration (MPA) intends to accommodate the increasing size of container ships at the Port of Baltimore to remain competitive among east coast ports (Exhibit G – MPA Memo, 2023). Container ship air drafts are primarily limited by the Suez Canal and the Panama Canal. The Suez Canal has an air draft of 230 feet, and the recently expanded Panama Canal has an air draft of 205 feet, allowing for larger ships than can currently call on the Port of Baltimore. As more container ships of large dimensions enter the world fleet, the frequency with which current bridges will be an obstacle for large vessels to access the Port has the potential to increase. Additionally, the MPA predicts the current vertical clearance of the Bay Bridge may limit PPX III Max vessels starting in 2045 due to anticipated water elevation rise, which is projected to be 7.08 feet by 2150.[10]

Future expansion plans for the Port of Baltimore include CSX Transportation's Howard Street Tunnel (HST) Project that consists of vertical clearance improvements along CSX's I-95 Rail Corridor to allow double-stack trains to travel between Baltimore, Maryland and Philadelphia, Pennsylvania. The HST expansion will allow CSX to double stack containers on rail cars for the two Class I rail lines serving the Port. In 2017, the estimated capacity of the CSX rail line was 130,000 to 150,000 containers annually. However, it was only handling 20,000 to 30,000 containers due to the tunnel inefficiencies. An additional 80,000 to 90,000 containers (126,000 and 141,000 TEUs) throughput can be realized immediately once the tunnel expansion comes online. Studies related to the Seagirt Loop Deepening study show a continued increase in total TEUs and an expected increase in the number of PPX III and larger vessels calling at the Port. The estimated number of calls at Seagirt Marine Terminal is expected to increase from 549 in 2030 to 701 by 2040.[11] Additionally, Trade Point Atlantic in partnership with Terminal Investments Limited is developing a 165-acre container terminal with dock rail facility at Coke Point (Sparrows Point) outside of the Key Bridge (Exhibit G - MPA Memo 2023). Although not an MPA terminal, the development will impact navigation around the Port of Baltimore and be a source of revenue for the State.

The current cargo vessel trend is toward vessels larger than the PPX III Max vessels, which are part of the fleet already in service (Exhibit G- Container Ships in Service, Container Ships Under Construction). To remain competitive with other East Coast ports, Maryland should be prepared to match the air draft of neighboring ports. At present, the air draft of the Verrazano Narrows Bridge leading into the ports of New York/New Jersey is 228 feet and the Bayonne Bridge is 215 feet (NOAA.gov). In addition, the controlling bridge at the Port of Savannah, the Talmadge Memorial Bridge, is being temporarily modified to increase the air draft from 185 feet to 205 feet with construction in 2025,[12] and studies are underway to

[10] USACE (February 2024). Baltimore Harbor Anchorages and Channels, Modification of Seagirt Loop Channel, Maryland Feasibility Study. https://www.nab.usace.army.mil/Missions/Civil-Works/Seagirt-Loop-Channel/
[11] USACE (February 2024).
[12] AP News (January 2024). *Georgia agency awards contract to raise Savannah bridge to accommodate bigger cargo ships.*

further increase the air draft to 230 feet or replace the bridge with a tunnel (Exhibit G-Savannah River Crossing).

Cruise ships will also continue to increase in size. Just 31 percent of cruise ships have access to the Port of Baltimore due to current clearance limitations (Exhibit G – Cruise Line Fleet). Most cruise ships recently built or that are currently under construction exceed the clearance under the existing Bay Bridge and are therefore unable to call at the Port. This trend is expected to continue, as almost all large cruise ships currently under construction exceed the vertical clearance of the Bay Bridge (Exhibit G-Cruise Line Fleet). Cruise lines prefer a safety buffer of 10 additional feet of air draft clearance to avoid schedule delays related to variable water heights. Currently, Royal Caribbean Cruise Lines has 34 ships and Carnival Cruise Lines has 20 ships with air drafts between 185 feet and 220 feet that could call on the Port (Exhibit G- Cruise Line Fleet). A vertical clearance of less than 230 feet would be a limiting factor in supporting a more competitive cruise market for the Port of Baltimore (Exhibit G- Cruise Line Fleet). A vertical clearance of 230 feet would allow for larger cruise ships, including the Venice Class for Carnival, the Oasis Class for Royal Caribbean, and the Breakaway Class for Norwegian Cruise Lines, resulting in a more competitive market for the Port (Exhibit G-Cruise Line Fleet).

As more container ships of relatively large dimensions enter the world fleet, the frequency with which the bridges will be an obstacle for large vessels to access the Port of Baltimore will increase. Consequently, at a height of 182 feet, the existing Bay Bridge is a detriment to the commercial attractiveness of the Port. This limitation creates the need to increase the air draft of the proposed Bay Bridge to maintain the safe and efficient movement of commercial vessels over the waterway. This is supported by the Association of Maryland Pilots which stated, "The Port currently has infrastructure capable of handling 14,000 TEU ships, some of which will be unable to pass under the existing bridges at light draft. Additionally, while cruise ships currently call at the Port of Baltimore, some existing cruise ships and certainly future cruise ships will not be able to pass under the existing bridges." [13]

If yes, provide the following information: N/A

1. Vessel name;
2. Registration/documentation numbers;
3. Vessel type;
4. Vessel owner contact information (company/individual name, address, contact info.);
5. Primary vessel mooring location (include waterway milepoint, if known); vessel overall length;
6. Vessel beam;
7. Vessel draft (depth of hull below waterline at full load);
8. Vessel air draft (height of the highest fixed point of the vessel above the waterline, when empty);

[13] Email dated May 9, 2024, from Captain J. Kinlein, Association of Maryland Pilots

9. Specialized vessels that use the waterway (e.g. vessels which have limited maneuverability due to inherent design or mode of operation);
10. Safety margin required by vessel to navigate through the bridge(s);
11. Vessel transit frequencies under proposed bridge(s), transit speeds, and load configurations; and
12. Vessel traffic characteristics (to include if tug assist is required for transit through the bridge(s) due to limited horizontal clearance).
13. Does the proposed bridge(s) impact existing and future cruise ship ports-of-call/terminals?
14. Does the proposed bridge(s) impact ports supporting post-Panamax vessels?
15. Does the proposed bridge(s) impact vessels that produce unique products for the region?
16. Does the proposed bridge(s) impact vessels that require helper boats/tugs? (Note the combined clearance requirement of the vessel and the helper boat/tug.)
17. Document annual cargo movements (cargo types and quantities);
18. State the estimated percentage of the commercial fleet, which may be affected by the proposed bridge(s).
19. Will the proposed bridge(s) clearance impact present and/or prospective upstream commercial activity, e.g., jobs and economic growth and development?
20. If yes, address any existing or planned commercial/industrial developments negatively affected by the proposed clearances and discuss the economic impacts the proposed clearances will have on these businesses:
21. Document the foreseeable needs to future navigation;
22. Provide existing and historical navigational use and waterway conditions;
23. Provide input from waterway dependent facilities concerning future use;
24. Describe land use zoning along the waterway (particularly within the riparian zone);
25. Describe future vessel size and traffic trends;
26. Include input from states based on state development plans;
27. Include input from facilities based on business plans;
28. Document local commercial shipping and other businesses affected by this restriction.

Note: the next opportunity to adjust clearances for navigation is usually between 50-100 years unless interim waterway improvement projects include the cost of bridge alterations.

29. Is it feasible to modify the restricted vessels to clear the proposed bridge(s) without substantially increasing operating costs? If yes, name the vessel(s), state the necessary modifications, cost of modifying each vessel and company or entity responsible
30. Provide any additional information concerning the potentially impacted or burdened users of the waterway as well as the future use of the waterway.

H. <u>Identify the name and contact information for marine facilities located within a 3-mile radius of the proposed project (public boat ramps, marinas or major docking facilities, boat repair facilities, etc.:</u>

For a structure and waterway of this magnitude the primary facility of concern is the Port of Baltimore, which accommodates the largest vessels traversing the area.[14] The Port of |Baltimore is approximately 20 miles upstream of the proposed Bay Bridge. There are many facilities that accommodate smaller commercial and recreational vessels in the mid-Bay area. The following marine facilities were identified within 3 miles of the project.

- Sandy Point State Park boat ramp, 1100 E College Pkwy, Annapolis, MD 21409, Ranger Curtis Dale (410-974-2149)
- Queen Anne's County Kent Narrows Landing, 100 Piney Narrows Rd, Chester, MD 21619, James Wood (410-758-0835)
- Queen Anne's County Thompson Creek Landing, 802 Thompson Creek Road, Stevensville, MD 21666, James Wood (410-758-0835)
- Bay Bridge Marina, 337 Pier One Road, Suite 102, Stevensville, MD 21666, Will Sunkler (410-643-3162)
- Queen Anne's County Matapeake Fishing Pier and Ramp, 251 Marine Academy Drive, Stevensville, MD 21666, James Wood (410-758-0835)
- Safe Harbor Podickory Point, 2116 Bay Front Terrace, Annapolis, MD 21409, James Baden (410-757-8000)
- Whitehall Marina & Yacht Yard, 1656 Homewood Landing Rd, Annapolis, MD 21409, John White (410-757-4819)
- Naval Support Activity Annapolis, Mill Creek Marina, 140 Hooper High Rd, Naval Academy, MD 21402, Brandt Rodey (410-293- 3731)
- U.S. Naval Academy, Waterfront Readiness Center, 66 Halligan Road, Annapolis, MD 21402, CDR Jon Miller (410-293-9009)

I. Will the proposed bridge(s) block access of any vessel presently using local service facilities (i.e., repair shops, parts distributors, fuel stations)?

No. The vessels currently traversing the Chesapeake Bay will not be restricted by the proposed bridge. The northern alternatives alignments may impact vessel access to the Mezick Pond Entrance Channel if the bridge configuration limits horizontal or vertical clearance.

If yes, provide the following information: N/A

1. Describe the facilities impacted and estimate the number of vessels currently using these facilities.
   a. Vessel information should include the following for each blocked vessel:
      1. Vessel name;
      2. Registration/ documentation numbers;
      3. Vessel type;

[14] USDOT Bureau of Transportation Statistics (April 2024). https://www.bts.gov/current-transportation-statistics/information-about-port-baltimore

4. Vessel owner contact information (company/individual name, address, contact info);
5. Primary vessel mooring location (include waterway milepoint, if known); vessel overall length;
6. Vessel beam;
7. Vessel draft (depth of hull below waterline at full load); and
8. Vessel air draft (height of the highest fixed point of the vessel above the waterline, when empty);

2. Could any of these facilities be considered critical infrastructure, key resources, or important/unique U.S. industrial capability (i.e., are these facilities unique or one of only a few of the type in the area?) Address whether the proposed clearances negatively affect those facilities and their customers.

3. What economic impact will loss of access have on these facilities? Include estimated dollar amount to support Commandant and DHS goals.

4. What is the distance to alternate service facilities capable of servicing the affected vessels? Describe the facilities.

5. Will use of these alternate facilities substantially increase vessel operation affected vessels? Describe the facilities.

6. Is it feasible to modify the affected vessels to clear the proposed bridge(s)?

7. If yes, state the name, necessary modifications, cost of modifying each vessel and who will pay for the modifications.

J. <u>Are alternate routes bypassing the proposed bridge(s) available for use by vessels unable to pass the proposed bridge(s)?</u>

No. An alternate route will not be necessary, since vertical and horizontal clearances for the proposed bridge will be greater than the existing Bay Bridge. Vessels currently using the Chesapeake Bay Bridge Channel and Eastern Channel under the existing Bay Bridge will be able to fully utilize the proposed Bay Bridge. It is anticipated that the proposed Bay Bridge will accommodate larger vessels than can currently traverse under the existing Bay Bridge. The northern alternatives alignments may impact vessel access to Mezick Pond Entrance Channel if the bridge configuration limits horizontal or vertical clearance.

<u>If yes, provide the following information:</u> N/A

1. State the number of vessels that will be forced to use alternate routes.

2. For each vessel identified in section H1.a. above, include the following information:
   a. Vessel name;
   b. Registration/documentation numbers;
   c. Vessel type;

d. Vessel owner contact information (company/individual name, address, contact info.);
e. Primary vessel mooring location (include waterway milepoint, if known);
f. Vessel overall length;
g. Vessel beam;
h. Vessel draft (depth of hull below waterline at full load);
i. Vessel air draft (height of the highest fixed point of the vessel above the waterline, when empty); and
j. Specialized vessels that use the waterway (e.g., vessels which have limited maneuverability due to inherent design or mode of operation);

3. Identify any alternate routes and provide the respective distances between the proposed bridge(s) and these routes.

4. Will use of these routes substantially increase the transit time and/or operating costs of the affected vessels? This relates to the mobility goals of the Commandant and DHS.

5. If yes, describe the impacts of increased transit time and/or operating costs.

6. Is it feasible to modify these vessels to clear the proposed bridge(s)?

7. If yes, state the name, necessary modifications, cost of modifying each vessel and who will pay for these modifications.

K. Will the bridge(s) prohibit the entry of any vessels to the local harbor of refuge?

No. The proposed clearance envelope will be sufficient to pass vessels currently navigating the Chesapeake Bay in the area of the existing Bay Bridge, and pass future larger vessels, so that local harbor of refuge availability will not be reduced/prohibited.

If yes, describe the harbor and provide the following information: N/A

1. What percentage of vessels currently using the harbor refuge will not be able to pass the proposed bridge(s) to gain access to that refuge? Describe the vessels.

2. Provide vessel information for those vessels identified in J.1.
   a. Vessel name;
   b. Registration/documentation numbers;
   c. Vessel type;
   d. Vessel owner contact information (company/individual name, address, contact info.);
   e. Primary vessel mooring location (include waterway milepoint, if known);
   f. Vessel overall length;
   g. Vessel beam;
   h. Vessel draft (depth of hull below waterline at full load);

i. Vessel air draft (height of the highest fixed point of the vessel above the waterline, when empty); and
j. Specialized vessels that use the waterway (e.g. vessels which have limited maneuverability due to inherent design or mode of operation);

3. Is it feasible to modify these vessels to clear the proposed bridge(s)?

4. If yes, state the name, necessary modification, cost of modifying each vessel and who will pay for the modifications.

5. If alternate refuges are available, describe them and state the distance of each from the present harbor of refuge.

NOTE: A harbor of refuge is defined as a naturally or artificially protected water area that provides a place of relative safety or refuge for commercial and recreational vessels traveling along the coast or operating in a region.

L. Will the proposed bridge(s) be located within one-half mile of a bend in a waterway?

No. The proposed Bay Bridge will continue to accommodate the existing Chesapeake Bay Bridge Channel that aligns with the Port of Baltimore Harbor approach channels. The Chesapeake Bay Bridge Channel is a straight alignment for approximately 1 mile north and 3 miles south of the Bay Bridge.

If yes, describe the bend and provide the following information: N/A

1. Is there sufficient distance between the bridge(s) and the bend to allow proper vessel alignment for the safe, efficient passage of vessels through the proposed bridge(s)?

2. If no, what factors make construction of the bridge(s) at an alternate location impractical?

M. Are there other factors (i.e., dockages, lightering areas, existing bridges, etc.) located within one-half mile of the proposed bridge(s), which would create hazardous passage through the proposed structure?

No dockages or existing bridges located within one half mile of the structure would create hazardous passage through the proposed structure.

If yes, provide the following information: N/A

1. Describe the factors. (For example, construction impacts to navigation and waterway users, etc.)

2. What mitigative measures are being recommended? (For example, navigation safety during construction, etc.) Why?

N. Do local hydraulic conditions (i.e., wave chop, cross currents, tides, shoals, etc.) increase the hazard of passage through the proposed bridge(s)?

No. There are no anticipated hydraulic conditions that would increase the hazard of passage through the proposed bridge. The Chesapeake Bay tidal conditions are expected to remain similar to the existing conditions.

If yes, provide the following information: N/A

1. Describe the conditions:
2. What mitigative measures are being recommended? Why?

O. Do local atmospheric conditions (i.e., strong, prevailing winds, fog, rapidly developing storms, etc.) increase the hazard of passage through the proposed bridge(s)?

No. There are no known unusual atmospheric conditions that increase the hazard of passage through the proposed bridge that might require mitigation.

If yes, provide the following information: N/A

1. Describe the conditions:
2. What mitigative measures are being recommended? Why?

P. Have guide clearances been established for the waterway?

No. Guide clearances have not been established for Chesapeake Bay.

If yes, provide the following information: N/A

1. Horizontal guide clearance;
2. Vertical guide clearance;
3. Do the proposed bridge(s) clearances differ from these guide clearances?
4. If yes, what factors justify deviating from these guide clearances?

Q. Are there other natural or man-made conditions that affect navigation (atmospherics, exclusion zones, etc.)?

Yes.

1. Describe the conditions:

The existing Chesapeake Bay Bridge Channel constrains large vessels. Vessels utilizing Mezick Pond are constrained by the Mezick Pond Entrance Channel. The lifespan of the proposed bridge is anticipated to be 75 to 100 years. Water elevations are anticipated to be between 1.3 and 5.2 ft higher at the end of this time frame.[15]

2. What mitigative measures are being recommended? Why?

   The vertical clearance of the proposed Bay Bridge over the Chesapeake Bay Bridge Channel would be set to accommodate the largest vessels while considering the anticipated future water elevation.

R. State any other factors considered necessary for the safe, efficient passage of vessels through the proposed bridge(s)? Are clearance gauges needed?

The vertical and horizontal navigational clearances will remain adequate. Fixed navigational lighting on the bridge to indicate channel perimeters is necessary for the safe, efficient passage of vessels through the bridge. An air gap system should also be used as a safety precaution. Final bridge vertical and horizontal clearances would be provided for inclusion in the US Coast Pilot and during construction through Notices to Mariners and other standard maritime information methods. The bridge alternatives will maintain the supplemental navigation channel over the Eastern Channel to allow smaller vessels to pass under the bridge separated from the main navigation channel.

S. Include a description of the impacts to navigation caused or which could be reasonably caused by the proposed bridge(s) including but not limited to: proposed construction methodology, proposed or prospective changes to the existing bridge(s) operating schedule (for movable bridges), and any proposed mitigation to all unavoidable impacts to navigation.

1. Conduct a navigational impact report, and include a review of all bridges upstream and downstream of the proposed site to determine the minimum vertical and horizontal clearances available on the waterway.

   As noted above, horizontal and vertical clearances on the Chesapeake Bay are controlled by the existing Bay Bridge with 1,500-foot horizontal and 182-foot vertical clearances. The proposed bridge would match or exceed the existing clearances. There are no other bridges on the Chesapeake Bay. The proposed Bay Bridge will be higher than the bridges on the tributary rivers and will match the replacement Francis Scott Key bridge clearances for access to the Port of Baltimore.

   The sequence of construction, along with temporary navigation restrictions, will be developed during design. Trestles or causeways from each shoreline may be needed to stage construction of the replacement Bay Bridge piers in the Bay. Crane and deck barges delivering materials and carrying equipment may be needed to construct the

[15] NOAA Fisheries. Chesapeake Bay: Climate Change. https://www.fisheries.noaa.gov/topic/chesapeake-bay/climate-change.

piers and erect sections of the superstructure. As details are developed, the project will coordinate with USCG through the Bridge Permit application process. Temporary impacts to navigation, including temporary channel closures, will be coordinated with USCG through the Local Notice to Mariners (L-NTM) process.

2. If the proposed bridge(s) is fixed, and is replacing an existing drawbridge with unlimited vertical clearance, the applicant must determine whether the proposed bridge(s) will accommodate existing and perspective navigation.

   There are no moveable span bridges being replaced.

T. <u>Is there any proposed or completed mitigation for impacted waterway users? Are there any impacts that cannot be mitigated?</u>

1. Can vessels and cargos be partially disassembled/dismantled in order to transit the proposed bridge(s), and if so, is it economically reasonable? The Coast Guard must take into consideration a vessel's ability to adjust its operations without economic loss. Adjustment or mitigations techniques may include using other routes, lowering electronics (GPS, radar, communication antennae, etc.), lowering crane booms, etc.

   Vessel and/or cargo disassembly/dismantling will not be necessary, as the clearance envelope for the proposed bridge will be sufficient to pass vessels currently navigating the Chesapeake Bay.

2. Are alternative routes available for vessel passage?

   Alternative routes for vessel passage will not be necessary, as the clearance envelope will be sufficient to pass vessels currently navigating the Chesapeake Bay.

3. Can vessels transit at typical lower water stages (mean low water, mean pool level, etc.)?

   Yes. The Chesapeake Bay Bridge Channel depth near the bridge site is approximately 50 feet.

Conclusion

The MDTA recommends:

Bridge	Vertical Clearance (FT)	Horizontal Clearance (FT)
Proposed Bay Bridge over the Chesapeake Bay Bridge Channel	230	1,500
Proposed Bay Bridge over the Eastern Channel	58	690
Proposed Bay Bridge over the Mezick Pond Entrance Channel*	31.5	75

* Vertical Clearance at MHHW

The recommended horizontal clearance does not restrict navigation channel use. The proposed Francis Scott Key Bridge will have the same vertical clearance at 230 feet, and a narrower horizontal clearance at 1,100 feet than the proposed Bay Bridge at 1,500 feet. The recommended air draft clearance is similar to the Verrazano Narrows Bridge in New York at 228 feet, which would place the Port of Baltimore as the third port (along with New York/New Jersey and Norfolk, Virginia) on the East Coast with the capacity to operate all classes of modern container and passenger ships. With the existing 182-foot Bay Bridge restriction, the Port of Baltimore can only serve container vessels up to 14,000 TEU. Worldwide, ships of up to 25,000 TEU are becoming common. The vertical clearance of the existing Bay Bridge limits the largest class of cargo vessel that can call on the Port to the Panamax (PPX) Generation III Max. The proposed Bay Bridge would allow an additional 400 existing large container vessels, and 186 large container vessels under construction, to call on the Port. These 586 ships cannot call on the Port with the existing Bay Bridge vertical clearance.

Nationally, to make it economical for shipping lines to have these large ships call on the East Coast, multiple ports must be available to accommodate a dispersed cargo operation. Having the Port of Baltimore as a third major East Coast port, with New York/New Jersey and Norfolk, has the potential to make the entire East Coast of the United States more attractive to large shipping companies. Also, the Port of Baltimore is specifically advantageous in that it is the East Coast's most inland deepwater port that is directly accessible to sea by large vessels. This allows containers to remain aboard ship, getting 150 miles closer to major markets before offloading and transferring containers to truck or train. CSX's Howard Street Tunnel Project will further contribute to the Port's ability to manage larger container volumes after offloading. The shipping benefits would be experienced, not only by Maryland and the Mid-Atlantic, but by the Midwestern states as well. Several hundred modern container ships cannot call on the Port of Baltimore due to the Bay Bridge air draft, with more being built every day.

Chesapeake Bay water elevation is predicted to rise in Maryland has been and will continue to be greater than the global average. Predicted water elevation of up to 5.2 feet[16] above present elevations would reduce future air draft at the existing Bay Bridge and is another factor to consider for the height of the new bridge. MPA predicts that PPX III Max vessels will be restricted from the Port as early as 2045, due to the current vertical clearance of the Bay Bridge.

[16] USACE (February 2024).

The Port of Baltimore has one of the East Coast's deepest channel depths at 50 feet, with room for expansion and deepening. As other ports, specifically Norfolk, have gotten even deeper (55+ feet), the vertical clearance restrictions in Chesapeake Bay are now more critical than ever. Ships calling at the Port of Baltimore could first lighten at a port such as Norfolk, which would create a higher air draft, and allow the vessel to navigate the Port of Baltimore approach channels. It is already quite common for large ships to call at both Norfolk and Baltimore.

The location of the Port of Baltimore has many advantages to the cruise lines that cannot be achieved due to the current air draft restrictions of the Bay Bridge. The inland location places the Port within driving distance of a massive portion of the nation's population. This allows passengers to embark on their vacations without a day of flying on each end, while still being far enough south to reach Caribbean destinations in reasonable times. The air draft of most large cruise ships built in the past several decades prevents passage under the current bridge. The two major cruise lines that currently service the Port are using older cruise ships that can meet the existing air draft restrictions of the bridge. A vertical clearance of 230 feet will allow most new and existing passenger ships to call on the Port.

The MDTA’s recommendation is a bridge vertical clearance of 230 feet for the proposed bridge over the Chesapeake Bay Bridge Channel, with a 1,500-foot horizontal clearance. To invest in a lower air draft restriction than exists in New York, Norfolk and as proposed in Savannah will leave the Port of Baltimore at a disadvantage both nationally and globally.

Table of Exhibits

Exhibit B – Location Map

Exhibit B – Concept Alignments

Exhibit D - Specialized Operation Vessel Examples

- **NAVFAC - Homeporting Criteria**
- **USCG - The Cutters, Boats, and Aircraft of the U.S. Coast Guard**
- **Hockema Group - A design overview of … the Frederick Paup**

Exhibit G - Present and Prospective Commercial Navigation and Cargo

- **Port of Baltimore Cargo and Vessel Planning Projections**
- **MPA Memo, 2023**
- **Port of Baltimore data**
- **Existing Vessels That Cannot Access the Port of Baltimore**
- **Future Vessels That Will Not Have Access to the Port of Baltimore**
- **Cruise Line Fleet**
- **Bayonne Bridge Air Draft Analysis**
- **Savannah River Crossing**

Exhibit B – Location Map

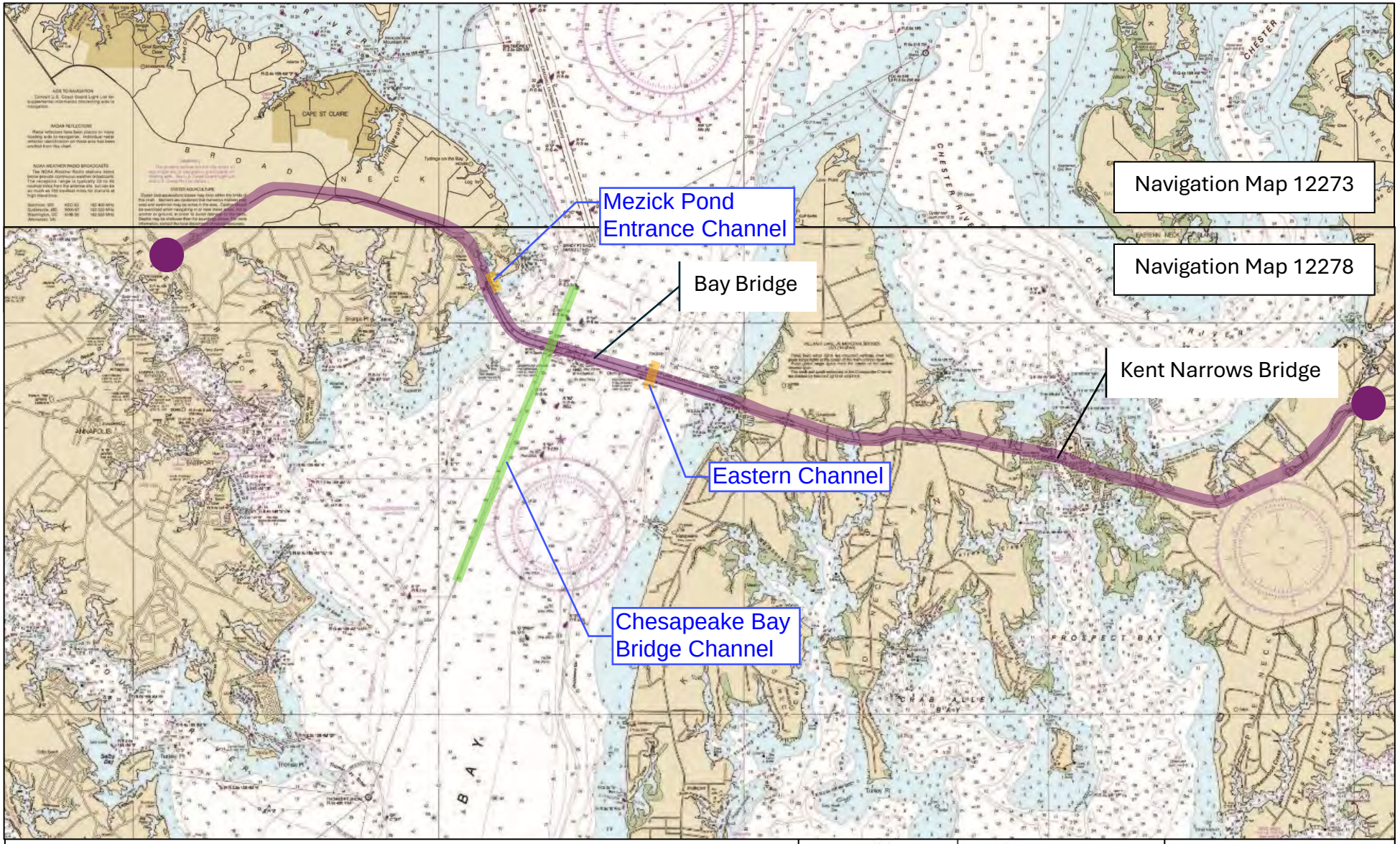

Navigation Map 12273
Navigation Map 12278
Mezick Pond Entrance Channel
Bay Bridge
Kent Narrows Bridge
Eastern Channel
Chesapeake Bay Bridge Channel
Study Limits
Bay Crossing Study: Tier 2 NEPA Limits
Federal Maintained Channel
Other Channel
0 1/2 1 Miles
MDTA
Maryland Transportation Authority
Chesapeake BAY CROSSING STUDY TIER 2 NEPA
Exhibit B
Location Map

Exhibit B – Concept Alignments

The full bridge structure would include an over-water bridge structure crossing the full width of the Chesapeake Bay as shown in **Figure 1**. The MDTA conducted a preliminary evaluation to determine the potential impacts associated with a bridge structure. Advantages of a full bridge compared to the other structure types, which are described in the following sections, include a smaller environmental footprint, the ability to transport hazardous materials across the Bay, lower cost, and the opportunity for inclusion of a shared use path. Advantages of having two bridge spans instead of one bridge span include redundancy; flexibility in funding; maintenance of traffic during construction, maintenance, and inspections; and the ability to use existing right-of-way with staged construction. Preliminary footprints for several configurations of connecting a new bridge to the approach roadways are shown in **Figures 2** through **5.**

Structure Location

The MDTA has evaluated the location of a new bridge. The alignments for the roadway east and west of a new bridge would remain along the existing U.S. 50/301 alignment to reduce environmental effects, but at the shorelines, the approach alignment would be adjusted to connect the approach roads to a new bridge. The alignment options for a new bridge were evaluated at a "north bridge location," and a "south bridge location." The MDTA has proposed these locations in relation to the existing Bay Bridge.

North Bridge Location

A north bridge location, which is shown in **Figures 2 and 3**, consists of one span north of the westbound Bay Bridge span and one span between the existing westbound and eastbound span.

A new westbound span could be located completely to the north to avoid conflicting with the existing spans during construction. Then one of the existing Bay Bridge spans can be removed and the new eastbound span can be constructed between the existing bridge span locations. Removal of the existing spans would be sequenced into the maintenance of traffic to maintain the number of existing lanes during construction of the new bridge spans.

South Bridge Location

A south bridge location, which is shown in **Figures 4 and 5**, consists of one span south of the eastbound Bay Bridge span and one span between the existing westbound and eastbound span.

A new eastbound span could be located completely to the south to avoid conflicting with the existing spans during construction. Then one of the existing Bay Bridge spans can be removed and the new westbound spans can be constructed between the existing bridge span locations. Removal of the existing spans would be sequenced into the maintenance of traffic to maintain the number of existing lanes during construction of the new bridge spans.

Figure 1: *Overall view of Bay Crossing Location with Alternatives*

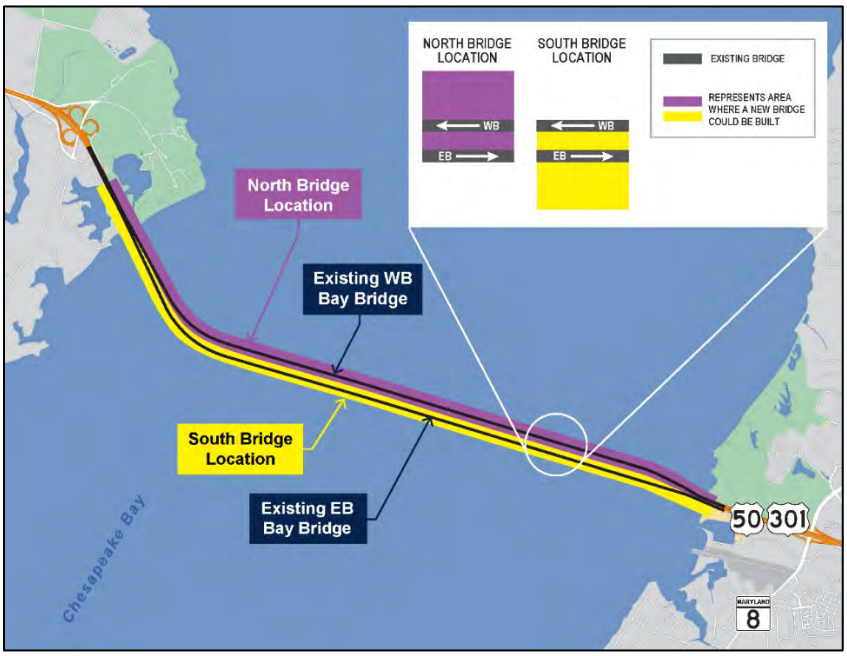


***Figure 1**: Western Shore Approach, Northern Alignment*



***Figure 2**: Eastern Shore Approach, Northern Alignment*



***Figure 3**: Western Shore Approach, Southern Alignment*



***Figure 4**: Eastern Shore Approach, Southern Alignment*



Exhibit D - Specialized Operation Vessel Examples

NAVFAC - Homeporting Criteria

11460
15C/rdc
3 NOV 98

From: Commander, Naval Facilities Engineering Command (NAVFAC Criteria Office)

Subj: INTERIM TECHNICAL GUIDANCE (ITG) – FACILITIES HOMEPORTING CRITERIA FOR NIMITZ CLASS AIRCRAFT CARRIERS

Encl: (1) Interim Technical Guidance (ITG) for Facilities Homeporting Criteria for Nimitz Class Aircraft Carriers

1. Purpose. The purpose of this guidance is to advise facility engineers, planners, and maintenance personnel of minimum facility planning and design criteria necessary to ensure efficient in-port operations of Nimitz class aircraft carriers. Use this document to support planned Military Construction (MCON) for facilities supporting these vessels. Existing sites may not meet all criteria and, therefore, perform less efficiently. However, future sites should incorporate the requirements stated herein. Retain this guidance until it is incorporated into the criteria noted in paragraph 5.

2. Background. Changes in homeporting assignments for Nimitz class aircraft carriers (CVN-68) have necessitated the construction of several new facilities to support these vessels. The Navy is constructing new CVN berths and industrial facilities at North Island Naval Air Station. Likewise, Puget Sound Naval Shipyard/Station is upgrading existing and constructing new facilities to support CVN homeporting. A third CVN homeport is expected at an undetermined location early next century. The Navy has used enclosure (1), in draft form, for the planning and design of the North Island and Puget Sound facilities. This ITG finalizes the draft criteria.

3. Discussion. This criteria is a compilation of lessons learned from existing CVN homeports, planning studies, COMNAVSEASYSCOM, COMNAVAIRLANT, and COMNAVAIRPAC. It includes state-of-the-art technology in vital facility areas such as mooring, dredging, shore steam, and oily waste collection. Congressional support for all new construction is dependent on specific planning and design criteria applied consistently throughout the Navy - hence, the need to formalize the criteria.

4. Technical Guidance. See enclosure (1).

5. Action.

a. Engineering Field Divisions (EFDs), Engineering Field Activities (EFAs), and Officers in Charge of Construction (OICCs) shall plan, design, and construct CVN homeports according

11460
15C/rdc
3 NOV 98

Subj: INTERIM TECHNICAL GUIDANCE (ITG) – FACILITIES HOMEPORTING CRITERIA for NIMITZ CLASS AIRCRAFT CARRIERS

to the criteria stated herein. This document shall be used in conjunction with Activity and Fleet site specific requirements.

b. NAVFAC Criteria Office will coordinate revisions of the following criteria to incorporate the ITG stated herein:

(1) Military Handbook 1025/1, “Piers and Wharves,”
(2) Military Handbook 1025/2, “Dockside Utilities for Ship Service”
(3) Military Handbook 1025/6, “General Criteria for Waterfront Construction”
(4) DM 26.1, “Harbors”
(5) Military Handbook 1026/4, "Mooring Design" (currently in draft format)

5. Coordination. This ITG has been coordinated with COMNAVSEASYSCOM, COMNAVAIRLANT, COMNAVAIRPAC and internally within NAVFACENGCOM.

6. Points of Contact. For clarification or additional information related to this subject, please contact the NAVFAC Criteria Office point of contact, David Curfman, P.E., DSN 262-4203, 757-322-4203, fax 4416, email address *curfmanrd@efdlant.navfac.navy.mil*.

P. N. BOLTON
By direction

Distribution:
COMNAVAIRLANT N4
COMNAVAIRPAC N4, N7
NAVFACENGCOM MCN
LANTNAVFACENGCOM
PACNAVFACENGCOM
SOUTHNAVFACENGCOM
SOUTHWESTNAVFACENGCOM
NORTHNAVFACENGCOM
LANTNAVFACENGCOM Codes 03, 04, 402, 16, 20
NORTHNAVFACENGCOM Codes 03, 09X, 4013 (F. Russ Jorlett), 402 (Greg Retzler), 20

11460
15C/rdc
3 NOV 98

Subj: INTERIM TECHNICAL GUIDANCE (ITG) – FACILITIES HOMEPORTING CRITERIA for NIMITZ CLASS AIRCRAFT CARRIERS

SOUTHNAVFACENGCOM Codes 07, 076DPD (D. Dennis), 07 (Jim Caulder), 20
SOUTHWESTNAVFACENGCOM Codes 03, 5710, 406 (C. Dahlen), 571 (Ed Hanlon), 20
PACNAVFACENGCOM Codes 03, 04, 406 (W. Takushi), 402 (Mel Tsutahara), 20
ENGFLDACT CHESAPEAKE Codes 04, 406 (H. Trechsel), 20
ENGFLDACT MEDITERRANEAN Codes N3, N4 (R. Cook)
ENGFLDACT MIDWEST Codes 04, 420 (J. Kang), 20
ENGFLDACT NORTHWEST Codes 15, 04B (K. Jones and M. Randel), T2SS (Steve Stanek), 20
ENGFLDACT WEST Codes T2, T2 (Ron Brody), T1E (K. Lee), 20
PWC GUAM Codes 400, 423 (H. Moguel)
PWC GREAT LAKES Codes 400, 422 (J. Harmon)
PWC JACKSONVILLE Codes 400, 420 (D. Simes)
PWC NORFOLK Codes 400, 424 (R. Jones)
PWC PEARL HARBOR Codes 400, 420 (L. Kaya)
PWC PENSACOLA Code 400 (W. Reinschmidt)
PWC SAN DIEGO Code 400 (J. Strauss)
PWC NORFOLK DET PHILADELPHIA Code 400
PWC WASHINGTON Codes 400, 410 (J. Verde)
PWC YOKOSUKA Code 400 (Steve Koepsell)
COMNAVSEASYSCOM PMS 312I
COMNAVSEASYSCOM Code 08
COMNAVSEASYSCOM Code 03
NAVFACENGCOM CHE
NAVFACENGCOM ESC (D. Potter)
NAVFACENGCOM ENG (B. Kamerman)
NAVFACENGCOM MCM (S. Shkapsky)
ENGFLDACT CHESAPEAKE
ENGFLDACT NORTHWEST TW (C. Greely)
ENGFLDACT WEST
ENGFLDACT MIDWEST
ENGFLDACT MED
NFESC EC DET
NFESC
NAVSHIPYD PUGET SOUND Codes 3410N (J. Frogness), 2310 (K. Koemmpel)
NAVSHIPYD NORFOLK Code 9910 (M. Guglielmo)

11460
15C/rdc
3 NOV 98

Subj: INTERIM TECHNICAL GUIDANCE (ITG) – FACILITIES HOMEPORTING CRITERIA for NIMITZ CLASS AIRCRAFT CARRIERS

CINCLANTFLT N46
CINCPACFLT N46
NAVSTA NORFOLK

Blind copy to:
15/rdc/jll
15(RF)/ssf
c:/mydocuments/lynch/itgcvn.doc

INTERIM TECHNICAL GUIDANCE -
FACILITIES HOMEPORTING CRITERIA
for
NIMITZ CLASS AIRCRAFT CARRIERS
3 November 1998

SECTION 1 – Command Issues

1-1. Scope

a. This document provides minimum facility planning and design criteria for efficient homeport operations of active Nimitz class aircraft carriers. Existing ports, facilities, and berths may not meet all criteria and may, therefore, perform less efficiently, but do not necessarily require upgrade.

b. Piers and wharves at Homeports may be grouped into 3 categories:

- Type I – Fueling and Ammunition
- Type II – General Purpose
- Type III - Repair

The requirements are different for each type. This document focuses on the entire homeport operation. The ship will visit fueling and ammunition piers for short periods, but generally berth at general purpose berthing piers. Every 18 months the carrier will undergo a 6-month “Planned Incremental Availability (PIA)” at the repair berth. Ships in dry dock, at liberty ports, and in inactive status require specialized criteria that NAVFAC will provide as requested.

c. This document supplements basic criteria contained in the following documents:

- Military Handbook 1025/1, “Piers and Wharves,”
- Military Handbook 1025/2, “Dockside Utilities for Ship Service”
- Military Handbook 1025/6, “General Criteria for Waterfront Construction”
- Military Handbook 1026/4, "Mooring Design" (Draft)
- DM 26.1, “Harbors”
- NAVFAC P-80, “Facility Planning Criteria”

1-2. Minimum Personnel and Support Facilities and Services

Contact local NAVFAC representative for specific facilities and services required for each site such as police, fire, medical, MWR, administrative, housing, and family services.

1-3. Local Fire Regulations

a. Fire aboard ship - The responsibility for fire prevention and protection for a ship in-commission rests fully with the Commanding Officer of the ship. However, all piers and wharves shall provide fire alarm systems or telephone connections to alert local fire department for truck and or tug supplemental support. Unless the berth will be used during full cold iron condition, such as for PIA, pressurized fire fighting water systems are not required. Berths designated for the PIA will require pressurized fire-fighting systems and salt water systems

b. Local fire protection systems may be called upon to support extensive ship board fires and augment fixed systems.

1-4. Disaster Control and Emergency Plans

a. In an emergency, tugs may not be available. Therefore, the slip, berth, basin, and channels should allow the ship to get underway without assistance. See OPNAVINST 3040.5c.

b. Should the ship be unable to leave prior to heavy weather (such as during a PIA), a Heavy Weather Mooring plan should be established for winds from 34 knots (39 mph) to the predicted 100-year recurrence wind speed at the site. General purpose berths are normally designed for 64-knot (75-mph) winds. Therefore, winds in excess of 64 knots (75 mph) such as may be seen at repair berths require special considerations. NAVFACENGCOM expects to publish separate Heavy Weather Mooring Facility criteria in December 1998.

c. Design facility systems for continuous operation in the event of a power outage

1-5. Ship Characteristics

a. Draft – use the limiting draft for the largest CVN in determining minimum water depth requirements; i.e., 40.8 ft.

b. Displacement – use the largest displacement expected of any CVN in determining berthing forces on the pier or wharf; i.e., 104,200 long tons.

c. Length – use the overall length for the longest CVN to determine pier and wharf length and utility locations; i.e., 1123 ft.

d. Breadth – use the widest to determine horizontal clearances and slip width; i.e., 280 ft. Note that the waterline beam for CVN 68-75 is 134 ft and the width of the flight deck structure (with antenna platforms, walkways, and portable flight deck sections removed) is 252 ft. Without removing these appurtenances, CVN 68 is 260 ft and CVN 76 is 280 ft wide.

e. Height – use the lightly loaded height of 215 ft above the waterline.

SECTION 2 - Navigation

2-1. Channel Approaches (Outer Channels) – site specific criteria

a. Coordinate dimensions of approaches with the NAVFAC Criteria Office, NAVSEASYSCOM, and COMNAVAIRLANT N4, or COMNAVAIRPAC N4. Consideration should be given to traffic lanes, local commercial traffic, navigational aids, magnetic anomalies, electronic navigation aids, waves, winds, currents, use-frequency, pilotage and tugs. Contact the US Coast Guard for navigational marking requirements and bridge clearances.

b. The geometrics of the approaches (depth, width, and course) are dependent on many operational and environmental factors. The wave environment greatly affects the required depth to transit the approach. Local commercial traffic affects the width. Maneuverability is the primary driver for the course. Consequently, the planner must examine each channel approach separately. Contact the NAVFAC Criteria Office to assist in evaluating or designing channel approaches.

c. Contact the local NAVFAC representative, who will contact the US Army Corps of Engineers to address environmental and material disposal issues.

2-2. Entrances and Harbors – site specific criteria

a. Entrance Restrictions – Entrance channels provide access between deep water subjected to a strong wave environment to sheltered harbors. Contact local Port Authority for any operational restrictions.

b. Entrance Currents - Strong currents greatly affect the usability of entrance channels. These currents should be quantified and the impact assessed during the planning stages.

c. Minimum Entrance Depth - CVN's require 50.0 feet of water during transit of channels (usually during mean to high tides) greater than 1000 ft. wide. Narrower channels require greater depths. Tides and waves should be quantified and the impact assessed to determine if a dredge depth of greater than 50.0 feet is required. Siltation occurs in most channels and shall be quantified initially. The design depth should then be deeper than the requirement to accommodate siltation. Expected siltation can be addressed through advance maintenance dredging or other means. More detail is contained in "ITG – CVN Dredge Depth Criteria," NAVFACENGCOM, dated 4 March 1997. That ITG includes NAVSEA ltr 11460 Ser 03D3/242, dated 3 Jan 95, "CVN 68 Class Water Depth Requirements".

d. Minimum Entrance Channel Width (outside breakwaters) – depends on wave and current environment but generally at least 800 ft. at toe of slope, assuming no bends in the channel and one way traffic during transit.

e. Vertical Bridge Clearances - 250 ft. Mean Higher High Water (MHHW) when ship is in light condition. Light condition occurs when ship has no aircraft, airwing, ammunition, and has 55% of JP-5, 10% of provisions and stores, 10% of potable water, aircraft handling vehicles, and 25% onboard discharge tank water. This height is based on the older CVs. If the facility is designed explicitly for Nimitz class, use 230 ft. MHHW.

f. Turning Basin Criteria – 2200 ft (optimal)/1650 ft (absolute minimum with full tug support) radius. Tug availability should be considered. Minimum depth = 49.5 ft. at Mean Lower Low Water (MLLW) and 45.5 ft at Extreme Low Water (ELW) with no waves as explained below.

g. Minimum Inner Channel Width (inside breakwaters) – 600 ft. min. at toe of slope, assuming no bends in the channel and no other traffic during transit. Narrower widths may create maneuverability difficulties, increase risk of grounding, and increase sinkage thus reducing efficient homeport operations.

2-3. Berths

a. Minimum slip width - 600 ft. with no other ships, 800 ft with CVN on opposite berth. Add 100 ft to width if ships are berthed at the bow or stern also.

b. Minimum slip depth - 49.5 ft. min. at Mean Lower Low Water (MLLW) and 45.5 ft. min at Extreme Low Water (ELW). The requirement at MLLW is based on preventing fouling of sea chest intakes. The requirement at ELW is based on preventing grounding. Over time, siltation occurs in most slips and should be quantified initially. The design depth should then be deeper than the minimum to accommodate siltation. Siltation may be mitigated through advance maintenance dredging or other means. These depths provide protection against condenser fouling and grounding, and accommodate variability in displacement, list and trim. More detail is contained in "ITG – CVN Dredge Depth Criteria," NAVFACENGCOM, dated 4 March 1997. The ITG includes NAVSEA ltr 11460 Ser 03D3/242, dated 3 Jan 95, "CVN 68 Class Water Depth Requirements"

c. Minimum slip length - 1300-1325 ft. min. This range in slip length provides adequate space for bow and stern lines, provides a safety clearance fore and aft of 100 ft., and facilitates emergency sorties without tug support. However, five to eight tugs should be available for berthing operations.

d. Arrangement – CVN's are typically moored "starboard-side-to" to allow access to the ship's three elevators for on/off loading.

2-4. Tides and Currents

a. Tides - avoid locations subject to tides greater than 10 ft. Location subject to tides greater than 10 ft. are functional but incur increased operational costs due to increased line tending, utility connection fatigue, and fender degradation.

b. Currents - avoid locations subject to average broadside currents greater than 3 knots. Moorings on Naval vessels are typically designed to resist up to 3 knot current. Local eddies can also make mooring difficult.

c. Seiches - avoid locations subject to seiches (long-period waves of large amplitude). Extreme and unpredictable surge may part mooring lines and damage vessel.

d. Tsunamis - avoid locations subject to tsunamis (seismic sea waves). Extreme and unpredictable surge may part mooring lines and damage vessel.

2-5. Winds and Weather

a. Winds - Moorings on Naval vessels are typically designed to resist wind speeds up to 50 knots (58 mph) coupled with a 3 knot current. Design facilities assuming the vessel is at the berth in winds up to 64 knots (75 mph). See also “Disaster Control and Emergency Plans” above.

b. Weather - Frequent fog and ice impact the efficiency of naval ports and sites should be selected with low occurrences.

2-6. Port Regulations

Contact the Local Port Authority for regulations that may affect homeporting considerations. While regulations are dynamic, items such as environmental protection, oily waste and sewage collection, clean air regulations, garbage and trash disposal, recycling, and channel speed limits can affect the optimization of a homeport.

SECTION 3 - Repair

3-1. Coordination of Repair

Coordinate capability of local ship repair facilities and salvage operations with NAVSEASYSCOM PMS 312 and Code 08, COMNAVAIRLANT N4, or COMNAVAIRPAC N4. The following facilities should be available within a reasonable distance from the homeport to minimize disruption to families and to allow an acceptable level of sailor quality of life as defined in PERSTEMPO requirements.

a. A Controlled Industrial Facility (CIF) or Radiological Work Facility used for the inspection, modification, and repair of radiological controlled equipment and components associated with Naval nuclear propulsion plants. It also provides facilities and equipment for the treatment, reclamation, and packaging for disposal of radiologically controlled liquids and solids. It includes non-radiologically controlled spaces for administration and other support functions.

b. A Ship Maintenance Facility (SMF) housing the machine tools, industrial processes and work functions necessary to perform non-radiological depot level maintenance on CVN propulsion plants. Non-radiological work is the primary burden of work during Nimitz availability.

c. A Maintenance Support Facility (MSF) housing both administrative and technical staff offices supporting CVN propulsion plant maintenance, as well as central area for receiving,

inspecting, shipping, and storing hazardous/mixed waste materials and maintenance materials, and controlled radiological tank storage.

d. Dry-dock facilities exist only in the Hampton Roads area. Aircraft carriers will be located to this location during periods when this service is required. Contact NAVSEA for specific requirements.

SECTION 4 - Logistics

4-1. Pier and wharf width

a. Wharves or piers with berths on one side = 90 ft min (20 ft bollards and utilities, 35 ft mobile crane ops, 15 ft. fire lane, 20 ft for loading area).

b. Piers with berths on both sides = 150 ft. min. (40 ft bollards and utilities, 70 ft mobile crane ops/loading area, 15 ft fire lane, 25 ft for loading area). This requirement is for carrier (CVN) berths or a combination of CVN/AOE berthed. Recommend 150-foot wide piers based on operational experience of existing facilities.

c. These widths provide adequate space for line handling, utility maintenance, ship maintenance, replenishment, and fire fighting access. Transformers are assumed off-deck or under-deck, deck mounted transformers require additional 25 ft. of pier width.

4-2. Pier and wharf length and height

a. Pier and wharf length should be 1300-1325 ft. min.

b. Deck height must not conflict with CVN elevators. When lowered, the lowest projection of the elevator is 9.0 ft above the water for a fully loaded CVN. Generally deck height is set 2/3 the significant wave height + 3 ft. above Mean Higher High Water (MHHW). Camels, as mentioned later, generally provide enough standoff to prevent interference. However, camels of narrower width may result in interference.

4-3. Pier strength

a. Live load = 800 psf min.

b. Mobile Crane load = 2-140 ton mobile cranes. Confirm crane sizes with those available at the location. During availability, cranes will periodically handle 60,000-pound tanks. Most lifts are in the 40,000-pound range.

c. Aircraft range in weight from 35,000 pounds to 74,000 pounds. Due to the 75-ft reach, use 75-ton portal cranes to remove aircraft from the flight deck. Contact local Activity to determine optimal lifting method. A portal crane has been used to lift a 90,000-pound mobile crane onto a carrier flight deck.

d. Bollards – For 64 knot wind capability, the pier should have at least 12-100 ton bollards at 100 ft centers and 4-200 ton storm bollards at each end of the berth.

4-4. Supporting items - provide the following

a. Camels - Three camels (one spare) of minimum width 55 ft. are required to prevent interference between the ship elevator and the pier deck. Naval Station Norfolk uses 32-ft wide camels but provides a 2 degree list. Naval Station Everett uses 60-ft wide camels. Camels may be barges or fabricated from NAVFACENGCOM standard drawings and specifications. Structurally evaluate barge for severe weather conditions. Also consider crane lift ability in camel design and utility location. NAVSEA PMS 312 recommends 60-ft camels for new CVN homeports.

b. Aircraft Support - Aircraft require extensive support. Those requirements are not addressed herein.

c. Laydown Area - A minimum of 5 acres of laydown area in addition to pier/wharf space is desirable. The laydown area should be within ½ mile of the pier/wharf.

d. Brows – 2- 45 ft brows are usually placed on ship's elevator #2 and 1-60 ft brow is placed between elevators #2 and #3 to the main deck.

e. Other Ship Use - CVN berths should generally be designed to accommodate a variety of surface combatants that may use the facilities.

f. Power - Ship-to-shore power/telecommunications cables.

g. Warehouse Space - General warehouse space accessible to large trucks and handling equipment.

h. Permit no pier interferences such as utilities and deck appurtenances in the zone of carrier elevators 1, 2, and 3.

4-5. Shore Utility Requirements (per CVN) [5]

Utility	Quality	Peak Demand with Air Wing	Average Demand Without Air Wing
a. Steam	Certified Pure, 150 psi	50,000 pph (pounds per hour)	35,000 pph
b. Potable water	EPA Approved, 40 psi (residual)	1000 gpm (gallons per minute) and 185,000 gpd (gallons per day)	1000 gpm and 95,000 gpd
c. Pure water	Certified Pure	150 gpm and 20,000 gpd	150 gpm and 20,000 gpd
d. Fire fighting water [1]	Salt or nonpotable, 150 psi	4400 gpm	4400 gpm
e. Cooling/flushing water	Salt or nonpotable, 150 psi	4100 gpm	4100 gpm
f. Compressed air (portable or pier-based system)	125 psig	2400 scfm	2400 scfm
g. Shore power [2]	4160V	2880 amps (21,000 kVA)	1800 amps (13,000 kVA)
h. Sanitary sewer [3]	400 gpm pumps	310,000gpd	190,000 gpd
i. Telephones	Not applicable	200 twisted pairs with 60 pairs of active lines	Same
j. Telecommunications	Not applicable	IT-21 requirements under development, contact NAVFAC Criteria Office	Same
k. Oily waste collection [4]	200 gpm	80,000 gpd	35,000 gpd
l. High pressure air	Chaper 9490 NSTM	3000-4500 psi	3000-4500 psi

Notes:

(1) Include salt water for fire fighting and cooling/flushing when potential exists for ship to be in cold iron status. Total demand equals fire fighting plus cooling/flushing flow.

(2) Supplemental 480 V service is recommended on all CVN piers for use by other classes of ships.

(3) There are two types of CVN sanitary sewage systems. CVN 68-71 has 7 tanks with 3 manifold discharge stations. Each station has 2-400 gpm pumps. CVN 72-76 has 2 tanks with 2 discharge stations. Each station has 2-400 gpm pumps.

(4) Peak demand assumes emptying an 80,000 gallon shipboard oily waste holding tank (OWHT) at arrival.

(5) For multiple CVN's at the pier, contact the NAVFAC Criteria Office for diversity factors for each utility system.

Exhibit D - Specialized Operation Vessel Examples

USCG - The Cutters, Boats, and Aircraft of the U.S. Coast Guard

THE CUTTERS, BOATS, AND AIRCRAFT OF THE U.S. COAST GUARD

PROFESSIONALLY AND PROFICIENTLY OPERATED BY THE MEN AND WOMEN OF THE U.S. COAST GUARD, the service's cutters, aircraft, and boats are standing by 24/7 to respond to safety and security threats in all weather conditions, day or night. As the lead federal agency in the maritime domain for law enforcement, incident response, homeland security, and disaster management, these specialized capabilities enable the Coast Guard to save lives, protect the environment, enforce federal laws on the high seas, and defend the homeland.

In recent years, the Coast Guard realized several achievements with recapitalizing its assets.

The service christened the sixth national security cutter (NSC), *Munro*, in November 2015. The fifth NSC, *James*, was commissioned in August 2015. The service commissioned its 14th fast response cutter late in 2015, and 14 HC-27J aircraft are being transferred from the Air Force and modified for Coast Guard missions.

Despite these milestones, fleet and aircraft recapitalization timelines lag service need, endangering the ability to be "Always Ready" to prepare for, respond to, and quickly recover from major incidents. Moving forward, the Coast Guard will thoughtfully pursue and achieve a balanced and executable acquisition program for the deteriorating offshore, coastal, and inland assets.






910
U.S. COAST GUARD




U.S. COAST GUARD








800




25160
U.S. COAST GUARD









ICEBREAKERS

The Coast Guard operates three oceangoing icebreakers, the newest of which, the CGC *Healy* (WAGB 20), commissioned in July 2000, is the service's largest ship. The Coast Guard also operates one icebreaker on the Great Lakes – the CGC *Mackinaw* (WLBB 30), which replaced an older ship of the same name. Icebreakers are painted with an "icebreaker red" hull to make them noticeable in ice-covered waters. One oceangoing icebreaker, the *Polar Sea*, was scheduled to be decommissioned and its parts used to help keep its sister, *Polar Star*, in operation, but Congress blocked the move and *Polar Sea* is still awaiting disposition.

- Length: 420 feet
- Beam: 82 feet
- Displacement: 16,000 tons
- Power plant: Four diesels, two shafts, 30,000 shaft horsepower (shp)
- Speed: 17 knots
- Range: 16,000 nautical miles at 12.5 knots; 37,000 miles at 9.25 knots

Vessel in this class:

- *Healy* (WAGB 20), Seattle, Washington

Icebreakers, 420-foot Healy class (WAGB)

The Coast Guard's largest ship, the CGC *Healy*, was launched in 1997 and commissioned in 2000, joining the two Polar-class icebreakers in their homeport of Seattle, Washington. The *Healy* is designed to conduct a wide range of research activities, providing more than 4,200 square feet of scientific laboratory space, numerous electronic sensor systems, oceanographic winches, and accommodations for up to 50 scientists.

Healy is capable of breaking 4.5 feet of ice continuously at 3 knots and can operate in temperatures as low as minus 50 degrees F. The scientific community provided invaluable input on lab layouts and scientific capabilities during design and construction of the ship.

As a Coast Guard cutter, the Healy is also a capable platform for supporting other potential missions in the polar regions, and is capable of accommodating two H-65 Dolphin helicopters or one Dolphin and one H-60 Jayhawk helicopter.

Icebreakers, 399-foot Polar class (WAGB)

The Polar-class icebreakers, built in the 1970s, were designed for open-water ice breaking and have reinforced hulls, special ice breaking bows, and a system that allows rapid shifting of ballast to increase the effectiveness of their ice breaking. These ships are capable of continuous progress through ice 6 feet thick at a speed of up to 3 knots. The CGCs *Polar Sea* and *Polar Star* were built to serve in the Arctic and Antarctic, supporting science and research as well as providing resupply to remote stations, but their capabilities also enable them to perform search and rescue, ship escort, environmental protection, and enforcement of laws and treaties in places most ships cannot reach. They are fully equipped for helicopter berthing and deck operations, and can carry two H-60 Jayhawks or H-65 Dolphins. *Polar Star* was reactivated in December 2012 after three years of refurbishment and modernization. *Polar Sea* remains laid up while its disposition is determined. The Coast



CGC *Healy*

COAST GUARD PHOTO



CGC *Polar Star*

Guard is conducting requirements generation and associated preliminary acquisition tasks for a new heavy icebreaker.

- Length: 399 feet
- Beam: 83.5 feet
- Displacement (28-foot draft): 13,194 tons full load
- Power plant: Six Alco diesels, 3,000 bhp each, three gas turbines, 25,000 shp each, electric drive, three shafts, 66,000 shp
- Speed: 18 knots
- Range: 16,000 nautical miles at 18 knots; 28,275 at 13 knots

Vessels in this class:
- *Polar Star* (WAGB 10), Seattle, Washington
- *Polar Sea* (WAGB 11), deactivated, Seattle, Washington

Icebreakers, 240-foot Great Lakes class (WLBB)

The CGC *Mackinaw* (WLBB 30), like its predecessor of the same name, was designed specifically for the Great Lakes, where its mission has been to keep the shipping lanes open through as much of the winter as possible. Like the former *Mackinaw* (WAGB 83), the new ship is homeported in Cheboygan, Michigan, and remains the only U.S. heavy ice breaking resource assigned to the Great Lakes. The ship performs ice breaking as well as ATON (aids to navigation), search and rescue (SAR), law enforcement, and other missions. It has a crew of nine officers and 46 enlisted members.

The *Mackinaw* features state-of-the-art navigation, communication, and security systems and is able to carry a smaller crew than its namesake. The vessel also has a 20-ton crane for servicing aids to navigation, and an oil spill recovery system on board. It uses two podded propulsors and a bow thruster to provide excellent maneuverability, and is designed to break through 32 inches of ice at 3 knots.

- Length: 240 feet
- Beam: 58 feet, 6 inches
- Draft: 16 feet
- Displacement: 3,500 tons full load
- Power plant: Three 4,200-bhp ABT diesel generators; two ABT 3,350-kw azipod propulsion units
- Speed: 15 knots
- Range: 4,000 nautical miles

Vessel in this class:
- *Mackinaw* (WLBB 30), Cheboygan, Michigan

CUTTERS

The term "cutter" identifies a Coast Guard vessel 65 feet in length or greater, with accommodations for a crew to live aboard. Major cutters like the national security cutter are capable of carrying multiple cutterboat types, including the over-the-horizon (CB-OTH-IV) rigid-hull inflatables, and long-range interceptors (CB-LRI-11). Polar-class icebreakers also carry an Arctic survey boat (ASB), a polar variant of the CB-OTH-IV, and landing craft. Most cutters more than 200 feet in length are capable of accommodating helicopters.

National Security Cutter (NSC), 418-foot Legend class

The first major cutter to join the Coast Guard as part of the fleet recapitalization plan, the national security cutter is the largest and most technologically advanced of the service's new cutters. At 418 feet in length, capable of speeds up to 28 knots, with a crew complement of 122 and a displacement of 4,500 long tons, the Legend-class cutters are capable of better seakeeping and higher sustained speeds as well as greater endurance than legacy cutters.

CGC *Mackinaw*



U.S. COAST GUARD PHOTO BY PETTY OFFICER 3RD CLASS RACHEL FRENCH / PETTY OFFICER 3RD CLASS GEORGE DEGENER



CGC Waesche

The ships, being acquired by the Coast Guard Acquisition Directorate, feature modern command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) capabilities and provide interoperability with U.S. Navy systems and a common operational picture to enhance maritime domain awareness. In addition to a helicopter deck, the class has a stern ramp for launching and recovering two classes of rigid-hull inflatable (RHIB) cutterboats that deploy with the NSC: the 35-foot CB-LRI-II and the 26-foot CB-OTH-IV. The NSC can carry a total of three boats: one LRI-II and two CB-OTH-IVs. The first cutter, *Bertholf*, was commissioned Aug. 4, 2008, and completed its first extended operations in 2009. The second cutter, *Waesche*, was commissioned May 7, 2010. The third, *Stratton*, was commissioned March 31, 2012. *Hamilton*, the fourth NSC, was commissioned in December 2014. The fifth, *James*, was commissioned in August 2015. The sixth NSC, *Munro*, was christened in November 2014, and the seventh, *Kimball*, is under construction. The Coast Guard plans construction of eight national security cutters.

The NSC is armed with a 57 mm/Mk. 110 gun, which is also employed by the Navy's littoral combat ships, and four M2 .50-caliber machine guns. The NSC can accommodate two H-65s, or one H-65 or H-60 and two vertically launched unmanned aerial vehicles, or other combinations.

- Length: 418 feet
- Beam: 54 feet
- Displacement: 4,500 long tons full load
- Power plant: Combined diesel and gas (CODAG); one 30,565 SHP gas turbine engine and two 9,655 HP diesel engines
- Speed: up to 28 knots
- Range: 12,000 nautical miles
- Armament: Mk. 110 57 mm gun; Phalanx 20 mm close-in weapon system; Mk. 53 decoy launching system (NULKA); and four M2 .50-caliber machine guns

Vessels in this class:

- *Bertholf* (WMSL 750), Alameda, California
- *Waesche* (WMSL 751), Alameda, California
- *Stratton* (WMSL 752), Alameda, California
- *Hamilton* (WMSL 753), Charleston, South Carolina
- *James* (WMSL 754) Charleston, South Carolina
- *Munro* (WMSL 755), christened November 2015, future homeport Alameda, California
- *Kimball* (WMSL 756) under construction, future homeport Honolulu, Hawaii
- *Midgett* (WMSL 757) planned; long lead-time materials ordered, future homeport Honolulu, Hawaii

NORTHROP GRUMMAN PHOTO BY STEVE BLOUNT



CGC *Midgett*

Vessels in this class:

- *Mellon* (WHEC 717), Seattle, Washington
- *Boutwell* (WHEC 719), San Diego, California
- *Sherman* (WHEC 720), San Diego, California
- *Morgenthau* (WHEC 722), Honolulu, Hawaii
- *Munro* (WHEC 724), Kodiak, Alaska
- *Midgett* (WHEC 726), Seattle, Washington

High Endurance Cutters, 378-foot Secretary class (WHEC)

Highly versatile and capable of performing a variety of missions, these cutters operate throughout the world's oceans. Because of their high endurance and their capabilities, similar to those of Navy warships, Secretary-class cutters occasionally deploy as part of Navy carrier battle groups. CGC *Hamilton* (WHEC 715), commissioned in 1967, was first of the class, which formed the mainstay of the Coast Guard from the 1970s into the 2010s.

The Secretary-class cutters are ideally suited for long-range, high-endurance missions, and for fulfilling the maritime security role, which includes drug interdiction, illegal immigrant interception, and fisheries patrol. The ships are powered by diesel engines and gas turbines, in a combined diesel and gas (CODAG) plant, and have controllable pitch propellers. Equipped with a helicopter flight deck, retractable hangar, and the facilities to support helicopter deployment, these 12 cutters were introduced to the Coast Guard inventory in the 1960s, and seven remain in service. The entire class was modernized through the Fleet Rehabilitation and Modernization (FRAM) program between 1985 and 1992, modernizing their helicopter flight deck facilities, radars and other sensors, and fire-control systems.

With a crew of 160, each displaces 3,340 tons. Each is capable of accommodating a single HH-65 Dolphin helicopter.

Secretary-class cutters have been given upgraded C4ISR capabilities under the Deepwater project. The *Chase* and *Hamilton* were transferred to the Nigerian and Philippine navies, respectively, in 2011. The *Dallas* and *Jarvis* were decommissioned in 2012 and transferred to the Philippine and Bangladeshi navies, respectively. *Gallatin* was decommissioned in March 2014 and has since been transferred to the Nigerian navy. *Rush* transfered to the Bangladeshi navy in May 2015. Ships of the class will continue to be retired as national security cutters enter the fleet.

- Length: 378 feet
- Beam: 43 feet
- Displacement: 3,340 tons full load
- Power plant: Two diesel engines 3,500 bhp each/two gas turbine engines 18,000 shp each, two shafts 36,000 shp
- Speed: 29 knots
- Range: 2,400 nautical miles at 29 knots or 9,600 miles at 19 knots (on gas turbines); 12,000 nautical miles at 14 knots (on diesels)
- Armament: One Mk. 75 76 mm gun; two Mk. 38 25 mm guns; one Phalanx CIWS; two .50-caliber machine guns; two SRBOC launchers

Offshore Patrol Cutter

Offshore patrol cutters (OPCs) will provide the midrange capability in the Coast Guard's layered defense concept, filling the role between the NSC and FRC and replacing the service's two classes of aging medium endurance cutters. The OPC is to feature increased range and endurance, more powerful weapons, a larger flight deck, and improved C4ISR equipment, and will accommodate aircraft and boat operations in higher sea states. Using a two-phase acquisition strategy that emphasizes affordability as a major requirement, the service awarded three Phase I contracts in February 2014 for preliminary and contract design (P&CD) to Bollinger Shipyards Lockport LLC (Lockport, Louisiana); Eastern Shipbuilding Group Inc. (Panama City, Florida); and General Dynamics, Bath Iron Works (Bath, Maine). At the end of the 18-month Phase I period, the Coast Guard will select one team to develop Phase II detail design and construction of the first OPC of a planned 25-ship class.

295-foot Cutter *Eagle* (WIX)

The tall ship *Eagle* is a three-masted sailing barque with 21,350 square feet of sail, homeported at the Coast Guard Academy, New London, Connecticut. It is the only active (operational) commissioned sailing vessel in the U.S. maritime services. Seventh in a line of cutters to bear its name, the CGC *Eagle* was built in 1936 by Blohm and Voss in Hamburg, Germany, as a training vessel for German naval cadets.

CGC *Eagle*



U.S. COAST GUARD PHOTO BY PETTY OFFICER 1ST CLASS LEVI READ / U.S. COAST GUARD PHOTO BY PETTY OFFICER 2ND CLASS PATRICK KELLEY



CGC *Alex Haley*

It was taken as a war prize in 1946, commissioned into Coast Guard service as the *Eagle*, and sailed from Bremerhaven, Germany, to New London, Connecticut. The *Eagle* serves as a seagoing classroom for approximately 175 cadets and instructors from the academy. On the *Eagle*, cadets apply the navigation, engineering, and other skills they develop in classes at the academy.

Eagle's hull is built of steel, four-tenths of an inch thick. It has two full-length steel decks with a platform deck below and a raised forecastle and quarterdeck. The weatherdecks are 3-inch-thick teak over steel. When at home, the *Eagle* is moored at the Fort Trumbull State Park on the Thames River. *Eagle* began the first phase of a four-year refit and renovation program at the Coast Guard Yard in Curtis Bay, Maryland, Sept. 26. The work will proceed in phases so that training periods at sea can continue. The first phase includes maintenance of the rudder, hull and rigging, lead ballast replacement, and berthing area renovations.

- Length: 295 feet
- Beam: 39 feet
- Displacement: 1,824 tons full load
- Power plant: Diesel, one shaft, 1,000 bhp, 21,350-square-foot sail area
- Speed: 10 knots under power;
- 16 knots under sail
- Range: 5,450 nautical miles under power

Vessel in this class:

- *Eagle* (WIX 327), New London, Connecticut (refitting at Coast Guard Yard in Curtis Bay, Maryland)

Medium Endurance Cutter
282-foot Alex Haley class (WMEC)

The cutter *Alex Haley* (WMEC 39) is a one-of-a-kind Coast Guard ship, named for the service's first chief journalist, who later wrote *Roots* and won a Pulitzer Prize.

Commissioned in 1971 as the Navy salvage and rescue ship USS *Edenton* (ATS 1), the vessel was transferred to the Coast Guard in November 1997 for conversion into a medium endurance cutter. The cutter's primary missions are law enforcement, domestic fisheries enforcement, and SAR in Alaskan waters. With a crew of 99, the ship can accommodate a single H-65 Dolphin or MH-60 Jayhawk.

- Length: 282 feet
- Beam: 50 feet
- Displacement: 3,000 tons full load
- Power plant: Four Caterpillar diesels, two shafts; bow thruster
- Speed: 16 knots
- Range: 10,000 nautical miles at 13 knots
- Armament: Two Mk. 38 25 mm cannons; two .50-caliber machine guns

Vessel in this class:

- *Alex Haley* (WMEC 39), Kodiak, Alaska

Medium Endurance Cutter
270-foot Famous class (WMEC)

The first of 13 Famous-class cutters, the *Bear* (WMEC 901), entered service in 1983, and these ships have become a familiar sight on the world's oceans ever since. Together with the

U.S. COAST GUARD PHOTO BY PETTY OFFICER 3RD CLASS JESSE KRISTOFFERSON

14 Reliance-class vessels, Famous-class cutters are the service's primary tools for law enforcement, counterdrug, and SAR missions. These ships are the most modern and advanced medium endurance cutters, with a modern weapons and sensor suite. They have long been equipped with a Command, Display, and Control (COMDAC) computerized ship control system that was significantly updated in the 1990s and makes these ships effective with smaller crews. Famous-class ships operate with a crew of 100.

Armament includes a Mk. 75 76 mm fully automatic gun capable of firing up to 80 rounds per minute. The Shipboard Command and Control System (SCCS) uses radar, LORAN (long range navigation), and GPS (Global Positioning System) technologies. SCCS is an integrated and sophisticated system that brings the ship's electronic resources together to facilitate operations.

Famous-class cutters are able to land, launch, and service the H-65 Dolphin, and some can also operate the Jayhawk. A Dolphin and a five-member aviation detachment usually deploy with the ship. The cutter's active stabilization system extends the operating parameters of the cutter aircraft team by providing a stable platform for flight evolutions during rough sea conditions. This allows the cutters to serve the vital role of search and rescue in almost any storm or location. For law enforcement boardings, these cutters carry a 23-foot over-the-horizon cutterboat and a 19-foot rigid-hull inflatable boat.

Under the Mission Effectiveness Project (MEP), Famous-class cutters received capability enhancements, major maintenance, and replacement of obsolete, unsupportable, or maintenance-intensive equipment, which included installing improved C4ISR suites. The Reliance-class ships also underwent MEP. All 270-foot cutters finished their MEP in September 2014, ensuring their operational reliability until their replacement by the offshore patrol cutter.

- Length: 270 feet
- Beam: 38 feet
- Displacement: 1,820 tons full load
- Power plant: Two 3,650-hp V-18 Alco diesel engines, two shafts
- Speed: 20 knots
- Range: Just under 3,800 nautical miles at 19.5 knots; 9,900 nautical miles at 12 knots
- Armament: One Mk. 75 76 mm gun, two .50-caliber machine guns, two SRBOC launchers

Vessels in this class:

- *Bear* (WMEC 901), Portsmouth, Virginia
- *Tampa* (WMEC 902), Portsmouth, Virginia
- *Harriet Lane* (WMEC 903), Portsmouth, Virginia
- *Northland* (WMEC 904), Portsmouth, Virginia
- *Spencer* (WMEC 905), Boston, Massachusetts
- *Seneca* (WMEC 906), Boston, Massachusetts
- *Escanaba* (WMEC 907), Boston, Massachusetts
- *Tahoma* (WMEC 908), Kittery, Maine
- *Campbell* (WMEC 909), Kittery, Maine
- *Thetis* (WMEC 910), Key West, Florida
- *Forward* (WMEC 911), Portsmouth, Virginia
- *Legare* (WMEC 912), Portsmouth, Virginia
- *Mohawk* (WMEC 913), Key West, Florida

Seagoing Buoy Tender, 225-foot Juniper class (WLB)

Juniper-class buoy tenders are seagoing Coast Guard cutters responsible for maintaining short- and long-range ATON such as fixed structures and buoys. They have replaced the aging Balsam class of World War II-era buoy tenders. Buoy tenders provide light ice breaking in ice-laden domestic waters. Buoy tenders are multi-mission vessels, and conduct maritime law enforcement, homeland security, and defense

CGC *Thetis*



U.S. NAVY PHOTO BY CHIEF PETTY OFFICER BILL MESTA

operations, as well as provide search and rescue assistance should the need arise.

The 225-foot Juniper's twin diesel engine propulsion system supplies the speed and maneuverability necessary to tend coastal and offshore buoys in exposed locations. Perhaps the most important advance is the use of a new Dynamic Positioning System (DPS). DPS uses a differential GPS to fix positions. Using this technology, the crews are able to maintain the vessel's position within a 10-meter circle in winds of up to 30 knots and waves of up to 8 feet. The Juniper-class cutters are to undergo mid-life renovation under the In-Service Vessel Sustainment (ISVS) project.

- Length: 225 feet
- Beam: 46 feet
- Displacement: 2,000 tons
- Buoy deck area: 2,875 square feet
- Power plant: Two Caterpillar 3608 diesels, one shaft, 6,200 bhp
- Speed: 15 knots
- Range: 6,000 nautical miles at 12 knots
- Armament: Two .50-caliber machine guns

Vessels in this class:

- *Juniper* (WLB 201), Newport, Rhode Island
- *Willow* (WLB 202), Newport, Rhode Island
- *Kukui* (WLB 203), Honolulu, Hawaii
- *Elm* (WLB 204), Atlantic Beach, North Carolina
- *Walnut* (WLB 205), Honolulu, Hawaii
- *Spar* (WLB 206), Kodiak, Alaska
- *Maple* (WLB 207), Sitka, Alaska
- *Aspen* (WLB 208), San Francisco, California
- *Sycamore* (WLB 209), Cordova, Alaska
- *Cypress* (WLB 210), Pensacola, Florida
- *Oak* (WLB 211), Charleston, South Carolina
- *Hickory* (WLB 212) Homer, Alaska
- *Fir* (WLB 213), Astoria, Oregon
- *Hollyhock* (WLB 214), Port Huron, Michigan
- *Sequoia* (WLB 215), Apra Harbor, Guam
- *Alder* (WLB 216), Duluth, Minnesota

U.S. COAST GUARD PHOTOGRAPHS

Medium Endurance Cutter, 210-foot Reliance class (WMEC)

The 14 Reliance-class cutters work alongside the Famous-class ships, carrying out primarily law enforcement and search and rescue missions. The 210-foot ships were the first true post-World War II Coast Guard cutters. Outwardly, these ships reflect evolving Coast Guard operations during the latter part of the 20th century – sleek lines, flight decks, and a high pilothouse giving the bridge crew excellent all-around visibility. They do not have a helicopter hangar but can operate a single H-65 Dolphin on deck. It has a crew complement of 77.



CGC *Spar*

Although lightly armed, these cutters were designed to carry additional armament including a 3-inch gun, a total of six .50-caliber machine guns, an SQS-17 sonar (later suggestions included using an SQS-36), an anti-submarine projector (Hedgehog), and/or two torpedo launchers. None of this armament was ever actually installed.

From 1986 to 1996, ships of this class underwent a midlife maintenance availability to upgrade machinery and equipment. There were 16 Reliance-class cutters, but budget cuts prompted the decommissioning of the *Courageous* (WMEC 622) and the *Durable* (WMEC 628) in 2001.

To prolong the longevity of the remaining cutters, the Coast Guard began the MEP in 2005 to increase operational availability by installing capability enhancements, performing major maintenance, and replacing obsolete, unsupportable, or maintenance-intensive equipment. The successful conclusion of the MEP in September 2014 ensures the operational reliability of these cutters until replacement by the offshore patrol cutter.

- Length: 210 feet
- Beam: 34 feet
- Displacement: 1,000 tons
- Power plant: Two Alco 16V-251 diesel engines, two shafts, 5,000 bhp
- Speed: 18 knots
- Range: 6,100 nautical miles at 12 knots
- Armament: One Mk. 38 25 mm cannon and two .50-caliber machine guns

Vessels in this class:

- *Reliance* (WMEC 615), Kittery, Maine
- *Diligence* (WMEC 616), Wilmington, North Carolina
- *Vigilant* (WMEC 617), Patrick Air Force Base, Florida
- *Active* (WMEC 618), Port Angeles, Washington
- *Confidence* (WMEC 619), Port Canaveral, Florida
- *Resolute* (WMEC 620), St. Petersburg, Florida
- *Valiant* (WMEC 621), Miami Beach, Florida
- *Steadfast* (WMEC 623), Warrenton, Oregon


CGC *Diligence*



CGC *George Cobb*

- *Dauntless* (WMEC 624), Galveston, Texas
- *Venturous* (WMEC 625), St. Petersburg, Florida
- *Dependable* (WMEC 626), Little Creek, Virginia
- *Vigorous* (WMEC 627), Little Creek, Virginia
- *Decisive* (WMEC 629), Pascagoula, Mississippi
- *Alert* (WMEC 630), Warrenton, Oregon

Coastal Buoy Tender, 175-foot Keeper class (WLM)

The 175-foot Keeper-class coastal buoy tenders are a new era in buoy tending, equipped with Z-drive propulsion units instead of the standard propeller and rudder configuration. The propulsion units are designed to independently rotate 360 degrees. Combined with a thruster in the bow, they give the Keeper-class cutters unmatched maneuverability.

With state-of-the-art electronics and navigation systems including DPS, which uses differential GPS and electronic chart displays, it is possible to maneuver and position navigation aids with a smaller crew. Carrying a crew of 24, ships in this class are named for well-known lighthouse keepers. Although not classified as icebreakers, these ships can move through 9 inches of ice at 3 knots.

- Length: 175 feet
- Beam: 36 feet
- Displacement: 845 tons
- Power plant: Two Caterpillar 3508TA diesels, two Ulstein Z-drive, 2,040 bhp
- Speed: 12 knots
- Range: 2,000 nautical miles at 10 knots

Vessels in this class:

- *Ida Lewis* (WLM 551), Newport, Rhode Island
- *Katherine Walker* (WLM 552), Bayonne, New Jersey
- *Abbie Burgess* (WLM 553), Rockland, Maine
- *Marcus Hanna* (WLM 554), South Portland, Maine
- *James Rankin* (WLM 555), Baltimore, Maryland
- *Joshua Appleby* (WLM 556), St. Petersburg, Florida
- *Frank Drew* (WLM 557), Portsmouth, Virginia
- *Anthony Petit* (WLM 558), Ketchikan, Alaska
- *Barbara Mabrity* (WLM 559), Mobile, Alabama
- *William Tate* (WLM 560), Philadelphia, Pennsylvania
- *Harry Claiborne* (WLM 561), Galveston, Texas
- *Maria Bray* (WLM 562), Atlantic Beach, Florida
- *Henry Blake* (WLM 563), Everett, Washington
- *George Cobb* (WLM 564), San Pedro, California

CGC *Pamlico*



U.S. COAST GUARD PHOTO / U.S. COAST GUARD PHOTO BY PETTY OFFICER 3RD CLASS TOM ATKESON

Inland Construction Tenders (WLIC)

The Coast Guard's inland construction tenders are broken into three classes, all designed for the construction, repair, and maintenance of fixed ATON and all operating on inland waters. The 160-foot WLICs are single units without barges. The 75-foot WLICs push either a 68- or 84-foot construction barge. The one 100-foot WLIC pushes a 70-foot construction barge. The barges are equipped with cranes and other ATON equipment to drive piles and work the smaller-sized buoys. The earliest of these tenders date to the 1940s and have crews of 13 to 15.

160-FOOT WLIC CLASS:

- Length: 160 feet
- Beam: 30 feet
- Displacement: 411 tons
- Power plant: Two Caterpillar D379 diesels, two shafts, 1,000 bhp
- Speed: 11 knots
- Range: 1,205 nautical miles at 6.5 knots

Vessels in the 160-foot WLIC class:

- *Pamlico* (WLIC 800), New Orleans, Louisiana
- *Hudson* (WLIC 801), Miami Beach, Florida
- *Kennebec* (WLIC 802), Portsmouth, Virginia
- *Saginaw* (WLIC 803), Mobile, Alabama

100-FOOT WLIC CLASS:

- Length: 100 feet
- Beam: 24 feet
- Displacement: 178 tons
- Power plant: Two Caterpillar 3412, two shafts, 1250 bhp
- Speed: 10 knots
- Range: 1,200 nautical miles at 7 knots

Vessel in the 100-foot WLIC class:

- *Smilax* (WLIC 315, oldest commissioned cutter), Atlantic Beach, North Carolina

75-FOOT WLIC CLASS:

- Length: 75 feet
- Beam: 22 feet
- Displacement: 145 tons
- Power plant: Two Caterpillar D353, two shafts, 750 hp; or two Caterpillar 3412 or V1312TI, two shafts, 1,250-1,350 hp
- Speed: 10 knots
- Range: 1,050-1,300 nautical miles at 9 knots; 2,400-2,500 nautical miles at 5 knots

Vessels in the 75-foot WLIC class:

- *Anvil* (WLIC 75301), Charleston, South Carolina
- *Hammer* (WLIC 75302), Mayport, Florida
- *Sledge* (WLIC 75303), Baltimore, Maryland
- *Mallet* (WLIC 75304), Corpus Christi, Texas
- *Vise* (WLIC 75305), St. Petersburg, Florida
- *Clamp* (WLIC 75306), Galveston, Texas
- *Hatchet* (WLIC 75309), Galveston, Texas
- *Axe* (WLIC 75310), Morgan City, Louisiana

COAST GUARD PHOTO BY PETTY OFFICER 3RD CLASS SETH JOHNSON



CGC Penobscot Bay

Ice Breaking Tug, 140-foot Bay class (WTGB)

The 140-foot Bay-class cutters are single-screw tugs used primarily for domestic ice breaking duties. They are named after American bays and are stationed mainly in the northeastern United States and the Great Lakes. They use a low-pressure-air hull lubrication or bubbler system that forces air and water between the hull and ice. This system improves ice breaking capabilities by reducing resistance against the hull, thereby reducing horsepower requirements. A 120-foot ATON barge augments the CGCs Bristol Bay and Mobile Bay. The Bay-class cutters have begun a mid-life renovation program under the In-Service Vessel Sustainment (ISVS) project to renew the most elderly or vulnerable components.

- Length: 140 feet
- Beam: 37.5 feet
- Displacement: 662 tons full load
- Power plant: Two Fairbanks-Morse diesel engines, electric drive, one shaft, 2,500 shp
- Speed: 14.7 knots
- Range: 1,500 nautical miles at 14.7 knots; 4,000 nautical miles at 12 knots

Vessels in this class:

- *Katmai Bay* (WTGB 101), Sault Ste. Marie, Michigan
- *Bristol Bay* (WTGB 102), Detroit, Michigan
- *Mobile Bay* (WTGB 103), Sturgeon Bay, Wisconsin
- *Biscayne Bay* (WTGB 104), St. Ignace, Michigan
- *Neah Bay* (WTGB 105), Cleveland, Ohio
- *Morro Bay* (WTGB 106), New London, Connecticut
- *Penobscot Bay* (WTGB 107), Bayonne, New Jersey
- *Thunder Bay* (WTGB 108), Rockland, Maine
- *Sturgeon Bay* (WTGB 109), Bayonne, New Jersey

River Buoy Tenders (WLR)

The Coast Guard operates 18 tenders of 75-foot and 65-foot lengths on rivers in the western United States, deploying ATON buoys and day boards to mark river channels and to ease

the efficient flow of commerce. WLRs push barges equipped with cranes that work ATON. Some WLRs are equipped with "jetting" devices that are used to set and anchor buoys in rivers with sandy or muddy bottoms. The barges are an integral part of the ATON mission. Barge lengths vary: 90 feet, 99 feet, and 130 feet.



CGC *Sangamon*

75-FOOT KANKAKEE-CLASS RIVER BUOY TENDERS:

- Length: 75 feet
- Beam: 22 feet
- Displacement: 175 tons
- Power plant: Two Caterpillar 3412 diesels, two shafts, 1,024 bhp
- Speed: 10 knots
- Range: 600 nautical miles at 10 knots

Vessels in this class:

- *Kankakee* (WLR 75500), Memphis, Tennessee
- *Greenbrier* (WLR 75501), Natchez, Mississippi

75-FOOT GASCONADE-CLASS RIVER BUOY TENDERS:

- Length: 75 feet
- Beam: 22 feet
- Displacement: 140 tons
- Power plant: Two Caterpillar D353 diesels, two shafts, 660-750 hp; or two Caterpillar 3412, two shafts, 1,250 hp
- Speed: 10 knots
- Range: 3,100 nautical miles at 6.5 knots

Vessels in this class:

- *Wedge* (WLR 75307), Demopolis, Alabama
- *Gasconade* (WLR 75401), Omaha, Nebraska
- *Muskingum* (WLR 75402), Sallislaw, Oklahoma
- *Wyaconda* (WLR 75403), Dubuque, Iowa
- *Chippewa* (WLR 75404), Buchanan, Tennessee
- *Cheyenne* (WLR 75405), St. Louis, Missouri
- *Kickapoo* (WLR 75406), Vicksburg, Mississippi

CGC *Greenbrier*



USCGAUX PHOTO BY LEN SCHULTE / U.S. COAST GUARD PHOTO BY SEAMAN PAUL JURASEK



CGC *Elderberry*

- *Kanawha* (WLR 75407), Pine Bluff, Arkansas
- *Patoka* (WLR 75408), Greenville, Mississippi
- *Chena* (WLR 75409), Hickman, Kentucky

65-FOOT CLASS RIVER BUOY TENDERS:
- Length: 65 feet
- Beam: 21 feet
- Displacement: 145 tons
- Power plant: Two Caterpillar D353 diesels, two shafts, 660-725 hp
- Speed: 10 knots
- Range: 3,500 nautical miles at 6 knots

Vessels in this class:
- *Ouachita* (WLR 65501), Chattanooga, Tennessee
- *Cimarron* (WLR 65502), Buchanan, Tennessee
- *Obion* (WLR 65503), Owensboro, Kentucky
- *Scioto* (WLR 65504), Keokuk, Iowa
- *Osage* (WLR 65505), Sewickley, Pennsylvania
- *Sangamon* (WLR 65506), East Peoria, Illinois

Inland Buoy Tenders, large-small (WLI)

100-FOOT INLAND BUOY TENDERS:
- Length: 100 feet
- Beam: 24 feet
- Displacement: 174 tons full load
- Power plant: Two diesels, two shafts, 600-660 bhp
- Speed: 10.5 knots
- Range: 2,000-2,700 nautical miles at 7 knots

Vessels in this class:
- *Bluebell* (WLI 313), Portland, Oregon
- *Buckthorn* (WLI 642), Sault Ste. Marie, Michigan

65-FOOT INLAND BUOY TENDERS:
- Length: 65 feet
- Beam: 17 feet
- Displacement: 71 tons
- Power plant: Two GM diesels, two shafts, 400 hp (WLI 65401); one GM diesel, one shaft, 300 hp (WLI 65303)
- Speed: 9 knots (WLI 65303); 11.3 knots (WLI 65401)
- Range: 1,700 nautical miles at 6 knots; 1,500 nautical miles at 5 knots (WLI 65303)

Vessels in this class:
- *Bayberry* (WLI 65400), Long Beach, North Carolina
- *Elderberry* (WLI 65401), Petersburg, Alaska

PATROL BOATS

The diverse range of Coast Guard duties is reflected dramatically by the number and variety of its patrol boats, which are assigned to most of the service's missions. Island-class cutters are high-speed vessels that offer an operating radius of almost 1,000 nautical miles, making them highly effective for illegal

USCG PHOTO



CGC Bernard C. Webber

immigrant interdiction operations (AMIO) and a range of other duties. However, the Island class are aging, and are being replaced by the fast response cutter. Eighty-seven-foot Marine Protector-class vessels have an IEBS (integrated electronic bridge system) and a stern-launched rigid-hull inflatable boat useful for various duties including carrying boarding crews.

Fast Response Cutter (WPC), 154-foot Sentinel class

The Sentinel class is a key component of the Coast Guard's recapitalized fleet and is critically needed to replace the aging 110-foot Island-class patrol boat fleet. The first cutter in this class, *Bernard C. Webber*, was delivered in February 2012. To honor past Coast Guard members, each cutter in this class will be named for one of the service's many enlisted heroes.

These cutters will be able to deploy independently to conduct the service's missions, such as port, waterway, and coastal security; fishery patrols; drug and illegal immigrant law enforcement; SAR; and national defense operations. The cutters' C4ISR suites will be completely interoperable with U.S. Navy, Coast Guard, Department of Defense, and Department of Homeland Security assets.

The 154-foot cutters have a speed of more than 28 knots, and are based on an existing patrol boat design from Damen Shipyards. This vessel class is planned for a total of 58 patrol boats.

- Manufacturer: Bollinger Shipyards Inc.
- Parent craft designer: Damen
- Length: 154 feet
- Beam: 25 feet
- Displacement: 353 metric tons
- Power plant: Two 4,300 Kw MTU diesel engines
- Speed: 28-plus knots
- Endurance: five days
- Crew: 24 (four officers, 20 enlisted)
- Armament: One stabilized 25 mm machine gun mount and four non-stabilized crew-served .50-caliber machine guns

Vessels in this class:

- *Bernard C. Webber* (WPC 1101), Miami Beach, Florida
- *Richard Etheridge* (WPC 1102), Miami Beach, Florida
- *William Flores* (WPC 1103), Miami Beach, Florida
- *Robert Yered* (WPC 1104), Miami Beach, Florida
- *Margaret Norvell* (WPC 1105), Miami Beach, Florida
- *Paul Clark* (WPC 1106), Miami Beach, Florida
- *Charles David Jr.* (WPC 1107), Key West, Florida
- *Charles Sexton* (WPC 1108), Key West, Florida
- *Kathleen Moore* (WPC 1109), Key West, Florida
- *Raymond Evans* (WPC 1110), Key West, Florida
- *William Trump* (1111), Key West, Florida
- *Isaac Mayo* (1112) Key West, Florida
- *Richard Dixon* (1113) San Juan, Puerto Rico
- *Heriberto Hernandez* (1114) San Juan, Puerto Rico

Under Construction:

- *Joseph Napier* (1115), San Juan, Puerto Rico
- *Winslow Griesser* (1116) San Juan, Puerto Rico
- *Richard Patterson* (1117), San Juan, Puerto Rico

U.S. COAST GUARD PHOTO BY PETTY OFFICER 3RD CLASS MARK BARNEY

- *Joseph Tezanos* (1118), San Juan, Puerto Rico
- *Rollin Fritch* (1119) Pascagoula, Mississippi
- *Lawrence Lawson* (1120) Pascagoula, Mississippi
- *John McCormick* (1121), Ketchikan, Alaska
- *Bailey Barco* (1122), ordered, Ketchikan, Alaska
- *Benjamin Dailey* (1123) ordered
- *Donald Horsley* (1124) ordered
- *Jacob Poroo* (1125) ordered

Patrol Boat, 110-foot Island class (WPB)

The Coast Guard 110-foot Island-class patrol boats are modified versions of a well-regarded British-designed patrol boat. These ships have excellent range and seakeeping capabilities, but are wearing out rapidly and are to be replaced by the fast response cutter.

Seventeen 110-foot WPBs were renovated under the Mission Effectiveness Project (MEP) to ensure the 110-foot WPB fleet remains a reliable entity until the arrival of the FRC. The MEP was completed in 2012. Built in the late 1980s, they are equipped with advanced electronics and navigation equipment. WPBs are being decommissioned as more fast response cutters join the fleet.

- Length: 110 feet
- Beam: 21 feet
- Displacement: 154-165 tons
- Power plant: Two Alco-Paxman Valenta diesel engines, 5,820 bhp; WPB 1338-1349: Caterpillar 3516 diesel engines, 5,460 bhp
- Speed: 28 to 30 knots
- Range: 3,380 nautical miles at 8 knots
- Armament: One Mk. 38 25 mm cannon; two .50-caliber machine guns

Vessels in this class:

- *Farallon* (WPB 1301), Valder, Alaska
- *Maui* (WPB 1304), Manama, Bahrain
- *Ocracoke* (WPB 1307), South Portland, Maine
- *Aquidneck* (WPB 1309), Manama, Bahrain
- *Mustang* (WPB 1310), Seward, Alaska
- *Naushon* (WPB 1311), Ketchikan, Alaska
- *Sanibel* (WPB 1312), Woods Hole, Massachusetts
- *Edisto* (WPB 1313), San Diego, California
- *Sapelo* (WPB 1314), San Juan, Puerto Rico
- *Matinicus* (WPB 1315), San Juan, Puerto Rico
- *Nantucket* (WPB 1316), Atlantic Beach, North Carolina
- *Baranof* (WPB 1318), Manama, Bahrain
- *Chandeleur* (WPB 1319), Ketchikan, Alaska
- *Cushing* (WPB 1321), San Juan, Puerto Rico
- *Cuttyhunk* (WPB 1322), Port Angeles, Washington
- *Drummond* (WPB 1323), Miami, Florida [San Juan, PR?]
- *Key Largo* (WPB 1324), San Juan, Puerto Rico
- *Monomoy* (WPB 1326), Manama, Bahrain
- *Orcas* (WPB 1327), Coos Bay, Oregon
- *Sitkinak* (WPB 1329), Miami, Florida [Bayonne, NJ?]
- *Tybee* (WPB 1330), Woods Hole, Massachusetts
- *Washington* (WPB 1331), Apra Harbor, Guam
- *Wrangell* (WPB 1332), Manama, Bahrain
- *Adak* (WPB 1333), Manama, Bahrain
- *Liberty* (WPB 1334), Auke Bay, Alaska
- *Anacapa* (WPB 1335), Petersburg, Alaska
- *Kiska* (WPB 1336), Hilo, Hawaii
- *Assateague* (WPB 1337), Apra Harbor, Guam
- *Grand Isle* (WPB 1338), Gloucester, Massachusetts
- *Key Biscayne* (WPB 1339), Key West, Florida
- *Kodiak Island* (WPB 1341), Atlantic Beach, North Carolina
- *Galveston Island* (WPB 1349) Honolulu, Hawaii

CGC *Liberty*



U.S. COAST GUARD PHOTO/PA3 ROB SIMPSON



CGC Crocodile

U.S. COAST GUARD PHOTO/PA3 ROB SIMPSON

Coastal Patrol Boat (WPB), 87-foot Marine Protector class

The Marine Protector is an innovative, multi-mission class of vessel capable of performing search and rescue, law enforcement, fishery patrols, drug interdiction, illegal immigrant interdiction, and homeland security duties up to 200 miles offshore. The 73 cutters in this class carry an 11-person crew and are capable of achieving a maximum continuous speed of 25 knots. The class offers numerous improvements over the former 82-foot Point-class vessels, including improved seakeeping abilities (up to sea state 5), enhanced habitability, and compliance with current and projected environmental protection laws. The Marine Protector class also employs an innovative stern launch and recovery system using aluminum-hulled cutterboats propelled by inboard diesel-powered waterjets. The vastly larger pilothouse is equipped with an integrated bridge system, including an ECDIS (electronic chart display system), which interfaces with surface search radars used by U.S. warships. Four were built specifically to protect Navy ballistic missile submarines while they are in transit in and out of Kings Bay, Georgia, and Bangor, Washington. Production was completed in 2009.

- Length: 87 feet
- Beam: 19.4 feet
- Displacement: 91 tons full load
- Speed: 25 knots
- Range: 900 nautical miles
- Power plant: Two MTU 8V diesel engines

Vessels in this class:

- *Barracuda* (WPB 87301), Eureka, California
- *Hammerhead* (WPB 87302), Woods Hole, Massachusetts
- *Mako* (WPB 87303), Cape May, New Jersey
- *Marlin* (WPB 87304), Fort Myers Beach, Florida
- *Stingray* (WPB 87305), Mobile, Alabama
- *Dorado* (WPB 87306), Crescent City, California
- *Osprey* (WPB 87307), Port Townsend, Washington
- *Chinook* (WPB 87308), New London, Connecticut
- *Albacore* (WPB 87309), Little Creek, Virginia
- *Tarpon* (WPB 87310), Tybee Island, Georgia
- *Cobia* (WPB 87311), Mobile, Alabama
- *Hawksbill* (WPB 87312), Monterey, California
- *Cormorant* (WPB 87313), Fort Pierce, Florida
- *Finback* (WPB 87314), Cape May, New Jersey
- *Amberjack* (WPB 87315), Port Isabel, Texas
- *Kittiwake* (WPB 87316), Honolulu, Hawaii
- *Blackfin* (WPB 87317), Santa Barbara, California
- *Bluefin* (WPB 87318), Fort Pierce, Florida
- *Yellowfin* (WPB 87319), Charleston, South Carolina
- *Manta* (WPB 87320), Freeport, Texas
- *Coho* (WPB 87321), Panama City, Florida
- *Kingfisher* (WPB 87322), Mayport, Florida
- *Seahawk* (WPB 87323), Carrabelle, Florida
- *Steelhead* (WPB 87324), Port Aransas, Texas
- *Beluga* (WPB 87325), Little Creek, Virginia
- *Blacktip* (WPB 87326), Oxnard, California
- *Pelican* (WPB 87327), Abbeville, Louisiana
- *Ridley* (WPB 87328), Montauk, New York
- *Cochito* (WPB 87329), Little Creek, Virginia
- *Manowar* (WPB 87330), Galveston, Texas
- *Moray* (WPB 87331), Jonesport, Maine
- *Razorbill* (WPB 87332), Gulfport, Mississippi
- *Adelie* (WPB 87333), Port Angeles, Washington
- *Gannet* (WPB 87334), Dania, Florida
- *Narwhal* (WPB 87335), Corona Del Mar, California
- *Sturgeon* (WPB 87336), Grand Isle, Louisiana
- *Sockeye* (WPB 87337), Bodega Bay, California

- *Ibis* (WPB 87338), Cape May, New Jersey
- *Pompano* (WPB 87339), Gulfport, Mississippi
- *Halibut* (WPB 87340), Marina Del Rey, California
- *Bonito* (WPB 87341), Pensacola, Florida
- *Shrike* (WPB 87342), Port Canaveral, Florida
- *Tern* (WPB 87343), San Francisco, California
- *Heron* (WPB 87344), Sabine, Texas
- *Wahoo* (WPB 87345), Port Angeles, Washington
- *Flyingfish* (WPB 87346), Boston, Massachusetts
- *Haddock* (WPB 87347), San Diego, California
- *Brant* (WPB 87348), Corpus Christi, Texas
- *Shearwater* (WPB 87349), Portsmouth, Virginia
- *Petrel* (WPB 87350), San Diego, California
- *Sea Lion (WPB 87352),* Bellingham, Washington
- *Skipjack* (WPB 87353), Galveston, Texas
- *Dolphin* (WPB 87354), Miami, Florida
- *Hawk* (WPB 87355), St. Petersburg, Florida
- *Sailfish* (WPB 87356), Sandy Hook, New Jersey
- *Sawfish* (WPB 87357), Key West, Florida
- *Swordfish* (WPB 87358), Port Angeles, Washington
- *Tiger Shark* (WPB 87359), Newport, Rhode Island
- *Blue Shark* (WPB 87360), Everett, Washington
- *Sea Horse* (WPB 87361), Portsmouth, Virginia
- *Sea Otter* (WPB 87362), San Diego, California
- *Manatee* (WPB 87363), Corpus Christi, Texas
- *Ahi* (WPB 87364), Honolulu, Hawaii
- *Pike* (WPB 87365), San Francisco, California
- *Terrapin* (WPB 87366), Bellingham, Washington
- *Sea Dragon* (WPB 87367), Kings Bay, Georgia (Navy owned)
- *Sea Devil* (WPB 87368), Bangor, Washington (Navy owned)
- *Crocodile* (WPB 87369), St. Petersburg, Florida
- *Diamondback* (WPB 87370), Miami Beach, Florida
- *Reef Shark* (WPB 87371), San Juan, Puerto Rico
- *Alligator* (WPB 87372), St. Petersburg, Florida
- *Sea Dog* (WPB 87373), Kings Bay, Georgia (Navy owned)
- *Sea Fox* (WPB 87374), Bangor, Washington (Navy owned)

65-foot Small Harbor Tug (WYTL)

Built between 1962 and 1967, the small, 65-foot harbor tugs are multi-mission cutters that have the distinction of being used only on the East Coast, from Maine to Virginia. With a crew of six, their primary missions are domestic ice breaking, port security, search and rescue, and law enforcement operations on rivers and in littoral areas. They are capable of breaking ice up to 12 inches thick.

- Length: 65 feet
- Beam: 16 feet
- Displacement: 72 tons full load
- Power plant: One diesel, one shaft, 500 bhp
- Speed: 10 knots
- Range: 850 nautical miles at 9.8 knots; 2,700 nautical miles at 5.8 knots

Vessels in this class:

- *Capstan* (WYTL 65601), Philadelphia, Pennsylvania
- *Chock* (WYTL 65602), Baltimore, Maryland
- *Tackle* (WYTL 65604), Rockland, Maine
- *Bridle* (WYTL 65607), Southwest Harbor, Maine
- *Pendant* (WYTL 65608), Boston, Massachusetts
- *Shackle* (WYTL 65609), South Portland, Maine
- *Hawser* (WYTL 65610), Bayonne, New Jersey
- *Line* (WYTL 65611), Bayonne, New Jersey
- *Wire* (WYTL 65612), Saugerties, New York
- *Bollard* (WYTL 65614), New Haven, Connecticut
- *Cleat* (WYTL 65615), Philadelphia, Pennsylvania

CGC *Hawser*



U.S. COAST GUARD PHOTO BY PA3 ANNIE R. BERLIN



47-foot Motor Life Boat

BOATS

Coast Guard vessels under 65 feet in length are classified as boats and usually operate near shore, on inland waterways, or attached to cutters. The service has about 1,680 altogether, although the number fluctuates. These craft include heavy weather response boats, special purpose craft, ATON boats, and cutter-based boats. Sizes range from 64 feet in length down to 12 feet. The new emphasis on homeland security has produced a corresponding emphasis on smaller, fast boats such as the Response Boat-Small and Response Boat-Medium. An added capability for the ATON forces is the procurement of new work boats that replaced those that have exceeded their economic service life and are no longer cost effective to maintain. The new boats brought into service are ATON Boat-Small (AB-S), a 20-foot aluminum hull with a range of 70 nautical miles, and ATON Boat-Skiff (AB-SKF), a 16-foot aluminum hull with a range of 50 nautical miles. Both boats are outfitted with standard electrical systems and ample working deck space. Coast Guard boats include:

47-foot Motor Life Boat (MLB)

The 47-foot MLB is primarily designed as a fast-response rescue vessel in high seas, surf, and heavy weather environments. But the unique feature of this boat is that it can self-right in only 30 seconds if knocked over by waves or surf. With state-of-the-art electronically controlled engines, fuel management systems, and integrated electronics suite, the 47-foot MLB has become the ideal platform for operations in extreme sea and weather conditions. The 47-foot MLBs are planned to undergo refit and renovation under the In-Service Vessel Sustainment (ISVS) project. There are currently 117 MLBs in inventory.

45-foot Response Boat-Medium (RB-M)

The 45-foot RB-M is being procured to replace the 41-foot utility boat (UTB). It is an all-aluminum boat that has a wireless crew communication system and is powered by twin diesel engines and water jet propulsion. Unlike the 41-foot UTB, the RB-M has the ability to self-right if it should ever capsize. This feature allows the RB-M to operate in higher seas, ensuring the crew (and rescued survivors) comes home safely. For example, RB-M's survivability parameters are 12-foot seas and 50 knots of wind, whereas the UTB's limits are 8-foot seas and 30 knots of wind. The RB-M has a top speed in excess of 40 knots and cruises at 30 knots, compared to the 41-foot UTB top speed of 26 knots. All 174 RB-Ms have been delivered.

25-foot Response Boat-Small (RB-S)

Brought into service in 2003 to replace shore-based nonstandard boats, the RB-S features a reinforced bow, full shock-mitigating seating, and a large cabin. It can tow up to 10 tons, operate in winds up to 25 knots and seas of up

U.S. COAST GUARD PHOTO BY CHIEF PETTY OFFICER DAVID MOSLEY

to 6 feet, and has a range of 150 nautical miles. The second-generation boats (RB-S II) are now in production and will replace the original RB-S classes. The RB-S IIs are 29 feet long and have a range of 220 nautical miles. Approximately 268 RB-S boats are in service.

32-foot Transportable Port Security Boat (TPSB)

Operated by Port Security Units (PSUs), which are composed of Reserve and active-duty personnel, the TPSB provides for defense readiness operations in the United States and when PSUs are deployed overseas. It travels at 43-plus knots, and carries a .50-caliber machine gun and two M60 machine guns. There are 52 in operation.



25-foot Response Boat-Small

U.S. COAST GUARD PHOTO BY PETTY OFFICER 1ST CLASS BRANDY N. HULL / U.S. COAST GUARD PHOTO BY PETTY OFFICER 2ND CLASS TARA MOLLE

16- to 64-foot Aids to Navigation Boats

These boats assist in maintaining the nearly 50,000 navigation aids on the marine transportation system. They include the 64-foot Self-Propelled Barge that primarily operates on protected rivers and protected waters; 55-foot aluminum hull that can operate in moderately rough weather in coastal and inland waters; 49-foot Stern Loading Buoy boat that supports the short-range ATON mission; 26-foot Trailerable ATON boat that serves as the workhorse for ATON teams; 20-foot ATON Boat-Small; and 16-foot ATON Boat-Skiff.

18- to 64-foot Special Purpose Craft

The special purpose craft are designed to meet specific mission requirements or provide a capable and safe asset in a unique operating environment. A few of these boats are: 64-foot Screening Vessel; 52-foot Heavy Weather; 42-foot Near Shore Lifeboat; 36-foot Boarding Team Delivery; 33-foot Law Enforcement; 24-foot Shallow Water; skiffs that can be used to support natural disaster response; and ice boats that are used for conducting ice rescues.

33-foot Special Purpose Craft



14- to 38-foot Cutter-based Boats

The cutterboats provide fast and effective surface capabilities that, in most cases, enable cutters to interdict boats on the high seas and conduct boardings. Included in this asset base are: 38-foot Arctic Survey Boat; 36-foot Long Range Interceptor; 24- to 19-foot Cutterboat-Large; 24-foot ATON-Large; 24-foot and 26-foot Over-The-Horizon cutterboats; 18-foot ATON-Medium; 17-foot Cutterboat-Medium; and 13-foot Cutterboat-Small, just to name a few.

27-foot Utility Boat-Medium

With a closed cabin, these aluminum-hulled boats are used for law enforcement, search and rescue, or ATON missions. They are being replaced by standard boats.

17- to 28-foot Utility Boat-Light (UTL)

With generally an open cabin, these boats are either fiberglass or aluminum hulled and are assigned to ATON cutters and shore units.

AIRCRAFT

The Coast Guard operates 202 fixed-wing and rotary-wing aircraft – airplanes and helicopters – to support its work as a law enforcement arm, a military service branch, and a seafaring service. Nearly all Coast Guard aircraft have some role in homeland security operations, and some are now armed.

The Coast Guard operates its aviation fleet on the principle that it cannot afford a fleet of aircraft intended solely for specialized missions, and has concentrated on aircraft that can carry out a wide range of diversified missions.

HC-144A Ocean Sentry, Medium Range Maritime Patrol Aircraft (MPA)

A medium-range maritime patrol version of the EADS CASA CN 235-300M cargo aircraft, the HC-144A is performing missions previously carried out by the HU-25 fleet as well as surveillance, rescue, and transport roles performed by the HC-130Hs. The HC-144A – equipped with a new command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) suite, radar and EO/IR sensor mission systems pallet – is designed to serve as an on-scene command platform for SAR and homeland security operations and perform transport missions.

The Coast Guard has accepted delivery of 17 Mission System Pallets (MSP), a roll-on, roll-off suite of electronic equipment that enables Ocean Sentry aircrews to compile data from the aircraft's multiple integrated sensors and transmit and receive classified and unclassified information with other aircraft, surface vessels, and shore facilities. With multiple voice and data communications capabilities as well as satellite communications, the MSP contributes to the common tactical and operating pictures.

The HC-144A provides extended on-scene loitering capabilities while also being capable of performing maritime patrol, law enforcement, SAR, disaster-response, and cargo

HC-144A Ocean Sentry



U.S. COAST GUARD PHOTO BY DAVE SILVA



C-37A Gulfstream V

and personnel transport missions. The Ocean Sentry also is capable of maintaining secure communications with the Department of Defense, Department of Homeland Security and allied forces.

The Coast Guard completed planned work under this project with the delivery of its 18th HC-144A in September 2014. Ocean Sentries are currently operating from Coast Guard Air Stations Mobile, Alabama; Cape Cod, Massachusetts; Miami, Florida; and Corpus Christi, Texas. Procurement has ended in light of the acquisition of 14 C-27J Spartans.

- Power plant: Two 1,750 shp (1,305 kW) General Electric CT7-9C3 turboprop engines
- Maximum cruising speed: 236 knots
- Range: up to 2,000 nautical miles (depending on configuration)
- Range with payload: (6,000 pounds) 1,000 nautical miles (cargo configured)
- Max endurance: 11.0 hours
- Maximum takeoff weight: 36,380 pounds
- Dimensions: Length, 70 feet, 2 inches; wingspan, 84 feet, 7 inches

HC-144 Air Stations:

- CGAS/CG Aviation Training Center Mobile, Alabama
- CGAS Miami, Florida
- CGAS Cape Cod, Massachusetts
- CGAS Mobile, Alabama
- CGAS Corpus Christi, Texas

HC-27J Medium Range Maritime Patrol Aircraft

The Coast Guard is integrating 14 ex-U.S. Air Force C-27J Spartan aircraft into its medium-range surveillance aircraft fleet, to work alongside the HC-144A Ocean Sentry. The C-27Js are already outfitted with weather radar and military communications equipment capable of supporting transport and other Coast Guard missions. All 14 aircraft are planned to be modified with a standard Coast Guard fixed-wing Mission Systems Pallet, an integrated surface search radar, electro-optical/infrared sensors, and night vision goggle capability.

- Length: 74 feet, 5 inches
- Wingspan: 94 feet, 2 inches
- Height: 31 feet, 8 inches
- Weight: 70,000 pounds
- Speed: 290 knots
- Range: Up to 2,674 nautical miles
- Endurance: 12 hours
- Ceiling: 30,000 feet



HC-27J Spartan

ALENIA AERMACCHI GRAPHIC / U.S. COAST GUARD PHOTO



HC-130H Hercules, HC-130J Super Hercules

C-37A Gulfstream V Command and Control Aircraft

The service operates two Gulfstream V aircraft as its principal command and control transport for senior Coast Guard and Department of Homeland Security officials. On long flights, the C-37A can carry 12 passengers and a crew of four with a range of 6,500 nautical miles, all with considerable fuel efficiency. The C-37A enjoys commonality of parts and supplies with more than a dozen C-37As operated by the other military branches.

- Power plant: Two 14,750-pound thrust BMW-Rolls-Royce BR710-48 turbofan engines
- Max cruising speed: Mach 0.885/459 knots
- Certified ceiling: 51,000 feet
- Range: 5,500 nautical miles
- Gross weight: 90,900 pounds
- Dimensions: Wingspan, 93 feet, 6 inches; length, 96 feet, 5 inches; height, 25 feet, 10 inches

C-37A Air Station:

- CGAS Washington, D.C. (Ronald Reagan Washington National Airport)

HC-130H Hercules and HC-130J Super Hercules, Long Range Surveillance (LRS) Aircraft

The Coast Guard currently operates a long-range turboprop aircraft fleet consisting of 22 HC-130H Hercules and six HC-130J Super Hercules. However, the HC-130H Hercules aircraft are reaching the end of their useful service lives. The Coast Guard conducted a limited sustainment and enhancement project to modernize systems on its HC-130Hs and is continuing with the acquisition of the more capable and cost-effective HC-130J. Under the direction of the Department of Defense Authorization Act for fiscal year 2014, seven HC-130Hs will be transferred to the U.S. Forest Service following modification by the U.S. Air Force. The remaining HC-130Hs will be systematically retired as the HC-130Js are accepted into service.

The HC-130 provides a versatile platform capable of serving as an on-scene command-and-control platform with extended loitering capabilities as well as performing various missions, including maritime patrol, law enforcement, search and rescue, disaster response, and cargo and personnel transport. As a surveillance platform, it provides the critical means to detect, classify, and identify targets. For each of these missions, the information is shared with operational forces capable

U.S. COAST GUARD PHOTO BY DAVE SILVA

of interdicting drugs or migrants, protecting living marine resources, and enforcing economic, safety, and security zones.

The HC-130 uses a powerful multimode surface-search radar and a nose-mounted electro-optical/infrared (EO/IR) device combined with an Airborne Tactical Workstation and military satellite communications capability to improve mission effectiveness.

In 2001, the Coast Guard received funding for the acquisition of six HC-130Js. Full operational capability with missionization was completed in mid-2010. In recent years, the service has received additional funding for five more aircraft, three of which were ordered through the U.S. Air Force in September 2012. These aircraft are scheduled for delivery in early 2016.

- Power plant: (HC-130H) Four 4,910-hp Allison T56-A15 turboprop engines; (HC-130J) four 5,600-hp Rolls-Royce AE2100D turboprop engines driving six-bladed propellers
- Performance: (HC-130H) Cruising speed, 280 knots/max 320 knots; service ceiling, 33,000 feet; range, up to 4,300 nautical miles; (HC-130J) cruising speed, 280 knots/max 362 knots; service ceiling, 39,000 feet; range, up to 5,200 nautical miles
- Weight: Maximum gross weight at takeoff, 155,000 pounds; normal max 175,000 pounds (EWP-Emergency War Planning)
- Dimensions: Wingspan, 132.6 feet; length, 99.6 feet; height, 38.6 feet; wing area, 1,734 square feet

HC-130 Air Stations:

- CGAS Sacramento, California
- CGAS Clearwater, Florida
- CGAS Elizabeth City, North Carolina
- CGAS Kodiak, Alaska
- CGAS Barbers Point, Hawaii

MH-60T Jayhawk Medium Range Recovery Helicopter

An all-weather, medium range recovery helicopter similar to the Navy MH-60R and MH-60S Sea Hawk, with roots

MH-60T Jayhawk



U.S. COAST GUARD PHOTO BY PETTY OFFICER 3RD CLASS ANN MARIE GORDEN



MH-65D Dolphin

going back to the Army's basic H-60 Black Hawk transport, the Coast Guard MH-60 is a medium range recovery helicopter that is capable of a variety of missions. The service began to operate the aircraft in 1990 as a replacement to the now-retired HH-3F Pelican. The Coast Guard has 42 MH-60Ts. Jayhawks are crewed by two pilots, a flight mechanic, and a rescue swimmer, and can carry up to six seated survivors. It is capable of limited shipboard operations as well as land-based operations out to 300 nautical miles, with a 45-minute on-scene time.

The MH-60T employs full night-vision-device capability. Primary tactical navigation is accomplished through blended GPS and inertial navigation system receivers. In addition to a rescue hoist – rated for 600 pounds – the Jayhawk is equipped with a heavy-lift external sling with a capacity of 6,000 pounds. The MH-60 carries sensors and equipment for SAR missions, law enforcement, and homeland security missions. Upgrades completed in 2008 providing armed response capability precipitated an airframe designation from HH-60J to MH-60J. The MH-60T is an upgrade of the MH-60J with "glass" cockpit, new electro-optical and infrared sensors, new radar, and upgrades to the engines. All MH-60Ts are equipped with Airborne Use of Force (AUF) capabilities. These upgraded MH-60Ts are expected to serve until 2027. The final MH-60T conversion was delivered in February 2014.

- Power plant: Two 1,560-shp General Electric T700-GE-401C turboshaft engines
- Dimensions: Rotor diameter: 53 feet, 8 inches; length, 64 feet, 8 inches; height, 17 feet; main rotor disc area, 2,261 square feet
- Performance: Maximum speed, 180 knots; service ceiling, 13,000 feet DA; range, 700 nautical miles
- Weights: Empty, 14,500 pounds; gross weight, 21,884 pounds
- MH-60 Armament: .50-caliber precision fire weapon, M240 7.62 mm machine gun

MH-60T Units:

- CGAS/CG Aviation Training Center Mobile, Alabama
- CGAS Kodiak, Alaska
- CGAS Sitka, Alaska
- CGAS San Diego, California
- CGAS Clearwater, Florida
- CGAS Cape Cod, Massachusetts
- CGAS Elizabeth City, North Carolina
- CGAS Astoria, Oregon

U.S. COAST GUARD PHOTO BY PETTY OFFICER 3RD CLASS JENNIFER A. NEASE



MH-65C/D Dolphin Short Range Recovery Helicopter

The H-65 Dolphin is the Coast Guard's oldest and most numerous current helicopter, dating to the 1980s when it was selected for the short-range rescue mission, and one of the service's first helicopters without the capability to perform water landings.

The H-65 is a short range recovery aircraft. This twin-engine, single-rotor helicopter is certified for all weather and night time operations, but it is prohibited from flying under known icing conditions. The strengths of this aircraft include its speed, flexibility, and integrated electronics package. The H-65 is the Coast Guard's standard shipboard-deployable aircraft and operates from all flight deck-equipped cutters. Navigation inputs are processed through a central mission computer unit, which can generate search patterns from pilot-provided input. This minimizes the attention needed to navigate the aircraft and maximizes search effectiveness. Endurance of the H-65 is limited, with a maximum endurance profile at 75 knots of 3.5 hours. The aircraft can sprint at speeds up to 165 knots for short periods and sustain speeds of more than 140 knots.

An AUF capability was added to all H-65s, resulting in their redesignation as MH-65C. The MH-65C also obtained SATCOM capability, an integrated EO/IR system, and a night vision goggles (NVG) heads up display (HUD) to help pilots maintain situational awareness during nighttime operations. The MH-65Cs used by Helicopter Interdiction Tactical Squadron (HITRON) Jacksonville, Florida, for counterdrug operations carry an M240 machine gun and an M107 .50-caliber precision fire weapon for disabling fire.

The MH-65D is the result of the latest incremental modernization project, Segment 4 of a six-segment modernization plan, which commenced in August 2010 and will extend the aircraft's service life through 2027. It addresses immediate critical mission degraders as well as replacing additional obsolete subsystems, including the aircraft's navigation system and gyros, with digital GPS and inertial navigation. It adds a new digital Automatic Flight Control System (AFCS), integrated flight deck with sensor display screens, and a robust, effective C4ISR suite. As of October 2014, 80 of the service's 99 H-65s had been modified to Segment 4, or MH-65D standard. Segment 5 will add a secure shipboard handling, securing, and traversing system. Segment 6, which brings the fleet to MH-65E standard, will replace the analog automatic flight control with digital systems, and install digital weather radar and digital glass cockpit instruments, among other modernization upgrades.

Data applies to MH-65C/D.

- Power plant: HH-65C – two 853-shp Turbomeca Arriel 2C2-CG turboshaft engines
- Performance: Maximum speed, 175 knots; cruising speed, 120 knots; operational ceiling, approximately 10,000 feet; range, 375 nautical miles
- Weights: Empty weight, 6,200 pounds; max gross weight, 9,480 pounds
- Dimensions: Main rotor diameter, 39 feet, 2 inches; main rotor disc area, 1,204 square feet; length, 44 feet, 4 inches; height, 13 feet, 4 inches
- MH-65C Armament: .50-caliber precision fire weapon, M240B 7.62 mm machine gun

H-65 Air Stations:

- CGAS Traverse City, Michigan
- CGAS Barbers Point, Hawaii
- CGAS Borinquen, Puerto Rico
- CGAS Atlantic City, New Jersey
- CGAS Corpus Christi, Texas
- CGAS Detroit, Michigan
- CGAS Houston, Texas
- CGAS Humboldt Bay, California
- CGAS Los Angeles, California
- CGAS Miami, Florida
- CGAS/CG Aviation Training Center Mobile, Alabama
- CGAS New Orleans, Louisiana
- CGAS North Bend, Oregon
- CGAS San Francisco, California
- CGAS Port Angeles, Washington
- CGAS Savannah, Georgia
- CGAS Kodiak, Alaska
- HITRON Jacksonville, Florida

Exhibit D - Specialized Operation Vessel Examples

Hockema Group - A design overview of … the Frederick Paup

A design overview of Manson Construction's latest trailing suction hopper dredge, the FREDERICK PAUP

An operator's investment in a new hopper dredge is a long-term commitment to a complex vessel working in an abrasive environment. Even with those headwinds, anticipated life cycle durations for modern US flagged dredges typically need to exceed 50 years with minimal downtime to achieve successful capital investment returns. Designed by Manson Construction Co. and Hockema Group (Hockema), the trailing suction hopper dredge (TSHD) GLENN EDWARDS has been a leading performer in the dredging industry over the past 15 years and set the trend for modern operators building large hopper capacity flagships as fundamental assets for their dredging fleets. The delivery and observed success of the GLENN EDWARDS (hopper capacity of 13,700 cubic yards, CY) was followed by the construction of the hopper dredge MAGDALEN (hopper capacity of 8,550 CY) and the articulated tug-barge ELLIS ISLAND (hopper capacity of 14,800 CY), both delivered in 2017.

With the dredging market demands continuing to outpace the existing US fleet capacities, Manson realized a new opportunity to strengthen their fleet with an advanced, high capacity TSHD design resulting in their latest addition, the FREDERICK PAUP.

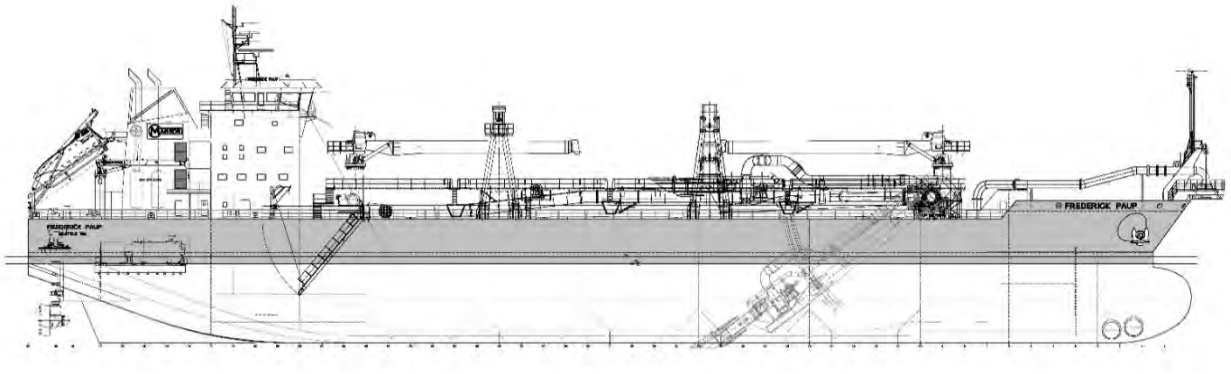


Figure 1: FREDERICK PAUP Outboard Profile

Scheduled to begin service in the spring of 2023, the FREDERICK PAUP will be the largest US-flagged, self-propelled hopper dredge delivered in American shipbuilding history. Once again collaborating with the naval architects at Hockema, the 419'-10" Length Overall x 81' Wide x 32'-6" Deep (to Main Deck) vessel boasts a hopper capacity of over 15,000 cubic yards, surpassing her predecessors, the afore mentioned ELLIS ISLAND and GLENN EDWARDS. The vessel is currently under construction at the Keppel AmFELS shipyard in Brownville, Texas and will receive ABS ✠A1, ✠AMS, and ACCU class notations as well as SOLAS certification once completed. The vessel will be propelled by (3) stern Z-drive units and has (2) bow thrusters forward.

As part of the design process, Hockema has developed a signature hopper dredge hull form and arrangement combination to maximize the ratio of hopper capacity versus cubic hull dimensions. The bow and stern hull lines of the FREDERICK PAUP were developed to reduce bare hull resistance in both the loaded and unloaded conditions using Computational Fluid Dynamic (CFD) analysis. The CFD validation was critical in ensuring Hockema's goal to achieve a high-capacity vessel with restricted overall hull dimensions while meeting target steaming speeds. Modifications to the hull form reduced calm water resistance from the initial baseline form approximately 18% in the loaded condition and 11% in the unloaded condition.

Flow was also evaluated over the stern skegs and z-drive pods, entering and exiting the Z-drive nozzles and over the bow thruster tunnels. The bow thruster tunnel grating alignment was adjusted to reduce resistance and the aft appendages leading flow into the z-drive legs were adjusted to reduce the streamline turbidity in those locations. Modifications to the appendages from the initial design reduced calm water appended resistance approximately 8% in the loaded condition and 10% in the unloaded condition.

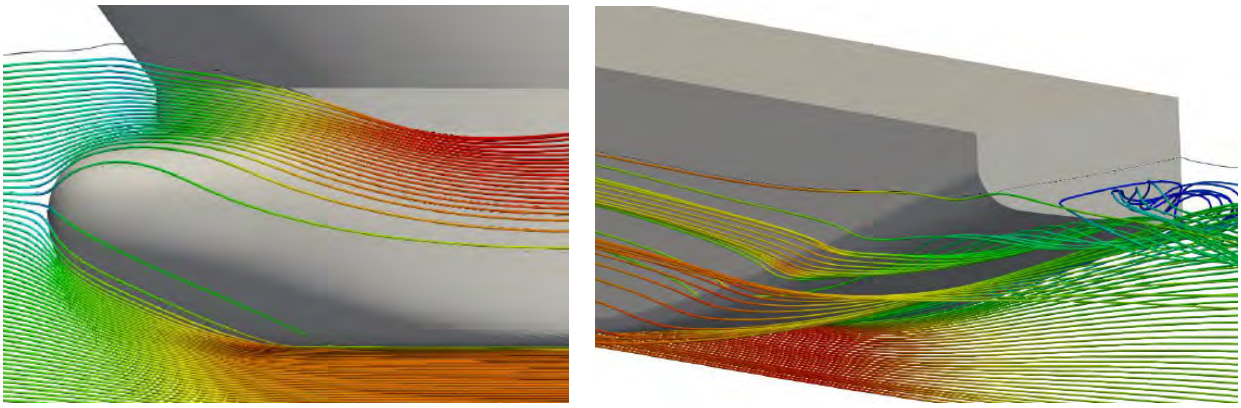


Figure 2: Bow and Stern Streamlines from the CFD Evaluation

The dredging system that supports the loading and emptying of the hopper volume includes dual dragarms deployed at the upper working deck level, five (5) pairs of dump doors located at the bottom of the hopper, and a bow coupling unit which can be connected to a floating discharge hose for long range distribution of spoils or by "rainbowing" hopper contents through a high pressure rated nozzle fitting. Drawing from their 115 years of marine operations experience, Manson's engineering team has custom-designed the dredging equipment to meet this vessel's industry-leading performance requirements while still integrating their fleet operational and maintenance standards.

The hopper shape includes a sloped bottom in the lower part as well as four (4) moguls running the breadth of the hopper which are evenly spaced over the hopper length. Coupled with the ability of the jet water system's numerous nozzles to create a spoils slurry within the hopper, these sloped surfaces direct hopper contents to the dump door bays between the moguls either for release through the doors or pump-off by suction bellmouths leading to a common pump-off manifold. Other than these pump-off branch suctions and the jet water system nozzles, all other dredging system piping is arranged outside of the hopper volume to reduce weather and spoils exposure as well as maximize the hopper volume capacity.

With fully automated systems, all vessel navigation and dredging operations can be executed from the pilot house located at the top of the superstructure in the after portion of the vessel, just forward of the engine room and exhaust stacks. The entire working deck, hopper loading chute, spoils level control weirs, dump door cylinders, and the above-deck portion of the pump-off system can be viewed from the dragtender's station at the forward end of the pilot house. The mate's navigating station is directly aft and higher than the dragtender, providing 360-degree visibility necessary for operations in busy shipping channels, also providing for overall vision of dredging operations and direct verbal communication with the dragtender. Vessel maneuvering during dredging operations is via a dynamic positioning system allowing for a precise track for the twin dragheads.

The pump and motor rooms supporting the pump-off and jet water systems are arranged forward of the hopper boundary near the vessel's bottom shell. The "wet" equipment, such as the large pump-off pumps, jet water pumps, and suction manifold piping, is isolated from the pumps' associated electric drive motors, switchboards, and other electrical equipment by a full hull depth watertight transverse bulkhead. Given such large equipment items and system pipe diameters, Hockema's designers modeled the entire pump room and pump-off suction manifold in 3D to efficiently arrange this tight space while maintaining equipment and fitting maintenance access needs. Clearance above the pumps was

maintained all the way up to the vessel's weather deck via large, bolted hatches allowing for direct crane lifting access. This facilitates fast turnarounds for equipment and system fitting removals.

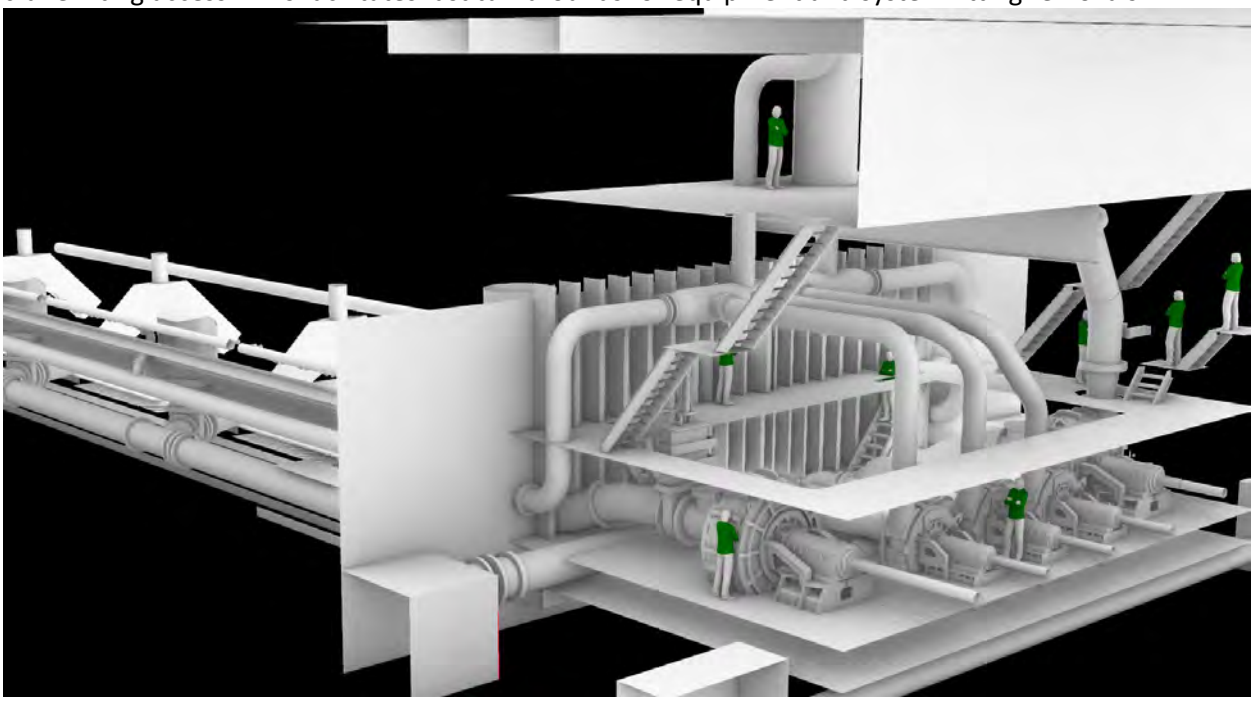


Figure 3: 3D Model of Pump Room and Suction Manifold

Many hopper dredge designs locate drag arms in a recessed well deck area on either side of the hopper to stow them nearer the water surface. In that arrangement, the drag arms still require a hoisting and/or vertical trunnion track system for deployment. Originally developed by Manson and Hockema on the GLENN EDWARDS, the continuous upper working deck (01 Level) on the FREDERICK PAUP runs the length of the hopper offering the following advantages:

- *Optimal hull girder strength performance* – Including this upper working deck in the vessel's hull girder section takes full advantage of the hull and hopper depth increasing allowable vessel bending moments when loaded with spoils. The hopper coaming itself also no longer becomes integral to hull girder strength and can be more economically constructed.
- *Continuous working deck in way of all dredging equipment* – The drag arms, associated winches and davits, trunnions, and bow discharge coupling unit can all be serviced at the same deck level. This arrangement avoids weather deck stair transits during dredging system installation, testing, and servicing and provides safer access to the dragarm components when the vessel is underway.
- *Weather protected, interior passageway surrounding the hopper* – Between the 01 Level and Main Deck, a completely enclosed passageway spans the length of the hopper for crew transit, routing of bow to stern cableways, and additional accessible equipment installations.

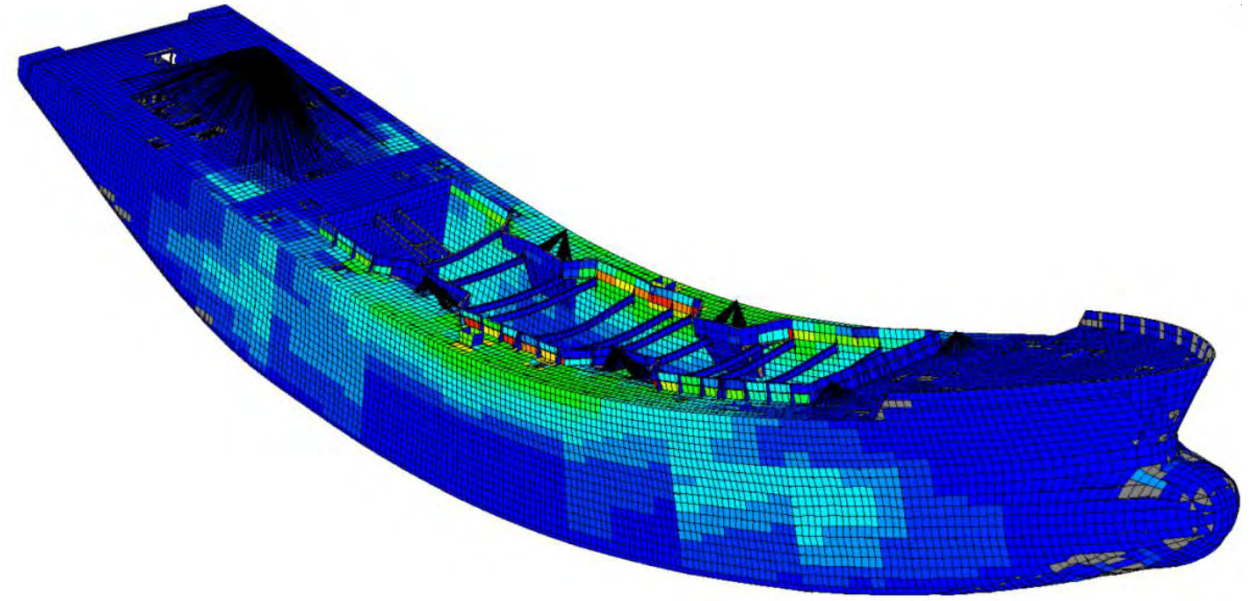


Figure 4: Finite Element Analysis model of the FREDERICK PAUP hull girder strength evaluation

The aft deck house arrangement of the FREDERICK PAUP also better concentrates those spaces of higher occupancy because the pilot house, accommodations, and engine room are all aft of the hopper. This consolidation of personnel spaces reduces crew walking distances, simplifies HVAC and ventilation systems, and minimizes wireways and piping spanning the full vessel length. The aft deck house coupled with protected passageways below the working deck offer efficient paths for personnel movements about the vessel. The crew can more quickly reach positions of operational readiness with reduced daily fatigue. With these and additional arrangement features, the FREDERICK PAUP design takes advantage of the hopper-hull interface to achieve the most compact vessel size practicable translating directly into construction cost savings.

Driving this advanced vessel is a fully centralized diesel-electric power plant providing a high level of versatility in terms of equipment location, arrangement, and redundancy – a key to significantly increased reliability. This system allows for improved power management by matching the generated power to the specific operational mode. Benefits include less fuel consumption, single engine room and exhaust piping arrangement, lower operating hours across the entire engine compliment, and reduced carbon emissions.

With five (5) EPA Tier-IV compliant generator sets configured in parallel, the FREDERICK PAUP is capable of continuous operations at near-peak performance levels even when a generator is taken offline. This type of powering scheme is, however, equipment-intense electrically considering the number of switchboards, transformers, variable frequency drives, and motor controllers required. With space constraints inherent to the efficient overall hull dimensions, Hockema's electrical engineers strategically grouped electrical systems into varying operating voltage categories to allow for the selection of more compact electrical equipment, minimizing their arrangement footprints.

Collaboration between the owner and naval architects was a key component to the success of the FREDERICK PAUP new construction program from the beginning. Starting with a proven vessel concept in the GLENN EDWARDS, this latest engineering effort blends Manson's deep experience in US-based dredging operations with Hockema's hopper dredge design capabilities and US and international regulatory expertise. The resulting design advances hopper dredge technology in the areas of hull size efficiency, dredging equipment automation, safety features, and powering versatility. The FREDERICK PAUP is anticipated to become the industry benchmark for large capacity dredge vessels upon entering service in 2023 as operators continue to expand their fleets to meet the mounting needs of America's ports and waterways.

Exhibit G - Present and Prospective Commercial Navigation and Cargo

Port of Baltimore Cargo and Vessel Planning Projections

MPA Memo, 2023

To: **Sarah Williamson**
Bay Crossing Study Team, Coastal Resources, Inc.

From: **Amanda Peñafiel**
Senior Project Manager, Maryland Port Administration

Date: **September 29, 2023**

Subject: **Chesapeake Bay Crossing Study Tier 2 – Purpose and Need Supporting information**

In order to support MDTA and the Bay Crossing Study Team in defining navigation clearance needs and limitations as part of the Bay Crossing Study, MPA is pleased to submit the following supporting information/data.

Existing Conditions

- Type, size, dimensions:
  - Cruise ship access to the Port of Baltimore (POB) is limited due to clearance under the current Bay Bridge span. Current vessels able to call at the POB include Spirit Class for Carnival, Vision Class for Royal Caribbean, and the Sun Class for Norwegian Cruise Lines. Please see the details provided in Document #1 Cruise Fleet excel file for further details on what cruise lines are limited.
  - The largest class of cargo vessel anticipated to call at the POB through 2040 is the Post Panamax (PPX) Generation III Max which has the following dimensions:
    - 16,000 twenty-foot equivalency units (TEU) capacity
    - 1,299 ft length overall (LOA)
    - 175.6 ft beam
    - 52.5 design draft
    - 175.4-181.9 ft air draft

    See Document #2 Seagirt Loop Deepening Study Appendix B - Engineering for additional vessel information. https://www.nab.usace.army.mil/Missions/Civil-Works/Seagirt-Loop-Channel/

- Freight type and volume: Information
  - In 2022, POB import and export tons totaled 43.3 million tons, surpassing the previous mark set in 2021. The value of foreign cargo marked a record year for POB with a value increase of $74.3 billion. While bulk products make up approximately 66% of the POB's total international cargo, general cargo products account for 95% of its value. Most of the domestic waterborne cargo within the Port of Baltimore consists of coal, petroleum products, sand and gravel moving within the Chesapeake Bay or to nearby ports along the U.S. East Coast. General cargo is defined as containerized cargo, automobiles,

- agriculture/construction machinery (Roll on/Roll off or Ro/Ro) and break-bulk shipments of forest products, steel, etc. Details can be found in Document #3 Foreign Commerce Statical Report.

- Volume of shipping traffic
  - Studies related to the Seagirt Loop Deepening study show a continued increase in total TEUs and an expected increase in the number of PPX III and larger vessels calling the POB. The estimated number of calls at Seagirt Marine Terminal is expected to increase from 549 in 2030 to 701 by 2040. See Documents # 4 Seagirt Loop Deeping Study Appendix C – Economics and #5 Harborsym Model of Baltimore Harbor Container Traffic for more details. https://www.nab.usace.army.mil/Missions/Civil-Works/Seagirt-Loop-Channel/

Total TEU Forecast			
	2030	**2035**	**2040**
Forecasted Import TEU	859,531	940,512	1,174,405
Forecasted Export TEU	940,512	1,077,154	1,221,111
Forecasted Total TEU	1,800,043	2,017,666	2,395,516

Vessel Class	Annual Average Forecasted Call by Vessel Class
	2030
Panamax	40
PPX I	99
PPX II	252
PPX III	139
PPX III Max	19
Total	**549**
	2040
Panamax	45
PPX I	77
PPX II	281
PPX III	273
PPX III Max	25
Total	**701**

Future Conditions

Future expansion plans (routes, accommodating other ships, other imports/exports)

- Currently there are 12 regularly scheduled container services calling the POB. Of these services there are five dedicated to the Asia and / or South Asia trade routes, four to the Europe/ Mediterranean region, two to the Americas and one to Africa. The largest vessels currently calling are approaching the PPX III (14,000 TEU) vessel class. Moffatt & Nichol estimates that in order meet growing demand on the routes that three of these services will likely see future upgrades to the average and max vessel sizes, including 16,000 TEUs. See Documents # 4 Seagirt Loop

Deeping Study Appendix C – Economics. https://www.nab.usace.army.mil/Missions/Civil-Works/Seagirt-Loop-Channel/

- The Howard Street Tunnel Project will increase transport efficiency related to the POB's increase in cargo handling. For the two Class I rail lines serving the port, the Howard Street Tunnel expansion will allow CSX to double stack containers. In 2017, the rail line was estimated to be capable of handling 130,000 to 150,000 containers annually. However, it was only handling around 20,000 to 30,000 containers due to the tunnel inefficiencies. An additional 80,000 to 90,000 containers (126,000 and 141,000 TEUs) throughput can be realized immediately once the tunnel expansion comes online. See Documents # 4 Seagirt Loop Deeping Study Appendix C –Economics. https://www.nab.usace.army.mil/Missions/Civil-Works/Seagirt-Loop-Channel/

- Trade Point Atlantic in partnership with Terminal Investments Limited will develop a 165-acre container terminal with dock rail facility at Coke Point (Sparrows Point) outside of the Key Bridge. Although not an MPA terminal, the development will impact navigation around the POB and be a source of revenue for the State.

- Lessons learned from the COVID pandemic have shown that POB is uniquely situated to continue to efficiently handle goods. Supply chain issues and backups in landside freight transport that were experienced at other large U.S. ports were not experienced at POB and in some cases, cargo was diverted to POB. This is in part due to the POB's hinterland location near major highways and rail lines and ability to efficiently provide service to a large regional population. POB continues to work to ensure resiliency to future supply chain issues through terminal improvements. Its role in the region will be further secured with the completion of the Howard Street Tunnel Project.

- Anticipated needs
    - The current cargo vessel forecast is limited to PPX III Max vessels which are part of the fleet already in service, however there is a trend toward even larger vessels. To remain competitive with other east coast ports, Maryland should be prepared to match the air draft of neighboring ports. At present, the Verrazano Narrows Bridge leading into the ports of NY/NJ is 228ft and the Bayonne Bridge is 218ft. Maryland ideally would be able to meet or exceed those limits.
    - Most new cruise ships recently built or under construction will not fit underneath the current Chesapeake Bay Bridge so do not call at the POB. Some "specialty" cruise ships would fit, but they will not call Baltimore because they are designed for certain markets (I.e., Expeditions or Luxury River Cruises (Viking). If the current bridge was not a controlling factor, a bridge height of 228ft (which is the height of Verrazano Narrows Bridge) would expand the Maryland Cruise Line market. It is expected that under these conditions, similar vessels to NY/NJ would call at the POB. This includes the Venice Class for Carnival, the Oasis Class for Royal Caribbean, and the Breakaway Class for Norwegian Cruise Lines resulting in a more competitive market for the state of Maryland.

Chesapeake Bay Shipping Channel

- Inland location
    - The POB is one of the largest ports on the East Coast and its hinterland location makes it uniquely situated to efficiently serve the Midwest markets and the interior U.S. The Seagirt Marine Terminal Berth 3 modernization study explains that without the improvements to the POB, cargo may be diverted to nearby ports such as NY/NJ; Norfolk, Virginia; or Canada, which

would be a loss in revenue to the region and would result in an increased number of trucks needed to meet the requirements of shipment volumes in and out of the Baltimore region. Improvements to the Seagirt Marine Terminal enable containers to arrive and depart from Baltimore, rather than entering the U.S. at another port and being trucked to Baltimore. This benefits all users of the regional transportation system through reduced congestion, improved road safety, and better air quality that will follow the traffic reduction. By reducing the number of trucks on the roads, accidents, fatalities, injuries, and property damage are reduced. Additional emissions reductions are expected related to the Howard Street Tunnel Project. Improvements of the regional air quality would result from the transfer of freight volume from highways to the rail system and the subsequent decrease of vehicle emissions as the optimized travel mode of freight by train replaces on-road vehicles from the POB. See Document #6 Seagirt BUILD18 Application and #7 Seagirt BUILD18 Appendix B.

- Channel Dimensions

Chesapeake Bay Channel	Current Width (feet)	Authorized Width (feet)	Authorized Depth (feet)
Maryland Channels			
Fort McHenry Channel	700	800	50
Curtis Bay Channel	400	600	50
Brewerton Channel	700	800	50
Craighill Channel A	700	800	50
Craighill Channel B	700	800	50
Craighill Channel Entrance	700	800	50
Virginia Channels			
Rappahannock Shoal Channel A	800	1000	50
Rappahannock Shoal Channel B	800	1000	50
York Spit Channel A	800	1000	50
York Spit Channel B	800	1000	50
York Spit Channel C	800	1000	50
Cape Henry Channel A	1000	1000	50
Cape Henry Channel B	1000	1000	50

Channels are further detailed in Document #8 Baltimore Harbor DMMP 2017 Update.
https://www.nab.usace.army.mil/Portals/63/docs/Civil%20Works/DMMP/Balt_Harbor_DMMP_Update_October_2017.pdf?ver=2018-02-08-110956-717

- Limitations to Access
    - Depth of Channels: With the deepening of the Seagirt Loop Channel (Seagirt Marine Terminal access), the current fleet of PPX III Max vessels can access the POB. 50-foot depths may limit future larger vessel access.
    - Width of Channels: Several channel components of the 50-foot project are not constructed to the authorized widths. The need for modification to the existing navigation system is to address the growing concerns about navigational safety and efficiency due to larger ships

calling at the Port of Baltimore. Data shows vessels with beam widths of 160 feet and larger already calling at the Port and forecasts show the number of these vessels, particularly containerships, increasing over the next 50 years. With current channel widths, larger vessels are experiencing transportation delays due to inadequate passing clearance in the channels. As the presence of larger vessels in the Baltimore Harbor and Channels increases, the frequency of these transportation delays will also increase.

- Air Draft Clearance of current Bay Bridge Span: The existing cargo fleet can access the POB by taking on ballast and coordinating passage with tides, as needed. Future limitations as vessel sizes increase and under future sea-level rise conditions. The Bay Bridge clearance does limit cruise line access to older, smaller vessels as mentioned above.
- One-way Traffic Restriction and Wait Times for Berth Access: Larger container vessels and some dry bulk vessels with wide beams and deep drafts are restricted to one way traffic from the Bay bridge north to the Port. There are also limited berths for docking. For large vessels, the Annapolis anchorage is the only waiting area once a vessel has passed the lower Bay anchorages. This is not a charted anchorage area, but it is just south of the Bay bridge and east of the channel. The Seagirt Loop analysis shows that even if all berth space at Seagirt Marine Terminal is provided to -50 ft MLLW, the increase in vessel traffic volume and size of vessels may result in average wait times of multiple days by 2040. This indicates a potential need to identify new container berth space in the Baltimore Harbor to accommodate the future fleet and cargo at POB.

- Maintenance Needs of Current Channel
  - The annual average maintenance dredging need is 1.34 million cubic yards (mcy). Dredging locations and quantities are variable and detailed Document #8 Baltimore Harbor DMMP 2017 Table 2.4.
    https://www.nab.usace.army.mil/Portals/63/docs/Civil%20Works/DMMP/Balt_Harbor_DMMP_Update_October_2017.pdf?ver=2018-02-08-110956-717

- Current Bridge Placement and Design
  - The current Bay Bridge span location was likely related to cost due to the distance between shores and location near Annapolis, Baltimore, and Washington D.C. The original span was built before the National Environmental Policy Act was enacted but likely costs and impacts were considered. The span's curve is a result of the fact that the Army Corps of Engineers would not approve the structure unless it crossed the shipping channel at a 90-degree angle.

- Chesapeake Bay Bridge Impacts
  - Recent trends in container service to the US East Coast indicate the PPX III Max Class will become more common at East Coast ports. Based on both the air draft trend in the world fleet and the 100-year projected SLR, the PPX III Max Class (16,000 TEU) represents the practical maximum feasible design vessel for the Seagirt Loop Channel that can call at the Seagirt Marine Terminal with the present-day air gap clearance of the Bay Bridge. Under the high sea-level rise scenario, air draft clearance may limit the PPX III Max vessels starting in 2045. In addition. Almost all new cruise ships being built are unable to fit under the bridge.

Other Considerations

- Operation of C&D Canal: (The C&D Canal handled 9.5% of all transits to/from the Port of Baltimore in 2022. The canal has an authorized depth of 35' and goes beneath 5 bridges. Four of the bridges have air drafts between 135' and 140',

- Port Facility locations: Trade Point Atlantic and Terminal Investment Group (owned by Mediterranean Shipping Co.) will be located outside of the Key Bridge. Trade Point Atlantic could be home to a future Cruise Terminal as well. However, there are no plans at this time because of current air draft limitations.

- Other limitations to POB facilities: All POB facilities are limited to the current design of the existing federal channels (50'). POB facilities inside of the Key Bridge are limited to air draft limits of both the Key and Bay Bridge structures.

- Other types of vessels using shipping channel/Chesapeake Bay: Other types of vessels using the shipping channels do not have the air draft limitations that the largest containerships and cruise ships have. Ro/Ro ships, Bulk Ships (liquid and dry), and other general-purpose ships are not impeded by the air draft. However, some of these bulk ships cannot be fully laden (fully loaded with cargo) because of the 50' channel. Some bulk ships need 55' of water and any plans to tunnel underneath the existing channel should take that into consideration.

- Temporary impacts during Bay Bridge span construction will likely have significant impacts on POB operations and will be addressed by considering how the fleet would be diverted and how that will impact scheduling and limitations of access to the POB. Safety concerns and the potential impacts on nearby anchorages (more use resulting in longer wait lines or cargo diversion to other nearby ports due to delays) should also be considered.

Exhibit G - Present Commercial Navigation and Cargo

Port of Baltimore data

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
				Summary	**Maximum**			
					1,670.03	**170.61**	**47.02**	**47.51**
ABTENAUER	9655212	Bulk	24163		590.58	98.43	32.25	27.33
AFRICAN AVOCET	9738870	Bulk	34769		656.13	105.78	32.68	29.76
AFRICAN BLUE CRANE	9351737	Bulk	31238		623.36	105.85	34.91	31.83
AFRICAN MACAW	9767431	Bulk	23247		590.25	97.77	32.42	34.52
AGIA MONI	9574028	Bulk	23264		590.48	97.77	26.41	35.34
AGIA SOFIA	9470820	Bulk	17023		555.70	89.24	32.51	
ALAMEDA	9228174	Bulk	87063		948.11	147.58	32.42	47.51
ALAMO	9851335	Bulk	24332		590.42	101.71	33.33	21.00
ALGOMA INTEGRITY	9405162	Bulk	33047		646.69	105.65	33.01	28.18
ALGOMA VALUE	7926148	Bulk	46068		802.93	105.75	26.51	43.01
ALGOMA VERITY	9183776	Bulk	28747		622.64	105.65	39.01	36.91
ALGOMA VICTORY	9138109	Bulk	41428		738.22	105.65	28.84	44.92
ALGOMA VICTORY	9515632	Bulk	17018		555.70	89.24	25.26	44.00
ALICE OLDENDORFF	9942720	Bulk	93718		957.72	147.64	32.84	47.02
ALONA	9493016	Bulk	91758		958.05	147.64	34.84	47.02
ALPHA HOPE	9446582	Bulk	92758		957.99	147.64	36.91	47.51
ALTAIR SKY	9811555	Bulk	34164		656.17	105.78	26.25	23
AM JYOTI	9880233	Bulk	44000		740.49	105.85	39.93	46.82

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
AMARYLLIS	9575254	Bulk	35812		656.17	105.85	33.01	
AMBER LAGOON	9663738	Bulk	25303		590.55	98.43	23.59	26.25
AMIS JUSTICE	9732424	Bulk	35825		652.92	105.78	38.49	32.35
AMIS POWER	9780990	Bulk	35607		655.87	105.85	22.51	35.83
AMIS TREASURE	9865362	Bulk	34657		655.90	105.85	39.08	22.67
AMIS UNICORN	9882279	Bulk	34657		655.87	105.78	39.08	19.85
AMIS VICTORY	9897810	Bulk	36000		655.87	105.85	24.02	27.92
AMIS WEALTH	9897896	Bulk	35728		655.87	105.85	23.26	31.17
AMIS WISDOM II	9426776	Bulk	33854		656.13	105.85	23.33	37.17
ANDROS PRINCESS	9469558	Bulk	93360		958.05	147.78	35.01	47.02
ANGLO ALEXANDRIA	9451044	Bulk	63940		836.66	141.08	25.00	47.51
ANGLO JESSICA	9490480	Bulk	64100		837.51	141.08	24.35	47.41
ANGLO MARIMAR	9520833	Bulk	52259		787.41	124.68	28.68	46.49
ANSHUN	9851347	Bulk	24332		600.00	101.71	21.65	33.17
AOM ELENA	9414888	Bulk	58113		835.41	141.21	22.51	44.59
AQUAMARINE	9469546	Bulk	93360		958.05	147.78	37.50	47.02
AQUATAURUS	9757034	Bulk	34323		649.64	105.85	34.16	29.5
ARCADIA	9635999	Bulk	32839		623.36	105.85	23.00	
ARGYROULA GS	9491587	Bulk	21483		580.74	93.84	19.65	21.82
ARIETTA	9545065	Bulk	22400		591.89	98.56	31.27	20.18
ARMIA KRAJOWA	9708033	Bulk	25278		590.55	98.43	27.27	27.49
ARTEMISSIO	9762364	Bulk	35752		656.17	105.78	39.08	22.34
ARUNA HULYA	9635391	Bulk	32715		616.43	105.98	39.67	22.02
ASAHI BULKER	9527180	Bulk	21483		580.74	93.84	33.76	26.25

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
ASL FORTUNE	9500687	Bulk	32309		623.36	105.85	20.67	43.51
ASL NEPTUNE	9340556	Bulk	42665		737.77	105.85	23.26	47.51
ASL SYMPHONY	9758363	Bulk	32378		623.39	105.94	37.99	21.42
ASSIMINA II	9300855	Bulk	19971		586.31	92.06	27.00	24.02
ATHINA II	9724192	Bulk	43439		751.35	105.78	24.67	46.75
ATHINA L	9487627	Bulk	44262		751.35	105.81	25.43	47.02
ATLANTIC TRAMP	9659921	Bulk	17597		555.67	89.24	23.33	19.33
AURELIA	9392133	Bulk	14501		493.89	85.31	27.92	27.49
BABY CASSIOPEIA	9478846	Bulk	61150		787.44	141.08	25.66	47.02
BALD EAGLE	9400904	Bulk	20236		581.16	93.18	22.74	22.18
BARRACUDA ISLAND	9583017	Bulk	32540		623.36	105.85	39.18	30.15
BAY PEARL	9460801	Bulk	29847		618.47	105.85	37.99	22.18
BBC SATURN	9932127	Bulk	25163		590.25	98.43	23.92	24.25
BBG DREAM	9609500	Bulk	42960		738.19	105.85	23.92	47.02
BBG GUIGANG	9847413	Bulk	44196		751.35	105.85	24.57	47.02
BBG GUILIN	9922249	Bulk	44200		751.02	102.50	39.34	43.41
BBG MASTER	9721982	Bulk	36332		655.97	106.01	23.33	44.00
BBG NOVA	9705342	Bulk	36421		656.17	105.85	25.00	41.50
BEATRICE	9865245	Bulk	24332		600.00	101.71	32.51	20.93
BEIRA	9753301	Bulk	25569		590.42	105.02	29.43	23.75
BEKS LEO	9573115	Bulk	93166		958.05	147.64	38.49	47.51
BELKNIGHT	9911666	Bulk	35000		655.87	105.78	23.26	41.18
BELLA OLYMPIA	9950600	Bulk	43355		751.35	105.85	24.08	47.02
BELMONT	9744087	Bulk	36321		655.77	105.98	28.51	

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
BERGE GALDHOPIGGEN	9753284	Bulk	25569		590.09	104.96	29.82	29.17
BERGE HOVERLA	9497359	Bulk	91971		957.40	147.64	36.52	
BERGE JUNGFRAU	9846304	Bulk	23240		590.58	98.43	21.59	23.00
BERGE SONG SHAN	9436513	Bulk	94710		967.90	150.93	41.67	42.42
BIWA ARROW	9687095	Bulk	31864		623.36	105.85	24.25	32.58
BLUE EVERTON	9250701	Bulk	19872		580.74	93.18	25.00	22.02
BONA	9594432	Bulk	19943		581.95	92.52	29.66	20.41
BONAS	9401972	Bulk	29841		618.47	105.85	39.40	
BRAVE STAR	9852729	Bulk	23194		590.25	98.43	27.92	19.75
BRIGHTEN TRADER	9771482	Bulk	24872		590.25	98.43	22.41	23.00
BUBBA BOOSH	9674218	Bulk	31557		623.06	105.85	21	39.24
BUFFLEHEAD	9926063	Bulk	25010		600.00	101.71	27.10	
BULK GINZA	9875111	Bulk	94090		957.89	147.64	39.50	47.02
BULK POLAND	9682863	Bulk	43025		751.32	105.85	25.26	35.60
BUNUN TREASURE	9894715	Bulk	23224		590.48	96.79	31.83	19.33
BW JAPAN	9836438	Bulk	43206		751.32	105.85	23.66	47.02
CANADIAN BULKER	9855422	Bulk	25189		590.25	98.43	23.00	23.00
CAPE BREEZE	9518919	Bulk	93960		958.05	147.81	26.08	47.02
CAPE CLOVER	9802085	Bulk	93451		957.72	147.64	40.16	47.02
CAPE IRIS	9563689	Bulk	92758		957.99	147.64	33.01	47.02
CAPE LAUREL	9446439	Bulk	90111		947.98	147.64	36.58	47.02
CAPE RAY	9405071	Bulk	91373		958.05	147.64	32.51	47.02
CAPETAN IOANNIS	9589695	Bulk	92752		957.99	147.64	37.40	47.02
CAPETAN VASSILIS II	9580118	Bulk	23453		590.58	98.56	33.50	20.51

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
CAPRI	9248526	Bulk	87784		915.40	147.64	37.67	46.82
CAPRICORN ONE	9739018	Bulk	92730		957.99	147.64	37.99	47.02
CAPRICORN SIGMA	9747962	Bulk	92730		957.99	147.64	40.68	47.02
CAROLINE SELMER	9474266	Bulk	23432		590.58	98.59	31.99	20.51
CENDANA	9263071	Bulk	28795		623.06	100.07	30.51	28.74
CENTURIUS	9712618	Bulk	21179		590.55	92.52	29.5	21
CENTURY BRIGHT	9694866	Bulk	10186		449.6	75.46	17.75	17.49
CENTURY DREAM	9694854	Bulk	10186		449.60	75.46	22.51	17.42
CENTURY EMERALD	9726841	Bulk	10186		449.60	75.46	22.25	16.77
CENTURY MELODY	9580211	Bulk	9993		449.60	75.46	18.93	18.83
CENTURY QUEEN	9831531	Bulk	10246		449.60	75.46	27.33	
CENTURY ROYAL	9614385	Bulk	9993		449.60	75.46	27.76	18.08
CHARADE	9520651	Bulk	32319		623.36	105.85	40.59	
CHASSELAS	9840506	Bulk	43062		751.32	105.85	23.59	47.02
CHLOE	9456173	Bulk	32987		623.36	105.85	30.68	47.02
CHOW	9743291	Bulk	94761		958.05	147.64	36.26	47.02
CIC ROLACO	9567116	Bulk	91971		957.4	147.64	35.83	47.51
CIELO D'EUROPA	9539286	Bulk	63087		803.84	141.08	27.33	47.51
CIELO DI TAMPA	9707754	Bulk	25303		590.55	98.43	29.00	23.49
CL DALIAO HE	9880300	Bulk	44403		751.02	105.85	24.57	47.51
CL GENEVA	9911587	Bulk	47500		754.30	118.12	25.76	45.41
CLIFTON BAY	9615743	Bulk	33126		646.36	105.85	39.01	29.17
CLIMATE PLEDGE	9932749	Bulk	48233		749.41	119.76	23.75	46.66
CLIPPER CLYDE	9455911	Bulk	19998		579.10	89.90	24.67	21.33

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
CLIPPER TALENT	9406075	Bulk	19972		586.31	91.87	30.91	20.18
CLIPPER TARPON	9406099	Bulk	19972		586.31	91.87	32.84	27.59
COMANCHE	9743289	Bulk	94839		958.05	147.64	36.09	47.02
COMMON CALYPSO	9594705	Bulk	32987		623.36	105.85	39.34	20.41
CONTAMINES	9743277	Bulk	94544		958.05	147.64	35.50	47.02
CORAL JASPER	9591961	Bulk	41963		738.16	105.85	45.51	47.18
COREFORTUNE OL	9511014	Bulk	34812		655.87	105.85	22.08	34.09
CORELEADER OL	9597678	Bulk	22866		583.53	95.15	29.99	33.50
CORINTHIAN SPIRE	9478482	Bulk	20242		581.16	93.18	20.67	32.15
COS ORCHID	9308704	Bulk	30953		623.06	105.85	22.51	40.91
CRIMSON DELIGHT	9732163	Bulk	32750		623.16	105.85	41.01	31.99
CRIMSON EMPRESS	9485021	Bulk	43013		751.32	105.85	24.02	47.02
CS CRYSTAL	9406128	Bulk	19972		586.31	91.87	32.51	29.17
CS JENNA	9748409	Bulk	23269		590.48	97.77	33.33	21.65
CS JI NAN	9874686	Bulk	94493		958.05	147.64	38.75	47.02
CS WU HAN	9874715	Bulk	94493		958.12	147.71	35.43	47.51
CSL KAJIKA	9710579	Bulk	44200		761.19	105.98	33.01	40.16
CSL KOASEK	9710567	Bulk	44200		751.15	105.94	25.59	43.34
CSL METIS	7926162	Bulk	43022		754.89	105.78	29.17	39.50
CSL SPIRIT	9138111	Bulk	41428		738.22	105.65	27.99	44.49
CSL TACOMA	9640956	Bulk	43691		750.04	105.65	29.00	40.32
CSSC CAPE TOWN	9853888	Bulk	66786		836.52	141.08	29.59	47.02
CSSC LE HAVRE	9853931	Bulk	66786		849.78	141.08	29.17	38.58
CSSC ROTTERDAM	9853905	Bulk	66630		836.49	141.08	29.17	47.02

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
CYMONA GALAXY	9375915	Bulk	42751		737.90	105.85	23.00	46.92
DAIWAN DOLPHIN	9672234	Bulk	21525		590.45	98.43	20.34	31.01
DANSHIP BULKER	9515682	Bulk	17025		556.13	89.24	17.75	18.08
DENSA COBRA	9460643	Bulk	94934		958.05	147.64	33.83	47.51
DENSA DOLPHIN	9403190	Bulk	32379		623.36	105.85	38.58	33.83
DENSA SHARK	9607681	Bulk	93153		957.95	147.84	35.66	47.02
DESERT VICTORY	9543706	Bulk	33631		633.46	105.85	22.67	43.34
DREAM SKY	9839076	Bulk	35832		656.13	105.78	24.35	44.59
DREAM TEAM	9875147	Bulk	45223		751.18	114.84	24.18	47.51
DSI POLLUX	9747405	Bulk	34551		656.17	105.81	22.08	42.85
DUHALLOW	9729207	Bulk	93488		958.28	147.64	37.76	29.17
DUKE SANTOS	9785988	Bulk	44397		751.35	105.85	27.59	45.02
DVADESETPRVI MAJ	9582427	Bulk	22456		590.25	93.18	31.43	21
EAGLE ARROW	9529592	Bulk	37046		656.13	105.85	40.49	39.24
EL COMINO	9624378	Bulk	34794		655.87	105.78	20.83	43.34
EMERALD ENTERPRISE	9701023	Bulk	21265		590.35	93.18	23.59	32.51
ENDLESS HORIZON	9499462	Bulk	32839		623.36	105.85	22.51	43.18
ERLYNE	9382736	Bulk	30351		623.06	100.04	30.84	28.58
EVER EXCELLENT	9899806	Bulk	44487		751.02	105.85	39.50	46.75
EXPLORER AFRICA	9460394	Bulk	34039		656.13	105.85	21	43.01
FABIA SCHULTE	9697155	Bulk	25515		590.42	104.99	25	23.49
FEDERAL FRASER	9866744	Bulk	21000		656.20	77.96	24.25	23.00
FEDERAL KIVALINA	9205885	Bulk	20659		656.17	77.96	31.99	21.49
FEDERAL TAKASE	9658989	Bulk	31584		623.36	105.85	21.00	41.18

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
FEDERAL TAMBO	9644495	Bulk	31590		623.39	105.85	30.58	
FELICIA K	9614309	Bulk	20992		594.39	93.18	22.57	21.10
FJ RUBY	9840881	Bulk	47006		751.35	124.68	24.08	44.75
FJ STAR	9797682	Bulk	35025		655.94	105.85	39.01	22.67
FORTUNE ISLAND	9570486	Bulk	34795		656.13	105.78	22.51	33.50
FRONTIER GARLAND	9590890	Bulk	92752		957.99	147.64	38.49	47.51
FRONTIER JASMINE	9933418	Bulk	93718		957.72	147.64	38.16	46.43
FU RONG FENG	9523184	Bulk	40913		738.22	105.85	23.59	28.68
FUTURE	9566447	Bulk	31753		623.36	105.81	41.01	22.84
GCL GODAVARI	9939929	Bulk	66667		836.66	141.08	28.09	46.59
GCL GOMTI	9939943	Bulk	66667		836.66	141.25	27.99	47.02
GCL KRISHNA	9939931	Bulk	66667		836.66	141.25	28.25	47.02
GENCO ENTERPRISE	9707699	Bulk	36280		655.87	105.85	41.01	25.99
GENCO MAXIMUS	9422081	Bulk	88397		943.29	147.64	35.17	47.02
GENCO MAYFLOWER	9714680	Bulk	36421		656.17	105.85	24.57	38.32
GEORGIA HARMONY	9836921	Bulk	24331		600.00	101.71	32.84	29.50
GEORGIOS P	9476680	Bulk	33044		623.36	105.85	21.00	43.24
GHARAPURI ISLAND	9496147	Bulk	32426		623.36	105.85	20.51	42.42
GIA AMBITION	9948425	Bulk	49305		745.44	118.12	25.92	46.00
GLOBAL ENTERPRISE	9490595	Bulk	89891		948.11	147.64	36.42	39.67
GLORY CUIABA	9311189	Bulk	40033		738.22	105.85	24.25	46.16
GLORY TRADER	9287778	Bulk	41205		737.54	105.98	24.25	46.59
GLOVIS MARIA	9543615	Bulk	32545		616.43	105.85	36.91	
GOLDEN BRILLIANT	9438638	Bulk	41586		738.22	107.19	23.00	47.02

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
GOLDEN FURIOUS	9860128	Bulk	44094		751.35	105.85	23.92	47.02
GREAT FORTUNE	9738507	Bulk	36429		656.17	105.85	23.59	38.32
GREEK SEAS	9718698	Bulk	44127		751.35	105.85	24.90	47.02
GRIZZLY	9659232	Bulk	44316		751.35	105.85	24.57	47.02
GUO MAY	9469625	Bulk	91412		958.05	147.64	39.08	47.02
GUO YUAN 86	9864186	Bulk	47370		751.35	111.55	25.26	46.82
HAMBURG TEAM	9855460	Bulk	25189		590.25	98.43	23.16	23.16
HERUN ZHOUSHAN	9715490	Bulk	94385		958.05	147.64	40.00	47.02
HISUI HORIZON	9707546	Bulk	107329		984.1	164.05	40.85	44.49
HL DALRYMPLE BAY	9458389	Bulk	93461		958.05	147.64	36.42	43.77
HL GLADSTONE	9581174	Bulk	93872		958.05	147.64	38.75	42.26
HONG SHENG	9563627	Bulk	40896		738.22	105.85	23.33	46.00
HOPA	9684213	Bulk	35812		656.17	105.85	23.49	44.00
HU PO HAI	9738090	Bulk	24748		590.55	98.43	22.34	27.66
IANTHE	9438779	Bulk	94008		958.05	147.64	40.00	47.25
IDEE FIXE	9700677	Bulk	36295		655.87	105.85	23.26	44.65
IMAVERE	9612325	Bulk	22746		613.55	91.31	32.25	20.34
IMPERATOR	9367906	Bulk	11743		459.08	82.02	20.41	17.09
IMPERIAL EAGLE	9478511	Bulk	31544		623.39	105.85	37.83	34.75
INCEPTION	9540481	Bulk	43837		751.35	105.94	23.66	45.57
INDIGO ACE	9758387	Bulk	43068		751.35	105.85	25.10	47.51
INDIGO JUGEM	9748497	Bulk	34813		656.13	105.78	22.25	43.18
INO HORIZON	9759977	Bulk	107215		984.27	164.05	40.16	47.02
INTERLINK NOBILITY	9711767	Bulk	25546		590.42	104.99	25.17	25.59

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
INTREPID	9324629	Bulk	30046		623.36	105.85	39.50	20.51
IOLI	9601340	Bulk	44133		751.35	105.85	24.84	47.02
IONIC SPIRIT	9514200	Bulk	31759		623.36	105.81	39.50	39.34
IRIDA GS	9614311	Bulk	20992		594.39	93.18	21.00	22.02
ISHIZUCHI STAR	9811919	Bulk	23351		590.58	97.77	22.41	21.00
JAL MURARI	9849564	Bulk	44397		751.35	105.85	28.51	
JASMUND	9696840	Bulk	24696		590.25	98.43	22.57	23.00
JIN ZHU HAI	9494383	Bulk	40896		738.22	105.85	23.59	46.00
JINLING CONFIDENCE	9798337	Bulk	25606		590.42	104.99	35.93	23.33
JY RIVER	9845269	Bulk	43968		751.35	105.85	24.25	47.02
KAIFONG	9860269	Bulk	22360		590.55	98.43	21.33	19.65
KANSU	9860283	Bulk	22360		590.55	98.43	33.66	21.33
KARLINO	9727510	Bulk	25278		590.55	98.43	25.99	24.57
KEY KNIGHT	9512317	Bulk	43013		751.32	105.85	24.67	44.00
KING MILO	9609512	Bulk	40850		738.22	105.85	23.00	46.00
KINLING	9893814	Bulk	22500		590.55	98.43	34.75	32.84
KIRSTEN OLDENDORFF	9863091	Bulk	43814		751.35	105.85	23.33	47.02
KIWI ARROW	9434527	Bulk	36925		656.13	105.85	36.16	35.01
KM OSAKA	9604990	Bulk	92752		961.27	147.64	34.58	47.51
KMARIN GENOA	9726504	Bulk	36518		655.87	105.85	29.17	25.99
KMARIN GOTEBORG	9643300	Bulk	43673		751.35	105.85	25.00	37.40
KNIGHTSHIP	9507893	Bulk	93186		958.05	147.87	38.09	47.02
KOTOR	9575981	Bulk	22456		590.25	93.18	20.67	34.75
KYPROS SPIRIT	9717436	Bulk	41759		738.22	105.65	25.66	

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
KYRA PANAGHIA	9647277	Bulk	35812		656.17	105.85	41.01	21.49
LA LUNA	9846079	Bulk	35194		656.13	105.85	23.00	25.26
LAKE DESPINA	9675676	Bulk	92726		957.72	147.64	33.24	47.25
LAN BAO HAI	9738105	Bulk	24748		590.55	98.43	31.99	21.65
LAURA D	9589633	Bulk	65976		853.16	141.12	25.92	45.51
LAURENCE FRANCOISE	9827061	Bulk	43067		751.32	105.85	24.35	43.41
LEM VERBENA	9845829	Bulk	36781		655.87	106.01	32.84	29.00
LEMESSOS QUEEN	9959149	Bulk	43613		751.32	105.85	25.66	46.66
LEON	9303871	Bulk	30707		623.36	105.85	39.67	31.99
LEONIDAS	9696474	Bulk	32502		655.87	105.85	24.25	43.51
LEONIDAS P.C.	9461233	Bulk	43012		751.32	105.85	23.82	47.02
LEYLA AKSOY	9931159	Bulk	34628		655.87	105.78	21.65	43.57
LIMA TRADER	9500821	Bulk	33042		623.09	105.85	31.01	42.92
LIVIA ROSE	9803352	Bulk	43066		751.32	105.85	23.33	46.10
LORDSHIP	9519066	Bulk	93564		958.05	147.81	35.99	47.02
LOWLANDS FUTURE	9799771	Bulk	34229		656.17	105.85	22.34	35.50
MAESTRO SAPPHIRE	9756250	Bulk	25427		590.25	98.43	31.60	25.10
MAGIC HORIZON	9553062	Bulk	39737		738.03	105.85	24.18	46.49
MAGIC ORION	9346330	Bulk	90085		947.98	147.64	37.67	47.02
MALINDI	9363015	Bulk	91739		958.05	147.64	33.99	47.02
MALTO ELAN	9792436	Bulk	32388		623.39	105.85	35.50	22.34
MAMA SARA	9933236	Bulk	44732		751.35	105.85	24.57	46.10
MAPLE HARBOUR	9593323	Bulk	31540		623.39	105.85	18.41	42.59
MARAN BRILLIANCE	9721035	Bulk	93127		958.05	147.81	39.08	

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
MARAN INNOVATION	9286798	Bulk	87250		948.21	147.64	32.84	47.02
MARAN PROGRESS	9606754	Bulk	61677		819.86	141.08	27.27	47.51
MARAN VICTORY	9721023	Bulk	93128		958.05	147.64	38.32	47.08
MARDINIK	9470571	Bulk	23322		593.80	98.56	31.99	19.85
MARIANNE STOEGER	9604859	Bulk	44096		751.35	105.85	23.82	30.68
MARINE WISDOM	9606766	Bulk	61677		819.86	141.08	26.84	47.51
MAXWELL	9782027	Bulk	43665		751.32	105.85	24.35	
MEDI EOLIE	9728186	Bulk	43036		751.32	105.85	24.02	46.92
MERITIUS	9515632	Bulk	17018		555.70	89.24	29.50	27.59
MINANUR CEBI 1	9480564	Bulk	23322		593.86	98.43	19.65	31.66
MINERAL HONSHU	9614892	Bulk	92727		957.72	147.64	39.83	47.02
MONDIAL SUN	9859296	Bulk	43368		751.35	105.78	24.74	46.49
MONTEVIDEO	9450777	Bulk	23456		590.58	98.43	20.51	30.84
MORNINGSTAR	9263069	Bulk	28795		623.03	100.07	32.25	30.15
MOUNT TROODOS	9402287	Bulk	93712		958.05	147.64	34.16	47.02
MSXT THALIA	9929326	Bulk	49228		754.30	118.28	25.59	45.93
NAOMI	9750971	Bulk	94351		958.02	147.81	35.01	
NAVIOS ANTARES	9481257	Bulk	88421		943.29	147.64	38.91	47.02
NAVIOS APOLLON I	9290842	Bulk	46982		751.35	119.76	28.25	47.02
NAVIOS ASTRA	9938614	Bulk	93297		958.05	147.64	40.00	47.08
NAVIOS BUENA VENTURA	9481233	Bulk	92715		958.05	147.64	39.67	47.02
NAVIOS CORALI	9747948	Bulk	92722		957.99	147.64	35.99	47.02
NAVIOS HERAKLES I	9852937	Bulk	44120		751.02	105.78	27.59	
NAVIOS PHOENIX	9552276	Bulk	90423		948.21	147.64	36.75	47.02

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
NAVIOS PRIMAVERA	9947225	Bulk	44175		751.02	105.78	24.08	47.02
NAVIOS SOL	9545170	Bulk	90399		948.21	147.64	38.49	47.02
NAVIOS URANUS	9852884	Bulk	43041		751.32	105.85	24.02	46.49
NBA MONET	9512305	Bulk	43013		751.32	105.85	23.59	47.02
NIKGENIOUS (X NAVIGARE BOREAS)	9729922	Bulk	34614		655.87	105.78	38.75	
NOOTKA ISLAND	9705299	Bulk	61593		655.87	105.78	22.02	43.67
NORD ANDROMEDA	9929390	Bulk	44654		751.35	105.85	24.02	39.18
NORD POWER	9537848	Bulk	93789		957.92	147.64	32.09	47.02
NORDIC BC MUNICH	9602174	Bulk	24187		590.58	98.56	31.5	21.16
NORDIC OLYMPIC	9727118	Bulk	41071		738.22	106.07	28.58	46.92
NORDMOSEL	9741877	Bulk	25546		590.51	104.99	24.57	23.82
NS GUANG ZHOU	9954955	Bulk	35433		655.87	105.85	23.59	45.51
NSU AMBITIOUS	9870563	Bulk	108100		984.14	164.05	37.99	44.92
NSU CHALLENGER	9870575	Bulk	108100		984.14	164.05	33.50	44.49
NSU SIRIUS	9774379	Bulk	94116		957.89	147.64	40.85	45.02
NY TRADER III	9761231	Bulk	24842		590.25	98.43	24.35	24.02
NYMPHE	9438781	Bulk	94008		958.05	147.64	33.93	47.02
OCEAN JOY	9668300	Bulk	23268		590.48	97.77	32.84	19.33
OCEAN PEARL	9401829	Bulk	29829		618.47	105.85	22.67	28.84
OCEANIC PRAISE	9687150	Bulk	22476		590.55	98.43	27.59	26.58
OCEANLADY	9641364	Bulk	33049		623.36	105.85	39.01	36.58
ORANGE HARMONY	9764099	Bulk	43088		751.32	105.85	22.51	47.34
ORIENTAL EXPRESS	9346366	Bulk	90091		947.98	147.64	35.76	47.02
OTAGO HARBOUR	9268928	Bulk	19829		573.19	91.21	23.59	18.01

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
OU MAY	9751016	Bulk	94724		967.83	150.96	39.34	47.02
PACIFIC VICTORY	9731896	Bulk	36449		655.87	105.85	24.02	25.99
PALANCA RIO	9302619	Bulk	90389		1101.43	140.66	28.91	23.00
PAN QUEST	9864394	Bulk	36025		655.87	105.85	31.99	23.75
PAN TOPAZ	9625827	Bulk	45055		751.35	105.78	24.35	31.83
PANAGIOTIS	9461063	Bulk	43817		751.35	105.78	22.67	47.02
PARTNERSHIP	9597848	Bulk	93175		957.95	147.64	37.99	
PAUL OLDENDORFF	9540871	Bulk	64769		833.37	141.28	25.00	47.02
PENELOPE I	9762601	Bulk	43007		751.32	105.85	25.26	47.02
PENGUIN ISLAND	9520962	Bulk	32433		623.36	105.85	20.34	42.59
PHATRA NAREE	9649861	Bulk	22860		590.58	98.56	22.18	33.50
PORT OSAKA	9838541	Bulk	35207		656.13	105.85	37.99	44.59
PORTO LEONE	9656096	Bulk	36353		656.2	105.85	24.57	44.39
PRISCILLA	9880221	Bulk	43829		740.49	105.85	24.35	46.10
PRT KAHO	9701152	Bulk	40937		738.16	105.78	23.66	47.02
PSU CMP	9446099	Bulk	90411		947.98	147.64	35.76	47.02
PUFFIN ARROW	9566605	Bulk	36925		656.13	105.85	41.01	22.34
QING MAY	9492220	Bulk	106884		984.04	164.05	35.07	42.26
RADIUS	9526710	Bulk	22866		583.53	95.15	29.27	21.16
REX OLDENDORFF	9463671	Bulk	65976		854.57	141.08	25.76	47.02
RICHMOND PEARL	9347889	Bulk	31117		623.36	105.85	30.91	23.49
RIK OLDENDORFF	9463657	Bulk	65976		854.27	141.08	26.25	47.51
RIVER PEARL	9363663	Bulk	29765		618.47	105.85	27.49	23.49
RIXTA OLDENDORFF	9598567	Bulk	66019		853.06	141.08	26.90	47.51

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
ROSSANA	9696838	Bulk	25546		590.42	104.99	34.52	27.92
ROWAYTON EAGLE	9575216	Bulk	35812		656.17	105.85	38.91	35.43
ROYAL KALEIDO	9851505	Bulk	43315		751.35	105.85	26.41	47.02
RT. HON. PAUL E. MARTIN	9600970	Bulk	43691		750.04	105.65	32.91	28.35
RUDDY	9459981	Bulk	19814		606.85	77.76	31.17	20.34
SAGITTARIUS	9550254	Bulk	17025		555.70	89.24	31.92	18.41
SAKIZAYA STAR	9861316	Bulk	44314		751.35	105.85	24.51	46.00
SANDPIPER BULKER	9441427	Bulk	33045		618.73	105.85	23.00	42.00
SANTA CAROLINA	9800398	Bulk	35035		655.94	105.85	39.01	31.17
SANTA FRANCESCA	9748124	Bulk	34810		656.13	105.78	20.74	43.08
SANTA SOPHIA	9404766	Bulk	58100		835.41	141.21	22.51	45.02
SANTANDER	9916305	Bulk	36108		655.87	105.85	23.66	
SARAH H	9858539	Bulk	43518		751.35	105.85	27.00	47.02
SARONIC TRADER	9453535	Bulk	51208		751.97	124.97	26.25	46.92
SASEBO ACE	9507960	Bulk	40339		738.22	105.81	24.08	47.02
SATIGNY	9875604	Bulk	36106		655.87	105.85	23.00	39.08
SAVITA NAREE	9726437	Bulk	36416		655.87	105.85	24.25	37.83
SEA AFFLUENCE	9569255	Bulk	33044		623.36	105.85	21	42.75
SEA BREEZE	9869710	Bulk	25546		590.58	104.99	23.33	35.99
SEA DOLPHIN C	9486427	Bulk	23236		594.19	98.56	22.02	32.35
SEA JUNO	9460588	Bulk	40070		738.22	105.85	23.92	46.82
SEA PEGASUS	9598220	Bulk	44276		751.35	105.85	24.74	47.25
SEA TREASURE	9885427	Bulk	34584		655.87	105.78	39.01	20.51
SEALEADER II	9439606	Bulk	94710		967.9	150.93	35.99	47.51

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
SERENITY	9544762	Bulk	22683		611.58	91.31	31.99	31.99
SHANDONG DE YUN	9872080	Bulk	94674		958.05	147.64	35.99	47.02
SHANDONG FU HUI	9734733	Bulk	44120		751.35	105.85	26.08	47.25
SHEILA ANN	9138094	Bulk	41428		738.22	105.58	29.50	39.01
SHENG WU	9286956	Bulk	39964		738.22	105.85	24.35	46.75
SIKINOS	9941570	Bulk	24000		590.25	98.43	28.35	20.01
SM NEW ORLEANS	9842499	Bulk	43989		751.35	105.85	23.16	47.02
SPAR VIRGO	9299276	Bulk	32474		623.39	105.94	24.02	42
SSI INEVITABLE	9336012	Bulk	89728		948.11	147.64	33.99	47.02
SSI MAGNIFICENT	9391828	Bulk	20236		581.16	93.18	20.67	
ST PAUL	9623051	Bulk	22856		583.36	93.84	32.51	23.43
STAR AQUA	9345805	Bulk	88930		948.21	147.64	37.50	47.02
STAR AQUILA	9594573	Bulk	33114		623.36	105.85	21.65	23.33
STAR CHALLENGER	9632997	Bulk	34777		656.13	105.78	21	41.34
STAR CLAUDINE	9444534	Bulk	95309		958.05	147.64	41.01	47.51
STAR MARTHA	9564097	Bulk	90126		947.98	147.64	37.01	47.34
STAR SHIBUMI	9921623	Bulk	93500		958.05	147.64	30.84	47.02
STAR TRIUMPH	9254692	Bulk	88594		948.21	147.64	36.58	47.02
STAR ZULU	9539729	Bulk	63993		837.44	141.08	25.10	47.02
STELIOS T (X ORIENT MATE)	9571430	Bulk	22910		593.27	98.59	31.66	29.43
STELLA GS	9363285	Bulk	20236		581.16	93.18	26.74	21.75
STERLING SVEA	9626687	Bulk	44601		751.35	105.78	24.02	47.51
STOJA	9585558	Bulk	30092		623.36	105.78	21.82	40.00
STRATEGIC HARMONY	9689897	Bulk	24658		590.58	98.43	31.99	21.00

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
STRATEGIC SPIRIT	9626388	Bulk	22662		611.58	91.21	23.92	20.67
STRATEGIC UNITY	9648099	Bulk	24641		590.55	98.43	32.35	27.49
SUDESTADA	9426087	Bulk	51255		752.01	125.73	25.99	47.02
SZARE SZEREGI	9708057	Bulk	25278		590.55	98.43	25.66	24.25
T PRIME	9611503	Bulk	20867		590.25	93.18	22.34	18.50
TAI SUCCESS	9642148	Bulk	34775		656.13	105.78	22.02	35.43
TAWA ARROW	9401879	Bulk	30983		623.36	105.85	28.74	
TBC PROGRESS	9489821	Bulk	19999		579.26	89.90	32.51	24.02
TCZEW	9727493	Bulk	25278		590.55	98.43	26.41	28.18
TEXAS HARMONY	9846160	Bulk	24331		600.00	101.71	31.01	
THALASSINI AGATHA	9479204	Bulk	93190		958.05	147.64	35.76	47.02
THALASSINI NIKI	9723186	Bulk	93245		957.72	147.64	35.24	47.51
THALASSINI NJORD	9757838	Bulk	92696		957.99	147.64	37.76	47.02
TIZIANA	9744764	Bulk	22457		580.7	98.43	33.24	20.83
TOMINI ALIZE	9754082	Bulk	24940		590.25	98.43	25.66	26.18
TOMINI FELICITY	9831799	Bulk	36380		655.77	105.85	23.33	44.16
TOMINI OROSHI	9714795	Bulk	25546		589.10	104.99	32.42	24.02
TOMINI SHAMAL	9709257	Bulk	25546		590.42	104.99	25.33	23.43
TOMINI SIROCCO	9711743	Bulk	25546		590.42	104.99	26.25	23.00
TRAMMO BAUMANN	9762883	Bulk	25611		590.35	105.19	25.59	25
TRANSATLANTIC	9597238	Bulk	43721		751.35	105.85	28.25	45.24
TRANSOCEAN	9644251	Bulk	15732		522.99	80.06	21.59	18.08
TRANSTIME	9595929	Bulk	32987		623.36	105.85	41.01	21.65
TRINIDAD PEARL	9659737	Bulk	27440		600.39	99.74	35.01	31.01

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
UBC STOCKHOLM	9426879	Bulk	21018		564.10	91.87	32.84	22.84
ULTRA BOSQUE	9880013	Bulk	25163		590.25	98.43	31.01	22.57
ULTRA COUGAR	9702778	Bulk	43184		751.32	105.85	23.00	46.43
ULTRA COURAGE	9856256	Bulk	35906		655.87	105.85	30.91	23.92
ULTRA PUMA	9758399	Bulk	43028		751.32	105.85	23.33	32.84
ULTRA SILVA	9873890	Bulk	25163		590.25	98.43	25.26	22.74
UNISON SAGE	9838448	Bulk	34896		656.2	105.85	23.92	45.02
UNITED ADVENTURE	9465215	Bulk	92822		957.72	147.64	36.09	45.93
UNITY ODYSSEY	9668934	Bulk	22469		590.55	98.43	21.59	
VEGA FALKTIND	9497426	Bulk	19994		582.15	92.49	17.75	17.75
VIRTUOUS STRIKER	9493690	Bulk	33044		623.36	105.85	39.08	22.34
W-ACE	9484687	Bulk	51239		752.01	125.73	25.26	47.18
WADI TIBA	9460746	Bulk	43736		751.35	105.78	23.33	46.26
WARIYA NAREE	9353668	Bulk	32661		623.26	106.07	21.65	
WARRIOR	9605865	Bulk	33044		623.36	105.85	40.91	22.74
WECO HOLLI	9929699	Bulk	34516		655.87	105.94	31.01	22.34
WOOYANG QUEEN	9491680	Bulk	22863		583.53	93.84	23.43	22.08
W-SKY	9476666	Bulk	51239		752.01	125.73	25.59	43.01
XIN BIN HAI	9492098	Bulk	94338		966.16	151.25	44.16	47.02
YANGZE 6	9718909	Bulk	36426		655.74	105.85	24.02	44.33
YASA DIAMOND	9877846	Bulk	49504		745.44	118.28	26.90	39.08
YONG MAY	9862970	Bulk	47002		749.71	119.76	25.26	46.59
ZHAO YANG FENG	9576791	Bulk	40913		738.22	105.85	26.9	
ZHEN MAY	9862982	Bulk	47002		749.71	119.76	24.02	46.59

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
AGIOS DIMITRIOS	9349605	Container	74175	6542	981.68	131.24	38.32	36.75
ARIANA	9327671	Container	32161	2732	691.80	105.81	34.42	33.50
BF HAMBURG	9332860	Container	71786	6494	961.92	131.24	36.42	33.01
BREMEN	9450387	Container	91203	8580	1096.08	141.08	34.52	33.83
BSG BAHAMAS	9439498	Container	41358	4255	859.79	105.65	30.84	27.92
CALANDRA	9445887	Container	35878	2758	697.21	105.65	34.42	29.82
CCNI ANDES	9718935	Container	95138	9030	984.20	158.18	34.75	
CEZANNE	9697416	Container	95128	10000	984.04	158.41	40.49	40.32
CMA CGM BALBOA	9344655	Container	22914	1819	611.55	90.56	30.84	31.33
CONTI COURAGE	9293789	Container	90449	8073	1095.92	140.43	31.83	29.50
DALI	9697428	Container	95128	10000	984.04	158.41	35.99	36.09
DUBAI EXPRESS	9440825	Container	41358	4255	859.92	105.81	32.15	30.84
EVER FAIR	9850886	Container	116295	11850	1095.69	158.90	44.85	45.74
EVER FAME	9850800	Container	116295	11888	87.90	158.80	42.65	45.02
EVER FAVOR	9850850	Container	117000	11850	1095.85	158.80	40.68	39.34
EVER FEAT	9850898	Container	116295	11850	1095.69	158.80	44.92	44.75
EVER FOND	9850848	Container	117000	11850	1095.85	158.80	40.00	41.01
EVER FOREVER	9850575	Container	117340	11000	1095.72	158.80	44.42	41.83
EVER FORTUNE	9850563	Container	112836	11000	1095.85	158.80	44.33	45.34
EVER FRANK	9850587	Container	112836	11000	1095.85	158.80	42.32	42.00
EVER MACH	9935210	Container	165350	15000	1200.85	167.33	43.57	43.01
EVER MAX	9935208	Container	165350	15500	1200.85	167.33	45.02	45.02
GEORG MAERSK	9320257	Container	98648	9204	1203.90	140.89	45.08	47.25
GERDA MAERSK	9359052	Container	99002	7000	1203.77	140.89	44.59	44.49

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
GJERTRUD MAERSK	9320233	Container	98648	7668	1203.80	140.43	46.00	46.00
GLEN CANYON	9302097	Container	68570	5642	934.13	131.24	39.67	38.75
GRETE MAERSK	9302889	Container	98648	6600	1203.90	140.89	45.34	46.82
GSL ELEFTHERIA	9509140	Container	39905	3400	697.21	105.65	35.07	32.15
GSL NICOLETTA	9229348	Container	75201	6178	983.64	131.24	29.66	30.74
GSL SOFIA	9260421	Container	93496	6600	1155.73	140.92	37.99	37.76
GSL TRIPOLI	9437048	Container	52726	5301	964.91	105.65	33.83	31.83
GSL VALERIE	9315874	Container	28927	2824	725.10	98.53	35.17	29.82
GUDRUN MAERSK	9302877	Container	98648	9074	1203.90	140.89	44.00	45.34
GUNHILDE MAERSK	9359026	Container	99002	7000	1203.77	140.89	45.24	45.51
GUNVOR MAERSK	9302891	Container	98648	6600	1203.90	140.43	45.34	45.51
GUSTAV MAERSK	9359038	Container	99002	7000	1203.77	140.89	45.51	45.57
GUTHORM MAERSK	9359040	Container	99002	7000	1203.77	140.89	45.02	44.75
JPO LIBRA	9297840	Container	41359	4132	866.32	105.81	32.84	27.49
LORI	9631125	Container	40855	3610	748.07	122.38	32.09	29.92
LYON II	9222285	Container	73172	6447	984.20	132.22	43.51	37.60
MAERSK ALGOL	9342528	Container	109534	9000	1107.67	149.61	41.67	42.26
MAERSK BENTONVILLE	9313929	Container	48853	4196	964.94	105.58	39.08	33.01
MAERSK EINDHOVEN	9456771	Container	141716	13092	1202.36	158.14	41.01	
MAERSK EMERALD	9502910	Container	141754	13092	1202.22	158.14	42.59	38.75
MAERSK ESMERALDAS	9502972	Container	141754	13092	1202.29	158.18	40.00	38.75
MAERSK GARONNE	9235579	Container	50686	4318	958.31	105.81	36.42	29.66
MAERSK GATESHEAD	9235543	Container	50686	4318	958.31	105.81	36.09	31.66
MAERSK GIRONDE	9235555	Container	50686	4318	958.31	105.81	37.01	34.75

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
MAERSK GUAYAQUIL	9727871	Container	113042	10100	1105.70	158.57	38.42	33.50
MAERSK KARLSKRONA	9085558	Container	81488	7403	1044.01	140.43	32.51	34.58
MAERSK KENTUCKY	9193240	Container	50698	4300	958.31	105.81	34.42	33.01
MAERSK MAKUTU	9318319	Container	50686	4154	958.31	105.81	34.25	31.50
MAERSK SARAT	9732591	Container	93702	9443	984.3	158.14	35.07	35.43
MAERSK SEMAKAU	9315252	Container	79702	6248	1044.70	131.44	38.42	34.84
MAERSK SHAMS	9726669	Container	95205	9962	984.04	158.14	39.67	39.01
MAERSK SHEKOU	9466984	Container	94407	8411	1091.72	144.36	34.09	33.83
MAERSK SHIVLING	9728253	Container	96424	9162	984.27	158.80	36.09	35.43
MAERSK SINGAPORE	9308649	Container	93511	8466	1099.07	140.43	41.67	41.50
MAERSK SIRAC	9725718	Container	95205		984.04	158.41	37.40	37.08
MAERSK SURABAYA	9330068	Container	94322	8400	1091.19	141.74	30.51	31.17
MAERSK VALLVIK	9411381	Container	20927	1810	589.46	90.56	31.17	29.92
MAERSK VILNIUS	9408956	Container	20927	1810	589.33	90.65	29.27	27.59
MAERSK VIRGINIA	9235531	Container	50686	4658	958.31	105.81	31.99	32.15
MAERSK VISBY	9411367	Container	20927	1810	589.37	90.56	29.27	33.17
MAERSK YUKON	9398436	Container	114044	10062	1145.07	149.61	39.08	37.40
MH HAMBURG	9332860	Container	71786	6494	961.92	131.24	35.43	34.09
MSC ACAPULCO	9401776	Container	41322	4330	849.48	105.65	33.83	31.17
MSC ADONIS	9706310	Container	96424	9162	984.27	158.80	34.42	31.01
MSC AGADIR	9619464	Container	94453	8762	981.61	158.14	38.42	34.75
MSC ALESSIA	9225653	Container	75590	6732	984.27	131.24	39.77	40.00
MSC ALINA	9695016	Container	94930	9000	984.04	158.41	36.09	36.26
MSC ALMA VII	9196852	Container	74661	6252	997.36	131.24	36.75	33.83

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
MSC AMALFI	9605279	Container	95166	9403	984.00	158.14	33.50	33.24
MSC ANSHIKA VI	9254848	Container	64845	5680	901.16	131.24	36.42	31.17
MSC ANTIGUA	9619476	Container	94453	8762	981.61	158.14	31.17	31.17
MSC APOLLO	9247730	Container	75484	6492	983.97	131.24	31.50	30.68
MSC ATHOS	9618317	Container	96262	8800	984.14	158.14	32.51	30.68
MSC AZOV	9605255	Container	95166	9403	983.87	158.11	39.40	38.58
MSC BARBADOS	9289544	Container	54626	5075	964.94	105.65	32.51	30.84
MSC BARCELONA	9480186	Container	61870	5560	886.79	131.24	32.51	33.17
MSC BEIJING	9289099	Container	89954	8034	1065.67	140.43	37.76	37.01
MSC BOSPHORUS	9247742	Container	75484	6492	983.97	131.24	36.42	32.51
MSC BREMEN	9369734	Container	54605	5029	965.11	105.81	32.84	29.82
MSC BRITTANY	9724049	Container	96424	9162	984.27	158.80	31.17	33.50
MSC CANDICE	9339284	Container	109109	9178	1104.65	149.61	33.50	
MSC CAPUCINE R	9210086	Container	37113	3430	797.61	105.65	30.51	30.51
MSC CATHERINE VI	9229300	Container	75201	6178	981.02	131.24	38.75	38.75
MSC CHARLESTON	9299537	Container	89954	8034	1065.83	140.43	32.51	30.15
MSC CLEA	9720524	Container	95514		983.97	158.14	34.09	35.17
MSC CORNELIA	9426817	Container	54182	5086	964.25	105.65	37.4	35.76
MSC DARDANELLES	9247754	Container	75484	6492	983.97	131.24	35.07	34.16
MSC DARWIN VI	9200689	Container	66278	5618	914.81	132.22	37.08	35.66
MSC DUBAI VII	9444285	Container	71867	6350	968.49	131.24	31.99	28.91
MSC ELA	9282259	Container	54304	5059	964.81	105.65	33.17	30.15
MSC ELENI	9278143	Container	54881	5059	964.91	105.65	39.34	31.83
MSC ENGLAND	9232890	Container	39812	4132	846.14	106.14	30.51	30.84

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
MSC ESTHI	9304411	Container	109109	9178	1104.61	149.61	35.07	34.75
MSC EVEREST VIII	9286231	Container	90745	8238	1096.08	141.08	33.83	28.84
MSC FIE X	9120853	Container	91560	7226	1138.44	140.43	34.25	32.51
MSC GREENWICH	9286267	Container	91038	8238	1096.05	141.08	35.99	36.26
MSC HONG KONG V	9231810	Container	53453	4800	964.94	105.65	35.07	33.83
MSC ILONA	9225641	Container	75590	6732	984.23	131.24	40.09	34.52
MSC INDIA	9231248	Container	65792	5762	908.84	131.37	37.60	33.99
MSC JEONGMIN	9720471	Container	95514	9400	983.94	158.14	34.75	33.50
MSC JOANNA	9304435	Container	107849	9178	1104.61	149.61	33.83	34.09
MSC JUDITH	9299549	Container	91023	8034	1065.80	140.43	35.07	34.32
MSC KATYAYNI	9110389	Container	64054	5711	900.96	131.24	36.09	31.50
MSC KOREA	9123154	Container	37518	3398	796.63	105.65	33.43	30.51
MSC LETIZIA	9702065	Container	96331	8800	983.61	158.14	36.42	35.66
MSC LORENA	9320403	Container	50963	4870	902.28	105.65	30.84	26.67
MSC LOS ANGELES	9327798	Container	66199	5527	906.21	131.57	36.75	34.42
MSC LUCY	9289104	Container	89954	8034	1065.83	140.43	32.84	32.15
MSC MAEVA	9289128	Container	89954	8034	1065.77	140.43	39.34	39.01
MSC MARINA	9275971	Container	73819	6750	997.16	139.44	42.32	44.16
MSC MATTINA	9315915	Container	42484	2824	866.87	105.65	32.15	30.51
MSC MAUREEN	9251717	Container	75590	6750	984.27	131.24	39.50	34.09
MSC MELISSA	9226918	Container	73819	6730	997.06	131.24	39.34	42.26
MSC MICHAELA	9230488	Container	73819	6730	997.19	131.24	37.08	37.76
MSC NERISSA	9278155	Container	54881	5050	964.88	105.65	31.50	29.99
MSC NIOVI VIII	9290488	Container	83011	7471	984.53	140.43	32.84	31.17

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
MSC NOA	9398228	Container	75582		997.95	139.44	29.99	30.15
MSC PARIS	9301483	Container	89941	8204	1096.08	140.43	36.75	34.09
MSC PEGASUS	9267637	Container	76199	6586	984.14	131.24	37.76	34.42
MSC PETRA	9222302	Container	73157	6627	984.14	132.22	35.83	31.50
MSC PHOENIX	9267649	Container	77048	6586	984.14	131.24	38.42	37.08
MSC PINA	9339272	Container	108930	9178	1104.68	149.61	35.07	31.50
MSC QINGDAO	9256470	Container	89097	7731	1059.66	140.43	40.32	41.83
MSC RACHELE	9290282	Container	90745	8238	1095.99	140.43	38.91	39.34
MSC RIKKU	9393319	Container	94479	8600	1114.29	149.61	37.40	30.15
MSC ROBERTA V	9038907	Container	53815		964.91	105.81	32.51	27.99
MSC ROBERTA V	9038907	Container	53815	4639	964.91	105.81	36.42	28.25
MSC ROCHELLE	9141297	Container	53324	4545	965.04	105.65	36.75	33.17
MSC ROMA	9304447	Container	107849	9078	1104.42	149.61	37.76	36.75
MSC SARAH V	9181675	Container	53208	4400	964.75	105.98	28.51	25.99
MSC SHAHAR	9471238	Container	40993	4250	856.44	105.81	34.09	29.50
MSC SHAY	9393022	Container	95681	8562	1114.23	153.12	39.40	40.68
MSC SHIRLEY	9224049	Container	23890	2024	617.12	98.43	30.15	30.15
MSC SILVANA	9309459	Container	94489	8401	1089.26	141.74	36.42	37.76
MSC SILVIA	9720457	Container	95514	9400	983.91	158.11	41.34	41.77
MSC SIYA B	9793947	Container	114000	11923	1082.73	158.14	39.67	35.76
MSC SURABAYA VIII	9330068	Container	94322	8400	1091.19	141.74	32.84	29.50
MSC SWEDEN VI	9231262	Container	66257	5762	909.56	131.37	33.66	32.25
MSC TAVVISHI	9189366	Container	66526	5468	912.12	131.24	36.75	36.16
MSC TIANJIN	9285471	Container	89097	8063	1059.66	140.43	38.09	33.76

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
MSC TIANPING	9305489	Container	91649	8204	1096.12	140.43	37.76	39.34
MSC TORONTO	9299525	Container	89954	8034	1065.73	140.43	35.07	33.99
MSC UBERTY	9337444	Container	90507	8626	1093.36	140.43	34.09	33.24
MSC UNITED VIII	9302619	Container	90389	8200	1101.43	140.66	36.09	33.17
MSC UNITED VIII	9302619	Container	90389	8200	1101.43	140.66	31.83	30.84
MSC VILDA X	9146479	Container	92198	7226	1138.44	140.43	39.34	31.50
MSC VITTORIA	9299551	Container	89954	8034	1065.80	140.43	30.51	31.50
MSC YAMUNA VI (XMAERSK YAMUNA)	9288409	Container	66462	5928	920.45	131.24	35.07	
MSC YUVIKA V	9141285	Container	53324	4428	964.94	105.65	39.34	36.09
NAVIOS DEVOTION	9352420	Container	39906	4250	855.39	105.81	33.17	29.07
NELE MAERSK	9192442	Container	27733	2240	651.61	99.09	31.50	30.35
NORTHERN DIAMOND	9405033	Container	36007	3534	757.68	105.65	33.17	28.58
NORTHERN JAMBOREE	9450363	Container	94419	8411	1091.79	141.74	43.01	40.49
NORTHERN JUBILEE	9450337	Container	94419	8411	1094.44	141.74	35.07	33.83
NORTHERN MAGNITUDE	9252553	Container	75590	6732	984.27	131.24	32.51	32.68
NORTHERN MAJESTIC	9252565	Container	75590	6732	984.27	131.24	39.34	37.17
NORTHERN MONUMENT	9252577	Container	75590	6732	984.27	131.24	37.6	36.52
NORTHERN PROMOTION	9467043	Container	47855	4616	867.10	105.65	29.66	28.51
ORCA I	9318113	Container	54309	5041	965.01	105.65	35.83	33.93
PARIS II	9222273	Container	73172	6447	984.23	132.22	36.75	32.84
POLAR ECUADOR	9786774	Container	43628	3884	754.63	122.38	37.08	32.51
PROTOSTAR N	9360257	Container	28007	2741	727.56	97.77	27.27	27.92
QUEEN ESTHER	9700251	Container	25145	2190	606.76	98.43	28.84	25.26
ROBIN 2	9399739	Container	32984	2797	736.58	102.33	32.84	32.84

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
SANTA ROSA	9430363	Container	85676	7114	983.97	140.43	31.01	30.68
SEASPAN CHIBA	9492713	Container	46444	4520	885.21	114.84	34.16	32.15
SEASPAN EMERALD	9407134	Container	54940	5041	965.04	107.22	35.76	31.17
SEASPAN KOBE	9492701	Container	46444	4520	885.21	114.84	35.76	32.84
SEASPAN SANTOS	9434321	Container	43810		590.58	98.43	35.07	31.17
SHIJING	9348663	Container	54675	5089	964.88	105.65	36.26	35.43
TAIPEI TRIUMPH	9737498	Container	151417	13870	1200.65	168.45	46.92	47.51
TALOS	9728930	Container	149210	14354	1210.66	167.43	41.01	42.00
TAMPA TRIUMPH	9737462	Container	150709	13870	1200.52	167.99	37.76	41.01
TAURUS	9728942	Container	149210	14354	1210.66	167.46	44.65	43.01
TEXAS TRIUMPH	9737503	Container	153014	14000	1200.52	168.45	40.59	41.57
THESEUS	9728954	Container	149210	14354	1210.66	167.46	37.40	37.76
TITAN	9728928	Container	149210	1134	1210.66	167.43	44.33	41.34
TOCONAO	9627899	Container	96628	8704	983.97	158.80	33.43	32.84
TOKYO TRIUMPH	9737474	Container	150709	13870	1200.52	167.99	42.65	43.34
TOLEDO TRIUMPH	9737486	Container	150709	13870	1200.52	167.99	45.02	45.24
TRAIGUEN	9627904	Container	96628	8704	983.97	158.80	30.58	32.51
TRITON	9728916	Container	149210	14354	1210.66	167.33	42.85	40.75
UTE	9320685	Container	53481	5041	964.94	108.80	36.16	30.51
VIRGO	9430765	Container	41225	4258	869.30	105.81	30.51	31.01
W KAMPALA	9215311	Container	80609	6802	984.27	140.43	31.50	30.51
XIAMEN	9318151	Container	39906	4253	854.93	105.65	27.92	23.66
ZIM ALABAMA	9677026	Container	71112	6900	886.10	140.66	37.08	37.17
ZIM AMBER	9967952	Container	74693	7000	892.43	140.82	40.68	39.34

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
ZIM AMERICA	9244934	Container	74656	6246	996.83	131.24	38.09	33.66
ZIM EUROPE	9189354	Container	66526	5618	912.15	131.24	38.49	37.34
ZIM HAIFA	9218650	Container	65792	5506	908.84	131.37	38.75	38.16
ZIM PUSAN	9200706	Container	66278	5618	914.87	132.22	34.84	33.07
ZIM SAVANNAH	9250971	Container	74071	6402	964.19	131.24	38.42	35.07
ZIM TAMPA	9196840	Container	74661	6252	997.36	131.24	38.42	37.99
ZIM VIETNAM	9244922	Container	74656	6246	996.90	131.24	36.09	32.51
ZIM VIRGINIA	9231808	Container	53453	4800	964.94	105.65	31.43	25.59
ZIM YANTIAN	9305582	Container	109149	9469	1150.19	140.43	40	39.08
ADAM ASNYK	9432115	General	24115	1904	655.54	91.21	29.17	
ADRIATICBORG	9546497	General	11885	959	469.18	70.54	26.25	20.34
ALAMOSBORG	9466348	General	11885	962	468.82	70.54	29.50	27.27
ALASKABORG	9466374	General	11885	962	465.90	70.54	31.83	21.33
ALBANYBORG	9466300	General	11885	962	468.53	70.54	31.83	19.33
AMAZONEBORG	9333541	General	11894	962	469.18	70.54	29.99	21.00
AMERICABORG	9365659	General	11894	962	469.18	71.36	26.25	
AMSTELBORG	9333527	General	11894	962	468.82	70.54	30.51	19.00
ANDESBORG	9466324	General	11885		469.18	70.54	20.18	21.33
ANNAMARIA	9488633	General	6569	275	545.40	59.06	17.00	19.65
ARAGONBORG	9466312	General	11885	962	468.79	71.49	30.41	18.77
ARUBABORG	9466295	General	11864	962	469.18	70.54	31.17	19.65
ASIAN SPIRIT	9273806	General	10899	767	482.60	71.66	22.25	21.00
ATLANTIC ACTION II	9509633	General	22863	1158	588.81	91.87	27.92	23.00
ATLANTIC NAVIGATOR II	9231145	General	23132	1471	632.87	91.21	31.17	28.58

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
ATLANTIC PROJECT II	9235983	General	23132	1888	632.90	91.21	26.90	28.58
ATLANTIC RUNNER II	9509619	General	22863	1158	588.81	91.87	31.17	23.33
ATLANTICBORG	9466350	General	11885	962	465.9	70.54	31.17	21.33
AVONBORG	9466362	General	11885	962	465.9	70.54	31.5	19.65
BALSA 84	9580259	General	5715		348.87	63	23.16	14.5
BALSA 85	9580261	General	5715		348.87	63	22.67	23.33
BALSA 86	9580273	General	5715		348.87	63.00	22.41	15.58
BALSA 88	9616034	General	5698		348.87	63.00	22.57	14.76
BALSA 89	9616046	General	5698		348.87	63.00	22.02	
BALSA 91	9616058	General	5698		348.87	63	22.18	17.09
BALSA 92	9616060	General	5698		348.87	63.00	22.67	
BALSA 95	9800867	General	5708		348.87	63.00	22.67	14.60
BBC ALBERTA	9468102	General	9611	665	452.91	70.54	26.25	19.00
BBC DAKOTA	9388900	General	9611	665	452.88	70.11	25.26	21.49
BBC ELISABETH	9593660	General	18189	1557	529.45	88.59	20.67	
BBC EMSLAND	9511648	General	7878	671	477.42	59.88	18.67	20.34
BBC GEORGIA	9357224	General	9625	658	454.42	68.90	25.59	21.00
BBC HUDSON	9435868	General	12936	981	469.68	75.89	25.99	18.34
BBC ICELAND	9605906	General	18567		528.24	89.90	25.99	20.34
BBC LOUISE	9685097	General	9719	813	452.78	71.49	26.41	18.50
BBC MINNESOTA	9260378	General	9611	665	453.01	68.90	26.90	27.10
BBC NAGASAKI	9559872	General	6351		433.75	52.07	15.75	16.40
BBC ORION	9347841	General	7223	506	393.13	65.62	22.02	19.33
BBC SKIPPER	9741138	General	11436	843	474.76	74.81	21.65	23.16

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
BBC VESUVIUS	9508471	General	8255	660	412.75	72.18	23.33	24.02
BBC WASHINGTON	9283954	General	9611	665	453.01	68.90	22.02	19.65
CHIPOLBROK STAR	9432127	General	24142	1108	655.54	91.21	28.84	24.25
COE LUISA	9435026	General	9611	665	452.97	68.90	26.58	20.67
DAMGRACHT	9420784	General	13558	1040	513.48	75.46	26.25	24.35
DANZIGERGRACHT	9420796	General	13558	1069	514.89	74.81	24.08	23.33
DIJKSGRACHT	9420772	General	13558	1069	513.48	74.81	21.75	27.59
DOLFIJNGRACHT	9420825	General	13706	1040	513.48	74.84	26.84	23.00
EVANS SPIRIT	9327774	General	9286	1200	459.18	68.90	24.35	19.00
EXEBORG	9650482	General	7680		474.30	52.07	27.27	14.99
FAGELGRACHT	9428425	General	8620	658	447.86	65.62	29.50	24.57
FAIRWIND LEGION	9699969	General	13110	212	431.98	75.46	19.00	18.77
FLEVOBORG	9419292	General	8911	475	468.53	57.42	27.10	19.00
FLORIJNGRACHT	9428413	General	8448	730	447.86	62.01	26.58	26.58
FORTUNAGRACHT	9507609	General	8620	730	449.73	62.01	27.59	22.67
FRASERBORG	9419319	General	8911	475	468.53	56.43	27.27	18.57
FRISIAN OCTA	9526095	General	5425	336	387.62	52.17	22.02	16.08
FRISIANA	9385893	General	5905	355	421.21	52.30	20.34	
FULDABORG	9559092	General	8911	475	468.53	56.43	23.59	
GENIUS STAR IX	9542867	General	9589		393.69	69.56	30.84	20.67
HAPPY RANGER	9139311	General	10990	1051	452.78	74.81	22.02	21.65
HUDSONGRACHT	9433262	General	9627	658	454.58	70.02	24.25	24.41
HUMBERGRACHT	9433274	General	9627	658	454.45	69.98	25.26	26.08
HYUNDAI MASAN	9469883	General	23265	1888	633.00	91.21	28.58	26.25

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
IKEBANA	9186209	General	33448	2096	651.28	101.71	41.24	32.84
INDUSTRIAL CHARGER	9213959	General	7252	506	393.10	65.62	20.01	21.00
INDUSTRIAL COURAGE	9810329	General	7498		328.07	67.26	24.25	24.25
KLARA	9467160	General	15549	1009	545.14	75.17	25.00	27.99
KRASZEWSKI	9432153	General	24221	1904	655.54	91.21	31.50	25.59
MAJESTIC STAR	9865568	General	44397		751.35	104.99	22.08	46.26
MARGUISA ZIERIKZEE	9317808	General	5057	390	393.65	49.87	21.92	22.25
MAXIMA	9882061	General	8849		491.99	52.17	26.25	16.40
MIRANDA	9344394	General	3610	267	330.13	50.66	18.67	11.52
NE BRASIL U27	7104290	General	6461		426.53	52.5	19.65	19.49
NUNALIK	9466996	General	9611	665	452.97	70.02	23.43	24.02
OCEAN FREEDOM	9506722	General	12810	985	503.7	76.15	22.02	22.67
OKIANA	9253868	General	38910	2286	697.21	106.01	41.34	37.01
ONEGO ISLE	9626156	General	7227		406.68	57.06	24.25	23.33
ONEGO MERCHANT	9238363	General	6301	552	433.75	52.07	20.01	14.50
PANAMANA	9401805	General	39258	2506	697.21	106.07	40.32	31.17
PAUWGRACHT	9448308	General	17644	958	553.08	82.68	29.50	27.27
PELICANA	9401790	General	39258	2506	697.21	106.07	29.82	29.00
PINTAIL	9902304	General	23600		590.35	98.43	29.27	20.41
PRINSENGRACHT	9448372	General	17644	958	553.18	82.68	23.49	
PROVIDANA	9380788	General	39258	2506	697.21	105.94	28.25	26.25
SAGA DISCOVERY	9317418	General	29758	760	653.58	100.37	29.50	22.67
SAGA FAITH	9808651	General	37441		655.87	105.85	42.85	
SAGA FRAM	9613874	General	37499	2022	655.87	105.94	25.49	24.02

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
SAGA JOURNEY	9363637	General	29758	760	653.58	100.37	38.75	30.51
SAGA MORUS	9117741	General	36463	2300	655.87	105.75	13.42	23.66
SAGA NAVIGATOR	9371062	General	29758	760	653.58	100.37	26.90	25.00
SAGA ODYSSEY	9401788	General	29758	760	653.58	100.37	29.50	28.25
SAGA PIONEER	9380764	General	29758	760	653.58	100.30	38.75	29.50
SAGA SPRAY	9014078	General	29381	1688	653.58	100.30	28.25	20.34
SAGA VIKING	9233466	General	29867	760	653.58	100.30	25.59	21.00
SAGA WIND	9074078	General	29381	1688	653.58	100.30	38.26	32.51
SAIMAAGRACHT	9288069	General	18321	1134	608.30	84.32	31.66	23.33
SAMPOGRACHT	9288071	General	18321	1134	936.40	84.32	27.66	24.35
SCHELDEGRACHT	9202510	General	16639	1134	568.17	83.67	34.58	29.50
SCHIPPERSGRACHT	9197363	General	16641	1134	551.90	83.34	29.59	23.92
SINGELGRACHT	9197375	General	16641	1134	551.90	82.68	30.15	23.00
SJARD	9303314	General	12936	958	469.74	75.89	28.25	20.01
SLOMAN DISCOVERER	9620669	General	9611		452.81	68.90	23.26	22.02
SLOMAN DISPATCHER	9620657	General	9611	665	453.11	68.90	20.34	22.02
SLUISGRACHT	9202522	General	16639	1134	564.33	83.01	33.50	22.51
SNOEKGRACHT	9202546	General	16641	1134	551.21	82.68	27.27	24.25
SOUND PEARL	9452907	General	29829		618.47	105.85	30.91	21.65
SPAARNEGRACHT	9202558	General	16641	1134	551.67	82.68	27.92	22.67
SPIEKEROOG	9506148	General	4591	367	354.91	54.46	19.65	
STADIONGRACHT	9202508	General	16641	1134	564.33	83.67	34.42	31.83
STAR HIDRA	9071569	General	32744	2070	649.64	101.81	34.09	32.58
STATENGRACHT	9288045	General	16676	1127	564.33	83.01	28.91	22.74

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
SUOMIGRACHT	9288057	General	18321	1134	608.30	84.32	33.93	28.25
TAAGBORG	9546461	General	14695	1228	566.96	71.33	29.92	
TAIGA DESGAGNES	9303302	General	12936	958	469.71	75.89	29.50	25.59
THORCO LIVA	9643623	General	13110		431.98	75.46	25.17	25.59
TIBERBORG	9546473	General	14695	1228	565.25	70.54	28.84	19.65
TRINITYBORG	9546485	General	14695	1228	565.41	70.54	30.51	
UBC TILBURY	9416721	General	24140		599.08	93.84	25.99	21.92
UBC TOKYO	9300752	General	24140		599.08	93.84	26.25	23.43
UHL FALCON	9789697	General	16729		491.89	85.31	19.65	22.02
ZEA SERVANT	9741126	General	11619	843	474.76	74.81	22.34	22.34
BW LESMES	9873840	LNG	115338		967.57	152.24	31.50	35.99
BW PAVILION ARANTHERA	9850678	LNG	114622		967.80	152.34	31.50	37.99
CASTILLO DE SANTISTEBAN	9433717	LNG	111665		983.97	150.27	32.84	39.08
CASTILLO DE VILLALBA	9236418	LNG	93450		933.12	139.54	32.84	38.42
COOL RIDER	9333591	LNG	102064		946.24	145.02	29.82	38.42
COOL ROVER	9333618	LNG	102064		946.24	145.02	31.83	37.34
COOL RUNNER	9636797	LNG	102097		920.32	142.46	30.15	32.35
DORADO LNG	9863182	LNG	115345		961.33	150.27	30.84	36.09
ENERGY ENDEAVOUR	9854624	LNG	114195		967.57	152.24	30.84	33.83
ENERGY GLORY	9752565	LNG	121981		983.97	160.44	31.17	38.49
ENERGY INNOVATOR	9758832	LNG	121981		983.97	160.44	31.01	38.85
ENERGY LIBERTY	9736092	LNG	121982		983.97	160.44	30.51	37.99
ENERGY UNIVERSE	9758844	LNG	122142		983.97	160.44	31.50	38.09
FLEX ARTEMIS	9851634	LNG	114380		967.57	152.24	31.83	35.24

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
GAIL BHUWAN	9877145	LNG	119891		977.41	157.16	31.50	38.09
GASLOG SEATTLE	9634086	LNG	98075		935.48	142.40	29.82	37.99
GOLAR ICE	9637325	LNG	102200		920.55	142.46	30.51	38.42
GRACE DAHLIA	9540716	LNG	141671		984.23	170.61	33.43	37.01
GRACE EMILIA	9884174	LNG	117564		974.46	152.24	29.82	37.60
GUI YING	9878888	LNG	114790		967.90	147.64	31.50	37.99
HOEGH GANDRIA	9624914	LNG	102100		920.55	142.46	31.17	35.99
HONGKONG ENERGY	9250725	LNG	96165		941.65	142.07	29.5	36.68
KOOL BLIZZARD	9635315	LNG	102200		920.55	142.46	30.84	38.75
KOOL ICE	9637325	LNG	102200		920.55	142.46	29.82	33.50
LA MANCHA KNUTSEN	9721724	LNG	116246		951.49	152.24	31.50	38.75
LNG FUKUROKUJU	9666986	LNG	127242		961.33	160.44	35.76	39.01
LNG SAKURA	9774135	LNG	135977		984.30	160.44	32.15	39.08
MARAN GAS APOLLONIA	9633422	LNG	105773		948.21	149.71	30.15	35.83
MARAN GAS LINDOS	9627502	LNG	103893		965.27	144.36	31.50	37.17
MARAN GAS MYSTRAS	9658238	LNG	103893		965.27	144.36	31.17	37.99
MARAN GAS VERGINA	9732369	LNG	113037		967.57	152.24	30.84	37.99
NEO ENERGY	9324277	LNG	100253		944.93	145.02	30.84	38.58
ORION BOHEMIA	9902926	LNG	114000		981.02	152.24	30.15	37.40
SEAPEAK MARIB	9336749	LNG	104169		935.08	142.40	31.83	38.42
STENA BLUE SKY	9315393	LNG	97754		936.40	142.53	31.17	36.42
VIVIT AMERICAS	9864667	LNG	116542		981.02	152.24	32.15	37.76
VIVIT ARABIA LNG	9902756	LNG	116299		981.02	152.24	30.51	35.07
ENDEAVOUR	9203306	other	10933		425.91	72.28	23.00	

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
GLOBAL SENTINEL	8900866	other	13201		477.91	70.87	20.34	22.34
KOJIMA	9034638	other	2950		377.32	45.93	15.09	
LIBERTAD	2023000	other	3765		340.40	46.95	21.00	21.00
POTTERSGRACHT	9424560	other	17634	958	553.18	82.68	25	24.25
STAD AMSTERDAM	9185554	other	723		255.92	34.75	15.75	15.75
U.S.S CARL M. LEVIN	2023000	other	9300		1670.03	65.62	31.99	31.99
UHL FOCUS	9813230	other	16732		488.87	85.31	23.26	21.65
USNS RED CLOUD	9145449	other	72737		950.05	105.75	28.68	
AMERA	8700280	Pass	39051		669.32	106.04	23.59	23.59
ARTANIA	8201480	Pass	44697		756.63	105.68	26.08	27.00
BALMORAL	8506294	Pass	43537		714.96	105.98	23.33	23.33
CARNIVAL LEGEND	9224726	Pass	85942		959.69	105.65	27.27	27.49
ENCHANTMENT OF THE SEAS	9111802	Pass	82910		988.76	105.65	24.35	24.35
EUROPA	9183855	Pass	28890		651.34	78.74	20.67	20.67
EUROPA 2	9616230	Pass	42830		740.26	87.60	21.00	21.00
NORWEGIAN SKY	9128532	Pass	77104		848.47	118.12	26.25	26.58
NORWEGIAN SUN	9218131	Pass	78309		846.50	118.12	26.90	26.58
SILVER CLOUD	8903923	Pass	17014		515.22	70.21	18.67	19.65
VISION OF THE SEAS	9116876	Pass	78717		915.40	116.80	26.25	26.41
ADRIA ACE	9446881	RoRo	41009		577.46	102.04	27.92	26.58
ADRIATIC HIGHWAY	9442885	RoRo	58990		656.1	105.85	29.82	29
ALTAIR LEADER	9539171	RoRo	60295		656.17	105.85	27.92	25.92
ANIARA	9377494	RoRo	71673		759.88	105.85	29.50	27.92
ANTARES	7226897	RoRo	48632		946.17	105.52	30.25	

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
APOLLON HIGHWAY	9728083	RoRo	76299		656.17	123.04	32.15	
APOLLON LEADER	9402706	RoRo	60213		656.17	105.85	28.84	28.74
AQUAMARINE ACE	9397987	RoRo	60143		656.17	105.85	25.76	25.82
ARC COMMITMENT	9505039	RoRo	74255		757.25	105.98	33.83	31.83
ARC DEFENDER	9375264	RoRo	61328		656.17	105.85	30.15	30.84
ARC INDEPENDENCE	9332925	RoRo	71583		747.41	105.85	30.84	30.84
ARC INTEGRITY	9332949	RoRo	71583		748.07	105.85	31.83	31.83
ASIAN EMPEROR	9176632	RoRo	55729		652.85	106.17	26.90	25.76
ATHENS HIGHWAY	9443073	RoRo	58994		656.10	105.85	31.99	31.83
ATLANTIC SAIL	9670585	RoRo	100430	3817	971.18	123.37	31.66	30.51
ATLANTIC SEA	9670597	RoRo	100430	3810	971.18	123.37	33.17	
ATLANTIC SKY	9670602	RoRo	100430	3810	971.18	123.37	30.51	29.00
ATLANTIC STAR	9670573	RoRo	100430	3807	971.18	123.37	32.15	29.59
ATLANTIC SUN	9670614	RoRo	100430	3817	971.18	123.37	31.33	29.82
AURIGA LEADER	9402718	RoRo	60213		656.17	105.85	29.17	27.92
BAHRI ABHA	9620944	RoRo	50714	364	721.82	105.98	26.58	27.17
BAHRI HOFUF	9620956	RoRo	50714	364	721.82	105.98	28.51	28.18
BAHRI JAZAN	9620970	RoRo	50714	364	721.82	105.98	27.27	28.91
BAHRI JEDDAH	9626522	RoRo	50714	364	737.90	106.96	25.59	25.76
BAHRI TABUK	9620968	RoRo	50714	364	721.82	105.98	27.27	28.74
BANGKOK HIGHWAY	9506710	RoRo	48936		590.55	105.65	29.17	25.59
BESS	9531715	RoRo	58750		656.13	105.85	26.74	25.59
BOHEME	9176565	RoRo	67264		747.71	105.85	33.24	26.90
BRAVERY ACE	9207120	RoRo	52276		621.59	105.65	26.18	27.00

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
BROOKLANDS	9748289	RoRo	72700		656.07	124.68	31.50	28.84
CAPE WASHINGTON	7826178	RoRo	51960		697.02	105.98	24.57	
CAPE WRATH	7826166	RoRo	51960	1203	697.05	105.98	25.92	
CAPRICORNUS LEADER	9283863	RoRo	61854		656	105.85	29.82	29.82
CARMEN	9505027	RoRo	74258		747.41	105.85	34.09	32.84
CARNATION ACE	9544920	RoRo	60975		656.17	105.85	29.00	26.18
CENTAURUS LEADER	9284740	RoRo	62195		656.00	105.85	29.17	27.59
COURAGEOUS ACE	9252204	RoRo	56563		649.64	105.71	27.92	25.00
CRONUS LEADER	9464455	RoRo	61804		656.00	105.85	28.51	28.58
CRYSTAL ACE	9539224	RoRo	60131		656.17	105.85	27.00	25.59
DAEDALUS LEADER	9426362	RoRo	62993		656.00	105.85	30.68	29.33
DEMETER LEADER	9477921	RoRo	62388		656.00	105.85	25.99	29.92
DIGNITY ACE	9441506	RoRo	58767		656.04	105.94	26.58	27.59
DIONYSOS LEADER	9426350	RoRo	62993		656.00	105.85	29.50	28.18
DON CARLOS	9122655	RoRo	67141		652.92	105.85	28.58	28.58
DONINGTON	9748291	RoRo	72700		656.07	124.68	31.17	29.99
DURBAN HIGHWAY	9536961	RoRo	58997		655.90	105.85	32.15	31.50
EMDEN	9941788	RoRo	69000		655.87	124.68	29.50	26.58
ESTRADEN	9181077	RoRo	18205	363	533.82	82.68	18.01	14.99
ETERNAL ACE	9606479	RoRo	59022		656.04	105.65	28.58	28.84
EUPHONY ACE	9293595	RoRo	58631		656.04	105.65	24.08	25.00
EUROCARGO BARI	9471082	RoRo	32825		658.27	86.95	21.92	23.43
FIDELIO	9332937	RoRo	71583		747.41	105.85	33.07	33.83
FIGARO	9505041	RoRo	74258		759.88	105.85	30.51	28.25

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
FIRMAMENT ACE	9293894	RoRo	60118		656.17	105.85	27.10	25.43
FRONTIER ACE	9209271	RoRo	52276		587.30	105.65	27.59	27.27
GAIA LEADER	9536818	RoRo	62383		656.00	105.85	28.51	28.25
GALAXY ACE	9624237	RoRo	59583		656.1	105.85	25.1	26.58
GARNET LEADER	9357327	RoRo	57692		655.90	105.91	28.58	27.17
GENCA	9307372	RoRo	28289	639	672.60	84.65	26.90	22.34
GENTLE LEADER	9391567	RoRo	57692		655.94	105.85	27.66	26.90
GENUINE ACE	9610418	RoRo	59022		656.04	105.65	27.92	26.58
GLOBAL LEADER	9237319	RoRo	48710		620.80	105.94	28.58	28.25
GLORIOUS ACE	9561277	RoRo	58939		656.04	105.65	27.49	25.59
GLORIOUS LEADER	9357298	RoRo	57692		655.87	105.91	28.18	27.27
GLOVIS CAPTAIN	9707015	RoRo	59760		656.13	105.85	29.17	28.25
GLOVIS CARAVEL	9441594	RoRo	58767		656.17	105.94	28.51	27.59
GLOVIS CARDINAL	9419759	RoRo	60404		653.25	105.85	34.09	34.09
GLOVIS CHALLENGE	9590591	RoRo	58288		656.13	105.85	28.25	28.25
GLOVIS CHORUS	9158604	RoRo	55729		656.13	105.85	28.25	25.59
GLOVIS COMET	9122942	RoRo	55680		656.13	105.85	28.51	
GLOVIS COMPANION	9460899	RoRo	60213		656.17	105.85	26.74	28.51
GLOVIS CONDOR	9414876	RoRo	60396		653.25	105.85	32.15	35.07
GLOVIS COSMOS	9707027	RoRo	59760		656.13	105.85	31.83	32.15
GLOVIS COUGAR	9451898	RoRo	60404		653.25	105.85	33.17	32.15
GLOVIS COUNTESS	9476721	RoRo	60213		655.87	105.85	27.92	27.00
GLOVIS SIRIUS	9749582	RoRo	65697		656.10	116.15	31.17	30.25
GLOVIS SKY	9798404	RoRo	72269		754.53	105.85	31.50	30.51

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
GLOVIS SOLOMON	9445409	RoRo	72635		762.47	106.01	29.82	29.82
GLOVIS SPIRIT	9674165	RoRo	64650		656.10	116.15	30.51	30.84
GLOVIS STAR	9736808	RoRo	71177		656.10	116.25	29.82	28.51
GLOVIS SUN	9749568	RoRo	65697		656.10	116.15	31.50	31.01
GLOVIS SUNRISE	9702405	RoRo	64546		656.10	116.15	30.84	31.83
GLOVIS SUPERIOR	9674189	RoRo	64650		656.10	113.19	30.51	28.84
GLOVIS SYMPHONY	9702429	RoRo	64546		656.10	116.15	30.84	30.84
GOLIATH LEADER	9357315	RoRo	57692		655.90	105.85	28.51	28.25
GOODWOOD	9701140	RoRo	59516		656.10	105.85	30.58	30.84
GORDON	7234430	RoRo	67671	2774	954.21	106.01	31.43	
GRACIOUS ACE	9604914	RoRo	59583		656.10	105.85	27.92	26.84
GRAND CHAMPION	9340570	RoRo	59217		655.87	105.85	29.50	28.91
GRAND CHOICE	9169316	RoRo	50309		587.82	105.85	25.26	24.57
GRAND COSMO	9303182	RoRo	59217		655.87	105.85	25.59	25.33
GRAND DAHLIA	9355238	RoRo	59217		655.87	105.85	28.84	26.90
GRAND DOLPHIN	9279329	RoRo	59217		655.87	105.85	29.5	28.25
GRAND DUKE	9303170	RoRo	59217		655.87	105.85	28.84	27.33
GRAND MERCURY	9247584	RoRo	58947		654.56	105.85	28.41	29.92
GRAND NEPTUNE	9303209	RoRo	59217		655.87	105.85	30.74	30.15
GRAND ORION	9303194	RoRo	59217		655.87	105.85	29.50	28.41
GRAND PHOENIX	9284764	RoRo	59217		655.87	105.85	30.15	28.51
GRAND PIONEER	9247572	RoRo	58947		654.56	105.85	28.41	27.92
GRAND RUBY	9325221	RoRo	59217		655.87	105.85	29.50	27.99
GRAND SAPPHIRE	9325233	RoRo	59217		655.87	105.85	29.17	26.58

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
GRAND URANUS	9472206	RoRo	72408		762.47	106.01	30.09	29.33
GRANDE ABIDJAN	9680712	RoRo	71543		775.37	118.64	30.15	27.59
GRANDE BALTIMORA	9784037	RoRo	62134		655.87	105.85	33.33	28.58
GRANDE BENIN	9343170	RoRo	47218	1318	692.03	105.85	26.90	26.25
GRANDE CAMEROON	9377482	RoRo	47218	1318	692.03	105.85	29.27	27.92
GRANDE CONGO	9437921	RoRo	47658	800	693.28	105.85	28.84	29.76
GRANDE COSTA D'AVORIO	9465382	RoRo	47218	1318	692.03	105.85	27.27	28.18
GRANDE COTONOU	9672105	RoRo	71543	900	775.37	118.64	31.17	29.82
GRANDE DAKAR	9680724	RoRo	71543	1800	775.37	118.64	29.50	30.84
GRANDE FLORIDA	9782716	RoRo	66704		655.87	118.94	30.84	31.01
GRANDE GABON	9437933	RoRo	47658	800	692.29	105.85	29.17	28.58
GRANDE GUINEA	9437919	RoRo	47658	800	692.29	105.85	30.84	31.50
GRANDE HALIFAX	9784051	RoRo	62134		655.87	105.85	30.84	30.15
GRANDE LAGOS	9672088	RoRo	71543	900	775.37	118.64	29.50	30.84
GRANDE LUANDA	9724738	RoRo	71543	1800	775.37	118.64	31.33	30.68
GRANDE MAROCCO	9437907	RoRo	47635	800	693.28	105.85	26.58	26.58
GRANDE NEW JERSEY	9782704	RoRo	66704		655.87	118.94	30.35	30.84
GRANDE NEW YORK	9784049	RoRo	62134		655.87	105.85	32.15	32.15
GRANDE PORTOGALLO	9245598	RoRo	37726	880	577.46	102.04	27.27	25.99
GRANDE SENEGAL	9377470	RoRo	47232	1318	692.03	105.85	30.68	30.58
GRANDE SIERRA LEONE	9437945	RoRo	47658	800	692.29	105.85	28.51	25.99
GRANDE TEMA	9672090	RoRo	71543	1800	775.37	118.64	31.27	29.82
GRANDE TEXAS	9796365	RoRo	66704		655.87	118.94	30.84	30.51
GRANDE TOGO	9465370	RoRo	47232	1318	692.03	105.85	28.68	24.25

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
GRANDE TORINO	9782675	RoRo	66704		655.87	119.59	29.33	28.25
GREEN COVE	9181560	RoRo	57566		655.97	105.85	27.59	28.58
GUARDIAN LEADER	9388716	RoRo	57692		656.13	105.85	29.17	27.59
HARMONY LEADER	9441568	RoRo	58767		656.04	105.94	31.17	30.15
HAWAIIAN HIGHWAY	9712632	RoRo	75126		656.07	124.68	31.66	30.25
HEROIC LEADER	9441570	RoRo	58767		656.04	105.94	29.27	27.27
HESTIA LEADER	9355226	RoRo	63007		656.00	105.85	29.50	27.76
HOEGH ASIA	9191876	RoRo	68060		750.36	105.94	30.84	30.15
HOEGH BERLIN	9295842	RoRo	68871		750.50	105.94	31.50	29.50
HOEGH COPENHAGEN	9420057	RoRo	68392		750.36	105.91	26.25	28.58
HOEGH DETROIT	9312470	RoRo	68871		750.59	105.94	26.90	24.67
HOEGH JACKSONVILLE	9673379	RoRo	58531		655.87	105.91	32.15	31.17
HOEGH JEDDAH	9673381	RoRo	58531		656.04	105.94	30.84	29.82
HOEGH KOBE	9330616	RoRo	59705		653.25	105.78	28.51	28.84
HOEGH LONDON	9342205	RoRo	68871		750.50	105.94	30.84	29.17
HOEGH MANILA	9368912	RoRo	51964		590.25	105.65	25.59	27.59
HOEGH NEW YORK	9295830	RoRo	57280		655.87	105.94	30.41	29.33
HOEGH OSAKA	9185463	RoRo	51770		590.25	105.65	25.59	28.25
HOEGH OSLO	9382396	RoRo	51964		590.25	105.65	26.25	27.99
HOEGH SEOUL	9285495	RoRo	68871		750.50	105.94	29.50	25.99
HOEGH SHANGHAI	9312482	RoRo	68871		750.50	105.94	27.27	27.49
HOEGH ST. PETERSBURG	9420045	RoRo	68392		750.66	105.91	28.25	26.58
HOEGH TARGET	9684976	RoRo	76420		655.87	133.86	31.17	27.82
HOEGH TOKYO	9285483	RoRo	68871		750.36	105.94	31.50	29.50

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
HOEGH TRADER	9171280	RoRo	68060		750.59	105.94	29.27	28.58
HOEGH TRANSPORTER	9176395	RoRo	57757		656.10	105.85	28.91	
HOEGH TRAVELLER	9710737	RoRo	76420		655.77	133.73	29.82	27.92
HOEGH TRIDENT	9075709	RoRo	56164		656.13	105.85	27.92	26.90
HOEGH TRIGGER	9684988	RoRo	76420		656.00	133.77	29.17	28.25
HOEGH TROTTER	9710749	RoRo	76420		655.77	133.73	28.51	28.84
KING QUEST	9728851	RoRo	62105		655.87	105.85	31.43	30.51
LAKE GENEVA	9713882	RoRo	59516		656.10	105.85	27.17	27.00
LAKE KIVU	9308792	RoRo	46800		599.77	103.45	29.5	28.84
LAKE TAUPO	9289908	RoRo	46800		599.77	103.45	29.82	29.00
LAKE WANAKA	9432892	RoRo	46800		599.77	103.45	29.82	29.66
LAVENDER ACE	9363948	RoRo	60065		656.17	105.85	28.68	25.49
LIBERTY ACE	9293650	RoRo	59992		656.17	105.85	24.90	26.25
LYRA LEADER	9284752	RoRo	62623		656.00	105.85	30.15	26.51
MARGUERITE ACE	9426386	RoRo	60067		656.17	105.85	29	26.9
MARTORELL	9267675	RoRo	57789		654.69	105.85	24.18	24.84
MARVELOUS ACE	9293519	RoRo	59422		656.10	105.85	27.27	26.58
MERCURY ACE	9591052	RoRo	59409		656.10	105.85	31.17	27.17
MERIDIAN ACE	9209518	RoRo	56175		656.00	105.65	27.59	25.26
MERMAID ACE	9561289	RoRo	58939		656.04	105.65	26.51	26.08
METIS LEADER	9650743	RoRo	59550		656.10	105.85	28.51	29.50
MIGNON	9189251	RoRo	67264		747.74	105.85	27.99	27.27
MONZA	9358888	RoRo	40628		577.46	104.99	29.00	26.25
MORNING CAMILLA	9477919	RoRo	60876		656.00	105.85	28.58	25.26

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
MORNING CAPO	9663295	RoRo	59615		656.13	105.94	33.17	27.59
MORNING CARINA	9338709	RoRo	60876		656.00	105.85	29.82	26.51
MORNING CATHERINE	9338711	RoRo	60876		656.00	105.85	25.76	24.25
MORNING CELINE	9519133	RoRo	60799		656	105.85	29.17	27.59
MORNING CHANT	9663300	RoRo	59615		656.13	105.94	27.17	27
MORNING CHANT	9663300	RoRo	59615		656.13	105.94	32.84	31.17
MORNING CHORUS	9312834	RoRo	57536		656.10	105.94	28.25	28.25
MORNING CLAIRE	9620683	RoRo	60825		656.17	105.85	29.17	27.92
MORNING COMPOSER	9336074	RoRo	57542		656.10	105.85	29.50	28.84
MORNING CONCERT	9312822	RoRo	57415		656.13	105.94	26.58	25.59
MORNING LADY	9445980	RoRo	70687		762.44	105.98	29.27	26.25
MORNING LAURA	9445992	RoRo	70687		762.44	105.98	28.18	28.18
MORNING LENA	9446001	RoRo	70687		762.44	105.98	31.17	30.35
MORNING LILY	9446013	RoRo	70687		762.44	105.98	28.25	27.27
MORNING LISA	9383417	RoRo	68701		762.41	105.85	31.17	29.66
MORNING LYNN	9383429	RoRo	68701		762.41	105.85	26.58	23.66
NABUCCO	9731652	RoRo	72400		656.17	119.76	33.17	30.51
NEPTUNE ACE	9584059	RoRo	59006		656.04	104.99	26.90	27.00
NEPTUNE BARCELONA	9762546	RoRo	44972		655.87	105.85	27.92	24.08
NEPTUNE KOPER	9279812	RoRo	44408		644.39	102.04	26.90	23.59
NOCC ATLANTIC	9430519	RoRo	60868		656.17	105.85	28.84	29.27
OBERON	9377509	RoRo	71673		759.88	105.85	31.01	26.90
OCEANUS LEADER	9553488	RoRo	62838		656.00	105.85	29.17	28.25
OPAL ACE	9539183	RoRo	60131		656.17	105.85	25.26	24.02

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
ORCA ACE	9777814	RoRo	63116		656.04	105.65	30.84	29.99
ORCHID ACE	9381677	RoRo	59262		656.17	105.85	26.67	25.49
OREGON HIGHWAY	9381665	RoRo	57147		656.00	105.85	31.50	29.99
ORION HIGHWAY	9728071	RoRo	76299		656.17	123.04	31.33	29.00
PAGNA	9427952	RoRo	47057		600.09	104.99	27.92	25.66
PARADISE ACE	9293648	RoRo	60175		656.17	105.85	27.10	25.76
PARSIFAL	9515395	RoRo	75251		869.46	105.88	31.50	30.84
PATRIOT	9316139	RoRo	60942		653.25	105.94	27.99	29.00
PLATINUM RAY	9210438	RoRo	57772		656.13	105.88	28.09	26.67
PLEIADES SPIRIT	9409326	RoRo	60330		656.17	105.85	27.92	25.92
PORGY	9409338	RoRo	58752		656.13	105.85	28.09	26.58
PRECIOUS ACE	9554200	RoRo	59402		656.1	105.85	25.59	24.51
PROGRESS ACE	9267687	RoRo	57789		654.69	105.85	27.17	24.57
PROMETHEUS LEADER	9338888	RoRo	41886		623.49	105.85	25.59	26.58
PROMINENT ACE	9267699	RoRo	57789		654.69	105.85	24.25	24.25
PULPCA	9345386	RoRo	28289	639	672.60	83.67	22.34	22.02
RCC TIANJIN	9361835	RoRo	41009		577.46	102.04	27.27	25.99
RESOLVE	9080297	RoRo	49443		622.73	105.94	28.84	25.99
RHEA LEADER	9355214	RoRo	63004		656	105.85	27.49	27.99
SAGITTARIUS LEADER	9283887	RoRo	32053		656.00	105.85	27.92	29.07
SALOME	9515412	RoRo	75251		869.46	105.88	28.51	25.76
SAN MARTIN	9382097	RoRo	40619		577.16	102.04	28.51	26.58
SANDERLING ACE	9409481	RoRo	58685		656.04	105.85	27.10	25.99
SEBRING	9434321	RoRo	43810		590.58	98.43	27.92	27.59

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
SERENITY ACE	9391579	RoRo	57692		656.13	105.91	27.92	28.25
SFL COMPOSER	9293583	RoRo	58631		656.04	105.65	30.35	27.76
SFL CONDUCTOR	9293909	RoRo	60118		656.17	105.85	30.15	27.92
SIEM ARISTOTLE	9841029	RoRo	72900		655.87	124.68	30.51	27.92
SIEM CICERO	9762534	RoRo	56677		655.87	105.85	28.51	27.99
SIEM CONFUCIUS	9841017	RoRo	75000		655.87	124.74	28.91	27.92
SILVER MOON	9448138	RoRo	47090		599.77	104.14	28.58	29.66
SILVER SKY	9448140	RoRo	47090		599.77	104.34	27.59	25.99
SILVER SOUL	9153783	RoRo	44219		588.87	105.75	27.92	27.76
SIRIUS LEADER	9213806	RoRo	51496		590.58	105.85	29.5	29.5
SPLENDID ACE	9252228	RoRo	56556		649.64	105.65	27.59	24.57
SUNLIGHT ACE	9338864	RoRo	58911		656.04	105.85	28.18	26.08
SUNRISE ACE	9338840	RoRo	58685		656.04	105.65	28.25	24.41
SUNSHINE ACE	9338852	RoRo	58917		656.04	105.85	28.58	27.82
SUPREME ACE	9610391	RoRo	59022		656.04	105.65	29.76	28.09
SWALLOW ACE	9338620	RoRo	58599		656.04	105.85	25.99	28.35
SWAN ACE	9338826	RoRo	58685		656.04	105.85	26.58	25.49
SWIFT ACE	9338838	RoRo	58685		656.04	105.85	25.59	25
TALISMAN	9191319	RoRo	67140	2340	789.41	105.94	27.17	25.59
TAMERLANE	9218648	RoRo	67140	2362	802.53	105.94	31.17	27.27
TAMESIS	9191307	RoRo	67140	2362	802.53	105.94	28.18	25.59
TANNHAUSER	9731640	RoRo	72400		656.17	119.76	34.42	31.17
TARAGO	9191321	RoRo	67140	2340	802.53	105.94	31.83	29.00
THALATTA	9702455	RoRo	75283		656.10	119.89	29.50	29.50

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
THEBEN	9722302	RoRo	75283		656.10	119.76	35.50	32.51
THERMOPYLAE	9702443	RoRo	75283		656.10	119.89	34.75	31.50
TIJUCA	9377511	RoRo	71673		748.07	105.85	30.84	
TIMCA	9307358	RoRo	28301	643	672.60	84.65	22.34	21.33
TIRRANNA	9377523	RoRo	71673		759.88	105.85	33.83	
TITANIA	9505053	RoRo	74258		757.25	105.85	29.17	
TITUS	9700512	RoRo	73358		656.20	119.76	34.42	31.83
TOLEDO	9293624	RoRo	61482		656.17	105.94	30.84	31.17
TOMBARRA	9319753	RoRo	61321		656.17	105.94	32.15	29.50
TONGALA	9605786	RoRo	61106		656.17	105.94	28.58	27.92
TONSBERG	9515383	RoRo	75251		869.46	105.88	32.84	28.25
TORONTO	9302205	RoRo	61482		656.17	105.94	32.15	30.25
TORTUGAS	9319765	RoRo	61321		656.17	105.94	27.92	26.90
TOSCA	9605798	RoRo	61106		656.17	105.94	30.84	29.82
TRAVIATA	9700524	RoRo	72400		656.17	119.76	34.16	
TRITON LEADER	9553103	RoRo	60876		656.00	105.85	27.92	26.90
TRIUMPH ACE	9209506	RoRo	55880		656.00	105.65	26.58	26.25
TUGELA	9505065	RoRo	72295		754.60	105.98	32.35	30.84
TULANE	9505089	RoRo	72295		754.60	105.98	35.17	31.83
TYSLA	9515400	RoRo	75251		869.46	105.88	29.07	27.92
USNS CHARLTON	9923166	RoRo	72737		950.05	105.75	29.17	
VALIANT ACE	9610420	RoRo	59022		656.04	105.65	27.59	27.17
VICTORIOUS ACE	9610406	RoRo	59022		656.04	105.65	28.18	26.58
VIKING DESTINY	9728863	RoRo	62105		655.87	105.85	31.99	23.82

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
VIKING ODESSA	9398876	RoRo	20216		459.34	73.59	20.34	18.08
VIOLET ACE	9395630	RoRo	49708		621.09	105.94	29.43	26.74
WISTERIA ACE	9355197	RoRo	59952		656.17	105.85	28.58	26.90
ZENITH LEADER	9384942	RoRo	62080		656.00	105.85	28.25	26.90
ZEUS LEADER	9476733	RoRo	60212		656.17	105.85	28.91	28.58
ALGONORTH	9362152	Tanker	12164		472.63	75.56	21.65	22.02
AMBER BAY	9764520	Tanker	10377		479.35	72.18	21.00	20.34
ASPHALT CARRIER	9293545	Tanker	6292		355.99	61.03	23.33	17.42
ASPHALT SPLENDOR	9763332	Tanker	26119		590.25	100.40	34.75	22.93
ATLANTIC ASPHALT	9798428	Tanker	14485		524.96	77.10	28.41	22.74
BOW CARDINAL	9114244	Tanker	23196		600.75	105.65	30.51	26.58
CHAMPION CONTEST	9272199	Tanker	27472		598.78	105.75	35.99	25.26
CHEM ALTAMIRA	9705744	Tanker	12129		475.74	79.40	32.68	30.84
CHEM AMSTERDAM	9640138	Tanker	11733		462.62	79.40	28.84	25.99
CHEM ARGON	9716004	Tanker	11918		480.67	78.74	29.76	26.90
CHEM BARCELONA	9725835	Tanker	12148		475.74	79.40	31.50	30.51
CHEM BULLDOG	9587790	Tanker	12196		488.87	78.74	27.49	23.26
CHEM HOUSTON	9705720	Tanker	12129		475.74	79.40	32.15	24.25
CHEM MERCURY	9815276	Tanker	11918		480.67	78.74	19.65	19.65
CHEM NEW ORLEANS	9705756	Tanker	12129		475.74	79.40	26.74	20.67
CHEM NEW YORK	9705732	Tanker	12129		475.74	79.40	27.59	25.49
CHEM NORMA	9486192	Tanker	11939		475.09	75.46	29.00	25.26
CHEM PATRIOT	9196709	Tanker	16786		541.36	88.26	34.75	27.99
CHEM ROTTERDAM	9640140	Tanker	11733		462.62	79.40	26.74	23.00

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
CHEM SAIPH	9731781	Tanker	16084		524.96	82.02	30.51	30.84
CHEM SILICON	9829681	Tanker	11918		452.78	78.74	31.83	28.84
CHEM SINGAPORE	9705768	Tanker	12128		475.74	79.40	31.01	31.01
CHEM SIRIUS	9558397	Tanker	11994		479.65	79.4	26.25	24.25
CHEM SPICA	9739264	Tanker	15717		521.45	87.27	31.66	24.02
CITY ISLAND	9360960	Tanker	11647		472.56	79.50	19.65	
CONSTELLATION	9308091	Tanker	41994		750.04	106.86	31.01	30.84
DA HUA SHAN	9779757	Tanker	10748		456.06	74.81	26.41	21.33
DAMIA DESGAGNES	9766437	Tanker	11978		442.94	75.46	27.27	21.00
EUROTRADER	9895927	Tanker	30000		600.42	105.65	31.17	27.76
FAIRCHEM COPPER	9829758	Tanker	15818		521.45	87.27	28.25	26.25
GINGA PANTHER	9379985	Tanker	16222		524.89	87.93	31.17	31.50
GLEN COVE	9414228	Tanker	16383		521.78	88.92	31.17	29.99
GOLDEN RAY	9640102	Tanker	11733		462.62	79.47	26.58	23.00
HINCH SPIRIT	9508940	Tanker	8638		448.15	65.62	20.67	24.67
HONESTY	9416393	Tanker	30235		601.08	105.65	33.76	24.90
JANE S	9702209	Tanker	29225		600.39	105.65	29.99	27.99
KONGO STAR	9508823	Tanker	8581		421.94	66.93	28.58	20.34
LILA RHINE	9313462	Tanker	30068		600.42	105.75	27.76	28.68
LILAC RAY	9883481	Tanker	12337		488.97	78.74	30.41	27.92
LUMEN N	9346457	Tanker	38955		748.07	105.75	28.58	29.50
MARINER A	9288954	Tanker	25364		577.36	101.81	25.59	25.59
MERONAS	9934905	Tanker	29514		600.42	105.65	30.68	26.25
MTM HAMBURG	9379844	Tanker	11585		462.62	79.4	30.84	22.34

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
OWL 6	9340350	Tanker	8539		421.94	66.90	29.33	21.49
PALANCA CADIZ	9748007	Tanker	10830		437.23	75.46	28.41	25.99
PALANCA RIO	9747998	Tanker	10830		437.23	75.46	29.00	17.75
PREVEZE 1	9811127	Tanker	9035		475.74	63.98	28.25	28.58
REBECCA SCHULTE	9576753	Tanker	19793		578.77	90.00	30.84	26.58
RUI FU TAI	9258600	Tanker	27357		598.78	105.65	33.99	26.25
SCARLET RAY	9799654	Tanker	12162		476.60	79.40	23.92	24.18
SEA LA VIE	9360336	Tanker	29266		601.11	105.65	25.59	25.00
SEA POWER	9322126	Tanker	8539		421.94	66.93	19.00	19.00
SILVER RAY	9493133	Tanker	11733		462.62	79.40	29.99	26.25
SOLAR NESRIN	9877626	Tanker	17915		554.55	83.99	32.15	23.66
SOLAR SKYLER	9877640	Tanker	17915		554.69	83.99	27.92	26.58
STOLT CONCEPT	9178197	Tanker	24522		579.92	102.04	31.17	29.82
STOLT CONDOR	9780017	Tanker	9035		475.74	68.9	23	24.25
STOLT ILEX	9505936	Tanker	11668		472.56	79.50	24.02	22.34
STOLT NORLAND	9414060	Tanker	25895		599.50	105.65	36.42	33.33
STOLT OCELOT	9459539	Tanker	13516		508.56	81.37	23.00	23.00
STOLT STREAM	9169940	Tanker	14900		533.49	77.83	26.58	24.35
STOLT SUN	9149512	Tanker	14900		531.52	77.76	29.07	23.59
STOLT VIKING	9196711	Tanker	16967		546.68	88.26	27.27	26.58
STOLT VIRTUE	9274317	Tanker	15715		521.12	83.76	31.01	27.59
THE BLACKSMITH	9659660	Tanker	23009		600.42	89.97	22.02	21.75
TSUKUBA GALAXY	9796834	Tanker	16589		521.78	88.92	21.33	21.33
WILLARD J	9749362	Tanker	17858		554.69	83.99	33.17	30.25

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Vessels calling on Port of Baltimore 2023								
Vessel Name	**IMO**	**Vessel Type**	**GRT**	**TEU**	**LOA (FT)**	**Beam (FT)**	**Arrival Draft (FT)**	**Departure Draft (FT)**
YASH	9231183	Tanker	25651		590.58	104.99	31.83	19.00
ATB FREEPORT	9447249	Tug/Barge	1348		150.01	46	25.49	22.02
GALVESTON	9503160	Tug/Barge	1348		150.01	46.00	22.02	29.82
SEA POWER | SEA CHEM 1	9762352	Tug/Barge	1317		141.08	45.93	28.25	25.00
SEA POWER | SEACHEM 1	9762352	Tug/Barge	1317		141.08	45.93	24.74	25.00

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Exhibit G - Prospective Commercial Navigation and Cargo

Existing Vessels That Cannot Access the Port of Baltimore

Container Ships Currently in Service with an Air Draft Clearance Greater Than 185 Feet			
Name of Ship	**IMO**	**Deadweight**	**Operator**
Summary	**Count**	**Average**	
	400	**192,410**	
AL DAHNA EXPRESS	9708825	199,744	Hapag-Lloyd AG
AL MURAYKH	9708863	199,744	Hapag-Lloyd AG
AL NEFUD	9708813	199,744	Hapag-Lloyd AG
AL ZUBARA	9708875	199,744	Hapag-Lloyd AG
ANE MAERSK	9948748	190,567	Maersk A/S
APL CHANGI	9631981	176,774	APL LLC
APL FULLERTON	9632026	176,142	APL LLC
APL LION CITY	9631967	176,818	APL LLC
APL MERLION	9632014	176,887	APL LLC
APL RAFFLES	9631979	176,752	APL LLC
APL SINGAPURA	9632002	176,634	APL LLC
APL TEMASEK	9631955	176,515	APL LLC
APL VANDA	9631993	176,754	APL LLC
ASTRID MAERSK	9948750	189,508	Maersk A/S
BARZAN	9708851	199,744	Hapag-Lloyd AG
BERLIN EXPRESS	9540118	229,348	Hapag-Lloyd AG
BUSAN EXPRESS	9540144	224,999	Hapag-Lloyd AG
CMA CGM ADONIS	9882528	155,502	CMA CGM SA The French Line
CMA CGM ALEXANDER VON HUMBOLDT	9454448	186,470	CMA CGM SA The French Line
CMA CGM AMERIGO VESPUCCI	9454395	165,171	CMA CGM SA The French Line
CMA CGM ANTOINE DE SAINT EXUPERY	9776418	198,375	CMA CGM SA The French Line
CMA CGM APOLLON	9882516	155,802	CMA CGM SA The French Line
CMA CGM ARCTIC	9867841	159,614	CMA CGM SA The French Line
CMA CGM ARGENTINA	9839909	157,076	CMA CGM SA The French Line
CMA CGM BALI	9867827	159,614	CMA CGM SA The French Line
CMA CGM BENJAMIN FRANKLIN	9706891	185,070	CMA CGM SA The French Line
CMA CGM BOUGAINVILLE	9702156	186,528	CMA CGM SA The French Line
CMA CGM BRAZIL	9860245	157,076	CMA CGM SA The French Line
CMA CGM CHAMPS ELYSEES	9839131	220,766	CMA CGM SA The French Line
CMA CGM CHILE	9839935	157,076	CMA CGM SA The French Line
CMA CGM CHRISTOPHE COLOMB	9453559	165,375	CMA CGM SA The French Line
CMA CGM CONCORDE	9839208	221,322	CMA CGM SA The French Line

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Container Ships Currently in Service with an Air Draft Clearance Greater Than 185 Feet			
Name of Ship	**IMO**	**Deadweight**	**Operator**
CMA CGM CORTE REAL	9454400	165,182	CMA CGM SA The French Line
CMA CGM DIGNITY	9897779	160,194	CMA CGM SA The French Line
CMA CGM GEORG FORSTER	9702144	194,752	CMA CGM SA The French Line
CMA CGM HERMES	9882499	156,055	CMA CGM SA The French Line
CMA CGM HOPE	9897755	160,194	CMA CGM SA The French Line
CMA CGM IGUACU	9859131	159,614	CMA CGM SA The French Line
CMA CGM INTEGRITY	9897781	160,194	CMA CGM SA The French Line
CMA CGM JACQUES SAADE	9839179	221,251	CMA CGM SA The French Line
CMA CGM JEAN MERMOZ	9776420	198,130	CMA CGM SA The French Line
CMA CGM JULES VERNE	9454450	186,470	CMA CGM SA The French Line
CMA CGM KERGUELEN	9702132	186,745	CMA CGM SA The French Line
CMA CGM LAPEROUSE	9454412	165,422	CMA CGM SA The French Line
CMA CGM LIBERTY	9897793	160,194	CMA CGM SA The French Line
CMA CGM LOUIS BLERIOT	9776432	198,264	CMA CGM SA The French Line
CMA CGM LOUVRE	9839143	220,868	CMA CGM SA The French Line
CMA CGM MAGELLAN	9454424	165,538	CMA CGM SA The French Line
CMA CGM MARCO POLO	9454436	187,625	CMA CGM SA The French Line
CMA CGM MEXICO	9839911	157,076	CMA CGM SA The French Line
CMA CGM MONTMARTRE	9839155	221,103	CMA CGM SA The French Line
CMA CGM OSIRIS	9882504	155,979	CMA CGM SA The French Line
CMA CGM PALAIS ROYAL	9839181	221,294	CMA CGM SA The French Line
CMA CGM PANAMA	9839923	157,076	CMA CGM SA The French Line
CMA CGM PRIDE	9924429	160,194	CMA CGM SA The French Line
CMA CGM RIVOLI	9839193	221,251	CMA CGM SA The French Line
CMA CGM SCANDOLA	9859129	159,614	CMA CGM SA The French Line
CMA CGM SORBONNE	9839210	221,251	CMA CGM SA The French Line
CMA CGM SYMI	9867839	159,614	CMA CGM SA The French Line
CMA CGM TROCADERO	9839167	220,666	CMA CGM SA The French Line
CMA CGM UNITY	9897767	160,194	CMA CGM SA The French Line
CMA CGM VASCO DE GAMA	9706889	184,700	CMA CGM SA The French Line
CMA CGM ZEPHYR	9882487	156,198	CMA CGM SA The French Line
CMA CGM ZHENG HE	9706906	185,199	CMA CGM SA The French Line
COSCO BELGIUM	9516404	156,605	COSCO Shipping Lines Co Ltd
COSCO DENMARK	9516478	156,694	COSCO Shipping Lines Co Ltd
COSCO ENGLAND	9516428	156,618	COSCO Shipping Lines Co Ltd
COSCO FRANCE	9516416	156,596	COSCO Shipping Lines Co Ltd
COSCO ITALY	9516454	156,610	COSCO Shipping Lines Co Ltd
COSCO NETHERLANDS	9516430	156,549	COSCO Shipping Lines Co Ltd
COSCO PORTUGAL	9516466	156,605	COSCO Shipping Lines Co Ltd

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Container Ships Currently in Service with an Air Draft Clearance Greater Than 185 Feet			
Name of Ship	**IMO**	**Deadweight**	**Operator**
COSCO SHIPPING AQUARIUS	9789623	197,049	COSCO Shipping Lines Co Ltd
COSCO SHIPPING ARIES	9783497	197,021	COSCO Shipping Lines Co Ltd
COSCO SHIPPING CAPRICORN	9783514	197,087	COSCO Shipping Lines Co Ltd
COSCO SHIPPING GALAXY	9795634	198,070	COSCO Shipping Lines Co Ltd
COSCO SHIPPING GEMINI	9783526	202,015	COSCO Shipping Lines Co Ltd
COSCO SHIPPING LEO	9783502	197,061	COSCO Shipping Lines Co Ltd
COSCO SHIPPING LIBRA	9783538	201,823	COSCO Shipping Lines Co Ltd
COSCO SHIPPING NEBULA	9795622	197,902	COSCO Shipping Lines Co Ltd
COSCO SHIPPING PISCES	9789647	196,996	COSCO Shipping Lines Co Ltd
COSCO SHIPPING PLANET	9795660	198,195	COSCO Shipping Lines Co Ltd
COSCO SHIPPING SAGITTARIUS	9783473	202,133	COSCO Shipping Lines Co Ltd
COSCO SHIPPING SCORPIO	9789635	196,913	COSCO Shipping Lines Co Ltd
COSCO SHIPPING SOLAR	9795646	197,820	COSCO Shipping Lines Co Ltd
COSCO SHIPPING STAR	9795658	197,976	COSCO Shipping Lines Co Ltd
COSCO SHIPPING TAURUS	9783459	201,868	COSCO Shipping Lines Co Ltd
COSCO SHIPPING UNIVERSE	9795610	198,485	COSCO Shipping Lines Co Ltd
COSCO SHIPPING VIRGO	9783461	201,827	COSCO Shipping Lines Co Ltd
COSCO SPAIN	9516442	156,572	COSCO Shipping Lines Co Ltd
CSCL ARCTIC OCEAN	9695169	184,320	COSCO Shipping Lines Co Ltd
CSCL ATLANTIC OCEAN	9695145	184,320	COSCO Shipping Lines Co Ltd
CSCL GLOBE	9695121	184,320	COSCO Shipping Lines Co Ltd
CSCL INDIAN OCEAN	9695157	184,320	COSCO Shipping Lines Co Ltd
CSCL JUPITER	9467263	155,480	COSCO Shipping Lines Co Ltd
CSCL MARS	9467287	155,467	COSCO Shipping Lines Co Ltd
CSCL MERCURY	9467275	155,373	COSCO Shipping Lines Co Ltd
CSCL NEPTUNE	9467316	155,263	COSCO Shipping Lines Co Ltd
CSCL PACIFIC OCEAN	9695133	184,320	COSCO Shipping Lines Co Ltd
CSCL SATURN	9467299	155,426	COSCO Shipping Lines Co Ltd
CSCL STAR	9466867	155,470	COSCO Shipping Lines Co Ltd
CSCL URANUS	9467304	155,627	COSCO Shipping Lines Co Ltd
CSCL VENUS	9467251	155,470	COSCO Shipping Lines Co Ltd
EBBA MAERSK	9321524	174,239	Maersk A/S
EDITH MAERSK	9321548	174,239	Maersk A/S
ELEONORA MAERSK	9321500	174,239	Maersk A/S
ELLY MAERSK	9321536	174,239	Maersk A/S
EMMA MAERSK	9321483	174,239	Maersk A/S
ESTELLE MAERSK	9321495	174,239	Maersk A/S
EUGEN MAERSK	9321550	174,239	Maersk A/S
EVELYN MAERSK	9321512	174,239	Maersk A/S

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Container Ships Currently in Service with an Air Draft Clearance Greater Than 185 Feet			
Name of Ship	**IMO**	**Deadweight**	**Operator**
EVER ACE	9893890	241,960	Evergreen Marine Corp
EVER ACME	9943267	241,816	Evergreen Marine Asia Pte Ltd
EVER ACT	9893905	241,960	Evergreen Marine Corp
EVER AIM	9893917	241,960	Evergreen Marine Corp
EVER ALOT	9893955	224,982	Evergreen Marine Corp
EVER ALP	9893929	241,960	Evergreen Marine Corp
EVER APEX	9893979	241,816	Evergreen Marine Corp
EVER ARIA	9909132	241,816	Evergreen Marine Corp
EVER ARM	9893931	241,960	Evergreen Marine Corp
EVER ART	9893943	241,960	Evergreen Marine Corp
EVER ATOP	9893993	241,816	Evergreen Marine Corp
EVER GENIUS	9786815	199,692	Evergreen Marine Corp
EVER GENTLE	9820922	199,489	Evergreen Marine Corp
EVER GIFTED	9786827	198,886	Evergreen Marine Corp
EVER GIVEN	9811000	199,489	Evergreen Marine Corp
EVER GLOBE	9786841	198,937	Evergreen Marine Corp
EVER GLORY	9786839	198,937	Evergreen Marine Corp
EVER GOLDEN	9811012	199,692	Evergreen Marine Corp
EVER GOODS	9810991	199,692	Evergreen Marine Corp
EVER GOVERN	9832717	198,937	Evergreen Marine Corp
EVER GRADE	9820855	198,886	Evergreen Marine Corp
EVER GREET	9832729	198,937	Evergreen Marine Corp
EVER MACH	9935210	156,238	Evergreen Marine Corp
EVER MAGI	9935222	156,208	Evergreen Marine Corp
EVER MAX	9935208	156,175	Evergreen Marine Corp
HANOI EXPRESS	9540132	229,348	Hapag-Lloyd AG
HMM ALGECIRAS	9863297	232,606	HMM Co Ltd
HMM COPENHAGEN	9863302	232,606	HMM Co Ltd
HMM DAON	9869227	160,927	HMM Co Ltd
HMM DUBLIN	9863314	232,606	HMM Co Ltd
HMM GAON	9869174	160,927	HMM Co Ltd
HMM GARAM	9869186	160,927	HMM Co Ltd
HMM GDANSK	9863326	232,606	HMM Co Ltd
HMM HAMBURG	9863338	232,606	HMM Co Ltd
HMM HANBADA	9869203	160,927	HMM Co Ltd
HMM HANUL	9869239	160,927	HMM Co Ltd
HMM HELSINKI	9863340	232,606	HMM Co Ltd
HMM LE HAVRE	9868314	232,606	HMM Co Ltd
HMM MIR	9869198	160,927	HMM Co Ltd

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Container Ships Currently in Service with an Air Draft Clearance Greater Than 185 Feet			
Name of Ship	**IMO**	**Deadweight**	**Operator**
HMM NURI	9869162	160,927	HMM Co Ltd
HMM OSLO	9868326	229,039	HMM Co Ltd
HMM RAON	9869215	160,927	HMM Co Ltd
HMM ROTTERDAM	9868338	229,039	HMM Co Ltd
HMM SOUTHAMPTON	9868340	229,039	HMM Co Ltd
HMM ST PETERSBURG	9868364	229,039	HMM Co Ltd
HMM STOCKHOLM	9868352	229,039	HMM Co Ltd
MAASTRICHT MAERSK	9780483	190,326	Maersk A/S
MADISON MAERSK	9619945	213,971	Maersk A/S
MADRID MAERSK	9778791	190,326	Maersk A/S
MAERSK CAMBRIDGE	9924182	175,897	Zodiac Maritime Ltd
MAERSK CAMDEN	9924194	175,897	Zodiac Maritime Ltd
MAERSK CAMPBELL	9924209	175,897	Zodiac Maritime Ltd
MAERSK CAMPTON	9924211	175,897	Maersk A/S
MAERSK CANDOR	9924223	175,897	Maersk A/S
MAERSK CANYON	9924235	175,897	Zodiac Maritime Ltd
MAERSK CHARLESTON	9936379	171,819	Seaspan Corp
MAERSK CINCINNATI	9936410	172,053	Seaspan Corp
MAERSK CLEVELAND	9936408	172,037	Seaspan Corp
MAERSK HALIFAX	9784271	178,257	Maersk A/S
MAERSK HAMBURG	9784312	178,257	Maersk A/S
MAERSK HANGZHOU	9784300	178,257	Maersk A/S
MAERSK HANOI	9784295	178,257	Maersk A/S
MAERSK HAVANA	9784336	178,257	Maersk A/S
MAERSK HERRERA	9784324	178,257	Maersk A/S
MAERSK HIDALGO	9784283	178,257	Maersk A/S
MAERSK HONG KONG	9784257	178,257	Maersk A/S
MAERSK HORSBURGH	9784269	178,257	Maersk A/S
MAERSK HOUSTON	9848950	178,257	Maersk A/S
MAERSK HUACHO	9848948	178,257	Maersk A/S
MAERSK MC-KINNEY MOLLER	9619907	213,971	Maersk A/S
MAGLEBY MAERSK	9619957	213,971	Maersk A/S
MAJESTIC MAERSK	9619919	213,971	Maersk A/S
MANCHESTER MAERSK	9780445	190,326	Maersk A/S
MANILA EXPRESS	9540120	229,348	Hapag-Lloyd AG
MANILA MAERSK	9780469	190,326	Maersk A/S
MARCHEN MAERSK	9632143	214,121	Maersk A/S
MAREN MAERSK	9632129	214,121	Maersk A/S
MARGRETHE MAERSK	9632131	214,121	Maersk A/S

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Container Ships Currently in Service with an Air Draft Clearance Greater Than 185 Feet			
Name of Ship	**IMO**	**Deadweight**	**Operator**
MARIBO MAERSK	9619969	213,971	Maersk A/S
MARIE MAERSK	9619933	213,971	Maersk A/S
MARIT MAERSK	9632167	214,121	Maersk A/S
MARSEILLE MAERSK	9778844	190,326	Maersk A/S
MARSTAL MAERSK	9619971	213,971	Maersk A/S
MARY MAERSK	9619921	213,971	Maersk A/S
MATHILDE MAERSK	9632179	214,121	Maersk A/S
MATZ MAERSK	9619983	213,971	Maersk A/S
MAYVIEW MAERSK	9619995	213,971	Maersk A/S
MERETE MAERSK	9632064	214,121	Maersk A/S
METTE MAERSK	9632155	214,121	Maersk A/S
MILAN MAERSK	9778820	190,326	Maersk A/S
MOGENS MAERSK	9632090	214,121	Maersk A/S
MONACO MAERSK	9778832	190,326	Maersk A/S
MORTEN MAERSK	9632105	214,121	Maersk A/S
MOSCOW MAERSK	9778818	190,326	Maersk A/S
MSC AAYA	9927263	160,194	MSC Mediterranean Shipping Co
MSC ADYA	9932921	163,443	MSC Mediterranean Shipping Co
MSC ALEXANDRA	9461374	190,734	MSC Mediterranean Shipping Co
MSC ALLEGRA	9897028	255,288	MSC Mediterranean Shipping Co
MSC ALTAIR	9465277	155,851	MSC Mediterranean Shipping Co
MSC AMBRA	9839480	254,042	MSC Mediterranean Shipping Co
MSC AMELIA	9896995	255,288	MSC Mediterranean Shipping Co
MSC AMSTERDAM	9606338	186,541	MSC Mediterranean Shipping Co
MSC ANITA	9947146	204,738	MSC Mediterranean Shipping Co
MSC ANNA	9777204	185,503	MSC Mediterranean Shipping Co
MSC APOLLINE	9896983	255,288	MSC Mediterranean Shipping Co
MSC ARIES	9857169	158,097	MSC Mediterranean Shipping Co
MSC ARINA	9839284	254,992	MSC Mediterranean Shipping Co
MSC AUDREY	9540065	159,528	MSC Mediterranean Shipping Co
MSC AURIGA	9857183	158,097	MSC Mediterranean Shipping Co
MSC AURORA	9484481	182,382	MSC Mediterranean Shipping Co
MSC AZRA	9932919	163,443	MSC Mediterranean Shipping Co
MSC BARI	9461441	165,905	MSC Mediterranean Shipping Co
MSC BEATRICE	9399014	187,047	MSC Mediterranean Shipping Co
MSC BENEDETTA XIII	9465253	155,851	MSC Mediterranean Shipping Co
MSC BERANGERE	9930947	175,897	MSC Mediterranean Shipping Co
MSC BETTINA	9399038	187,080	MSC Mediterranean Shipping Co
MSC BIANCA SILVIA	9930935	175,897	MSC Mediterranean Shipping Co

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Container Ships Currently in Service with an Air Draft Clearance Greater Than 185 Feet			
Name of Ship	**IMO**	**Deadweight**	**Operator**
MSC C. MONTAINE	9930961	175,897	Zodiac Maritime Ltd
MSC CALYPSO	9932036	159,528	MSC Mediterranean Shipping Co
MSC CAMILLE	9404651	189,249	MSC Mediterranean Shipping Co
MSC CANDIDA	9946714	204,347	MSC Mediterranean Shipping Co
MSC CAPELLA	9465289	155,851	MSC Mediterranean Shipping Co
MSC CARMELITA	9946879	170,843	MSC Mediterranean Shipping Co
MSC CELESTINO MARESCA	9930040	272,353	MSC Mediterranean Shipping Co
MSC CHINA	9936642	272,131	MSC Mediterranean Shipping Co
MSC CHIYO	9947110	204,748	MSC Mediterranean Shipping Co
MSC CLARA	9708693	221,517	MSC Mediterranean Shipping Co
MSC CLAUDE GIRARDET	9936628	271,957	MSC Mediterranean Shipping Co
MSC CLORINDA	9484429	165,959	MSC Mediterranean Shipping Co
MSC CRISTINA	9465241	155,851	MSC Mediterranean Shipping Co
MSC DANIELA	9399002	187,080	MSC Mediterranean Shipping Co
MSC DANIT	9404649	165,517	MSC Mediterranean Shipping Co
MSC DARIA	9927287	160,194	MSC Mediterranean Shipping Co
MSC DARLENE	9930959	175,897	MSC Mediterranean Shipping Co
MSC DEILA	9461415	166,093	MSC Mediterranean Shipping Co
MSC DIANA	9755933	221,354	MSC Mediterranean Shipping Co
MSC DILETTA	9897004	255,288	MSC Mediterranean Shipping Co
MSC DITTE	9754953	222,676	MSC Mediterranean Shipping Co
MSC ELOANE	9755957	201,792	MSC Mediterranean Shipping Co
MSC EMANUELA	9399052	187,080	MSC Mediterranean Shipping Co
MSC ERICA	9755191	222,676	MSC Mediterranean Shipping Co
MSC EVA	9401130	162,867	MSC Mediterranean Shipping Co
MSC FATMA	9927251	160,194	MSC Mediterranean Shipping Co
MSC FEBE	9839478	254,042	MSC Mediterranean Shipping Co
MSC FLAVIA	9467433	175,327	MSC Mediterranean Shipping Co
MSC FRANCESCA	9401116	174,897	MSC Mediterranean Shipping Co
MSC FREYA	9932062	159,528	MSC Mediterranean Shipping Co
MSC GAIA	9401142	187,080	MSC Mediterranean Shipping Co
MSC GEMMA	9936616	272,133	MSC Mediterranean Shipping Co
MSC GENOVA	9461386	166,041	MSC Mediterranean Shipping Co
MSC GIUSY	9947134	170,965	MSC Mediterranean Shipping Co
MSC GULSUN	9839430	254,042	MSC Mediterranean Shipping Co
MSC HAMBURG	9647461	210,475	MSC Mediterranean Shipping Co
MSC IDANIA	9962562	171,056	MSC Mediterranean Shipping Co
MSC ILARIA	9962586	171,079	MSC Mediterranean Shipping Co
MSC ILENIA	9962548	171,099	MSC Mediterranean Shipping Co

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Container Ships Currently in Service with an Air Draft Clearance Greater Than 185 Feet			
Name of Ship	**IMO**	**Deadweight**	**Operator**
MSC INGY	9755945	202,347	MSC Mediterranean Shipping Co
MSC IRENE	9399040	187,080	MSC Mediterranean Shipping Co
MSC IRINA	9929429	240,739	MSC Mediterranean Shipping Co
MSC ISABELLA	9839272	254,992	MSC Mediterranean Shipping Co
MSC ISTANBUL	9606326	186,650	MSC Mediterranean Shipping Co
MSC IVA	9962550	171,111	MSC Mediterranean Shipping Co
MSC JADE	9762326	222,676	MSC Mediterranean Shipping Co
MSC KALINA	9399026	187,080	MSC Mediterranean Shipping Co
MSC KATRINA	9467445	175,327	MSC Mediterranean Shipping Co
MSC KAYLEY	9927299	160,194	MSC Mediterranean Shipping Co
MSC LA SPEZIA	9461403	165,977	MSC Mediterranean Shipping Co
MSC LAURENCE	9467419	175,327	MSC Mediterranean Shipping Co
MSC LEANNE	9767390	221,354	MSC Mediterranean Shipping Co
MSC LELLA	9947158	171,309	MSC Mediterranean Shipping Co
MSC LENI	9839454	254,042	MSC Mediterranean Shipping Co
MSC LIVORNO	9461427	165,918	MSC Mediterranean Shipping Co
MSC LONDON	9606302	186,650	MSC Mediterranean Shipping Co
MSC LORETO	9934735	281,456	MSC Shipmanagement Ltd
MSC LUCIANA	9398383	174,897	MSC Mediterranean Shipping Co
MSC MARA	9932892	162,524	MSC Mediterranean Shipping Co
MSC MARGRIT	9465318	155,222	MSC Mediterranean Shipping Co
MSC MARIAGRAZIA	9964194	173,069	MSC Mediterranean Shipping Co
MSC MARIE	9962574	171,082	MSC Mediterranean Shipping Co
MSC MARIELLA	9934747	281,456	MSC Mediterranean Shipping Co
MSC MARTINA MARIA	9540077	159,528	MSC Mediterranean Shipping Co
MSC MAYA	9708679	221,517	MSC Mediterranean Shipping Co
MSC MELATILDE	9404675	190,343	MSC Mediterranean Shipping Co
MSC METTE	9936630	272,192	MSC Mediterranean Shipping Co
MSC MIA	9839466	228,149	MSC Mediterranean Shipping Co
MSC MICHEL CAPPELLINI	9929431	281,456	MSC Mediterranean Shipping Co
MSC MICHELLE	9897016	255,288	MSC Mediterranean Shipping Co
MSC MICOL	9931290	281,456	MSC Mediterranean Shipping Co
MSC MINA	9839260	254,992	MSC Mediterranean Shipping Co
MSC MIRJA	9762338	222,676	MSC Mediterranean Shipping Co
MSC MIRJAM	9767376	221,354	MSC Mediterranean Shipping Co
MSC MONICA CRISTINA	9932050	159,528	MSC Mediterranean Shipping Co
MSC NELA	9839296	254,992	MSC Mediterranean Shipping Co
MSC NEW YORK	9606314	186,766	MSC Mediterranean Shipping Co
MSC NICOLA MASTRO	9930064	272,347	MSC Mediterranean Shipping Co

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Container Ships Currently in Service with an Air Draft Clearance Greater Than 185 Feet			
Name of Ship	**IMO**	**Deadweight**	**Operator**
MSC NOA ARIELA	9946843	170,658	MSC Mediterranean Shipping Co
MSC OLIVER	9703306	221,517	MSC Mediterranean Shipping Co
MSC ORION	9857157	158,097	MSC Mediterranean Shipping Co
MSC ORSOLA	9946726	204,332	MSC Mediterranean Shipping Co
MSC OSCAR	9703291	221,517	MSC Mediterranean Shipping Co
MSC PALOMA	9441001	189,901	MSC Mediterranean Shipping Co
MSC PERLE	9503732	155,249	MSC Mediterranean Shipping Co
MSC RAVENNA	9484431	165,963	MSC Mediterranean Shipping Co
MSC RAYA	9930052	272,405	MSC Mediterranean Shipping Co
MSC REEF	9754965	222,676	MSC Mediterranean Shipping Co
MSC REGULUS	9465291	155,851	MSC Mediterranean Shipping Co
MSC RENEE	9465306	155,222	MSC Mediterranean Shipping Co
MSC RIFAYA	9767388	221,354	MSC Mediterranean Shipping Co
MSC ROSA M	9461398	165,991	MSC Mediterranean Shipping Co
MSC ROSE	9957359	161,210	MSC Mediterranean Shipping Co
MSC RUBY	9502960	155,249	MSC Mediterranean Shipping Co
MSC SAMAR	9839442	254,042	MSC Mediterranean Shipping Co
MSC SAVONA	9460356	165,887	MSC Mediterranean Shipping Co
MSC SIXIN	9839301	254,992	MSC Mediterranean Shipping Co
MSC SOFIA	9927275	160,194	MSC Mediterranean Shipping Co
MSC SONIA	9404663	190,343	MSC Mediterranean Shipping Co
MSC SVEVA	9708681	221,517	MSC Mediterranean Shipping Co
MSC TARANTO	9475258	166,085	MSC Mediterranean Shipping Co
MSC TAYLOR	9932048	159,528	MSC Mediterranean Shipping Co
MSC TERESA	9469560	166,101	MSC Mediterranean Shipping Co
MSC TESSA	9930038	272,373	MSC Mediterranean Shipping Co
MSC THAIS	9957347	163,449	MSC Mediterranean Shipping Co
MSC TINA	9762340	222,676	MSC Mediterranean Shipping Co
MSC TOPAZ	9502908	155,249	MSC Mediterranean Shipping Co
MSC TURKIYE	9931288	281,456	MSC Mediterranean Shipping Co
MSC VALENTINA	9946855	204,150	MSC Mediterranean Shipping Co
MSC VALERIA	9461439	190,734	MSC Mediterranean Shipping Co
MSC VEGA	9465265	155,222	MSC Mediterranean Shipping Co
MSC VENICE	9647473	186,650	MSC Mediterranean Shipping Co
MSC VICTORIA	9932907	162,524	MSC Mediterranean Shipping Co
MSC VICTORINE	9946867	203,855	MSC Mediterranean Shipping Co
MSC VIRGO	9857171	158,097	MSC Mediterranean Shipping Co
MSC VIVIANA	9777216	185,503	MSC Mediterranean Shipping Co
MSC VIVIENNE	9947122	204,316	MSC Mediterranean Shipping Co

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Container Ships Currently in Service with an Air Draft Clearance Greater Than 185 Feet			
Name of Ship	**IMO**	**Deadweight**	**Operator**
MSC ZOE	9703318	221,517	MSC Mediterranean Shipping Co
MUMBAI MAERSK	9780471	190,326	Maersk A/S
MUNICH MAERSK	9778806	190,326	Maersk A/S
MUNKEBO MAERSK	9632117	214,121	Maersk A/S
MURCIA MAERSK	9780457	190,326	Maersk A/S
NORFOLK EXPRESS	9665592	157,794	SFL Management Singapore
ONE FANTASTIC	9936381	171,899	Seaspan Corp
ONE FOCUS	9944792	155,932	Ocean Network Express Pte Ltd
ONE FOREVER	9944807	156,102	Ocean Network Express Pte Ltd
ONE FORWARD	9936422	172,058	Ocean Network Express Pte Ltd
ONE FREEDOM	9934357	155,928	Seaspan Corp
ONE FRIENDSHIP	9934369	156,114	Seaspan Corp
ONE FRONTIER	9934383	156,002	Seaspan Corp
ONE FRUITION	9934371	156,083	Seaspan Corp
ONE INFINITY	9933004	225,219	Ocean Network Express Pte Ltd
ONE INGENUITY	9933016	224,986	Ocean Network Express Pte Ltd
ONE INNOVATION	9939137	225,405	Ocean Network Express Pte Ltd
ONE INSPIRATION	9939149	224,983	Ocean Network Express Pte Ltd
ONE INTEGRITY	9933119	225,219	Shoei Kisen KK
ONE INTELLIGENCE	9933121	224,986	Ocean Network Express Pte Ltd
ONE TRADITION	9769300	196,324	Ocean Network Express Pte Ltd
ONE TREASURE	9773222	189,766	Ocean Network Express Pte Ltd
ONE TRIBUTE	9769295	196,384	Ocean Network Express Pte Ltd
ONE TRIUMPH	9769271	196,155	Ocean Network Express Pte Ltd
ONE TRUST	9769283	197,059	Ocean Network Express Pte Ltd
ONE TRUTH	9773210	189,766	Ocean Network Express Pte Ltd
OOCL FELIXSTOWE	9922512	224,861	Orient Overseas Container Line
OOCL GDYNIA	9908102	224,868	Orient Overseas Container Line
OOCL GERMANY	9776183	191,688	Orient Overseas Container Line
OOCL HONG KONG	9776171	191,422	Orient Overseas Container Line
OOCL INDONESIA	9776224	196,847	Orient Overseas Container Line
OOCL JAPAN	9776195	191,640	Orient Overseas Container Line
OOCL PIRAEUS	9908097	224,821	Orient Overseas Container Line
OOCL SCANDINAVIA	9776212	191,343	Orient Overseas Container Line
OOCL SPAIN	9908126	224,969	Orient Overseas Container Line
OOCL TURKIYE	9908138	224,827	Orient Overseas Container Line
OOCL UNITED KINGDOM	9776200	191,570	Orient Overseas Container Line
OOCL VALENCIA	9922598	228,142	Orient Overseas Container Line
OOCL ZEEBRUGGE	9908140	224,826	Orient Overseas Container Line

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Container Ships Currently in Service with an Air Draft Clearance Greater Than 185 Feet			
Name of Ship	**IMO**	**Deadweight**	**Operator**
SAVANNAH EXPRESS	9665607	157,794	SFL Management Singapore
THALASSA TYHI	9667162	158,657	SFL Management Singapore
TIHAMA	9736107	199,744	Hapag-Lloyd AG
ZEAL LUMOS	9864241	158,097	Ocean Network Express Pte Ltd
ZENITH LUMOS	9864215	157,097	Ocean Network Express Pte Ltd
ZEPHYR LUMOS	9864227	158,097	Ocean Network Express Pte Ltd
ZEUS LUMOS	9864239	158,097	Ocean Network Express Pte Ltd
ZIM MOUNT BLANC	9931111	160,978	Zim Integrated Shipping Servs
ZIM MOUNT DENALI	9931123	160,978	Zim Integrated Shipping Servs
ZIM MOUNT ELBRUS	9932529	160,978	Zim Integrated Shipping Servs
ZIM MOUNT EVEREST	9931109	160,978	Zim Integrated Shipping Servs
ZIM MOUNT FUJI	9932517	160,978	Zim Integrated Shipping Servs
ZIM MOUNT KILIMANJARO	9932490	161,069	Zim Integrated Shipping Servs
ZIM MOUNT OLYMPUS	9932505	161,070	Zim Integrated Shipping Servs
ZIM MOUNT RAINIER	9931135	160,978	Zim Integrated Shipping Servs
ZIM MOUNT VINSON	9932531	161,070	Zim Integrated Shipping Servs
ZIM SAMMY OFER	9931094	160,978	Zim Integrated Shipping Servs

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Exhibit G - Prospective Commercial Navigation and Cargo

Future Vessels That Will Not Have Access to the Port of Baltimore

Container Ships Under Construction with an Air Draft Clearance Greater Than 185 Feet				
Name of Ship	**IMO**	**Build Date**	**Deadweight**	**Operator**
Summary	**Count**		**Average**	
	186		**178,596**	
A. P. MOLLER	9948803	2024-10	189,508	Maersk A/S
ADRIAN MAERSK	9948815	2024-11	189,508	Maersk A/S
ALBERT MAERSK	9961805	2025-01	189,508	Maersk A/S
ALETTE MAERSK	9948774	2024-06	189,508	Maersk A/S
ALEXANDRA MAERSK	9948786	2024-07	189,508	Maersk A/S
ALVA MAERSK	9961817	2025-02	189,508	Maersk A/S
ANTONIA MAERSK	9948762	2024-05	189,508	Maersk A/S
ARTHUR MAERSK	9961829	2025-03	189,508	Maersk A/S
AXEL MAERSK	9961831	2025-05	189,508	Maersk A/S
BANGKOK EXPRESS	9943889	2024-10	230,000	Hapag-Lloyd AG
CMA CGM BIG SUR	9938169	2024-08	155,000	CMA CGM SA The French Line
CMA CGM CAPE COD	9938133	2024-04	155,000	CMA CGM SA The French Line
CMA CGM GRACE BAY	9938145	2024-05	155,000	CMA CGM SA The French Line
CMA CGM LAGUNA	9938171	2024-09	155,000	CMA CGM SA The French Line
COSCO YANGZHOU N1071	9945899	2025-06	164,000	COSCO Shipping Lines Co Ltd
COSCO YANGZHOU N1072	9945904	2025-08	164,000	COSCO Shipping Lines Co Ltd
COSCO YANGZHOU N1073	9945916	2025-10	164,000	COSCO Shipping Lines Co Ltd
COSCO YANGZHOU N1074	9945928	2025-12	164,000	COSCO Shipping Lines Co Ltd
CSSC TIANJIN C16K-13	9968308	2025-06	168,000	MSC Mediterranean Shipping Co
CSSC TIANJIN C16K-14	9968310	2025-06	168,000	MSC Mediterranean Shipping Co
CSSC TIANJIN C16K-15	9968322	2025-06	168,000	MSC Mediterranean Shipping Co
CSSC TIANJIN C16K-16	1021051	2025-12	156,100	CMA CGM SA The French Line
CSSC TIANJIN C16K-17	1021075	2026-04	156,100	CMA CGM SA The French Line
CSSC TIANJIN C16K-18	1021087	2026-06	156,100	CMA CGM SA The French Line
CSSC TIANJIN C16K-19	1021099	2026-08	156,100	CMA CGM SA The French Line
CSSC TIANJIN C16K-20	1021104	2026-10	156,100	CMA CGM SA The French Line
CSSC TIANJIN C16K-21	1021116	2026-12	156,100	CMA CGM SA The French Line
DAEWOO 4384	9954735	2024-09	157,000	MSC Mediterranean Shipping Co
DAEWOO 4385	9954747	2024-12	157,000	MSC Mediterranean Shipping Co
DAEWOO 4386	9954759	2024-11	157,000	MSC Mediterranean Shipping Co
DAEWOO 4387	9954761	2024-12	157,000	MSC Mediterranean Shipping Co
DAEWOO 4388	9963580	2025-03	157,000	MSC Mediterranean Shipping Co

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Container Ships Under Construction with an Air Draft Clearance Greater Than 185 Feet				
Name of Ship	**IMO**	**Build Date**	**Deadweight**	**Operator**
DAEWOO 4389	9963592	2025-05	157,000	MSC Mediterranean Shipping Co
DAEWOO 4390	9963607	2025-07	157,000	MSC Mediterranean Shipping Co
DAEWOO 4391	9963619	2025-08	157,000	MSC Mediterranean Shipping Co
DAEWOO 4392	9963621	2025-10	157,000	MSC Mediterranean Shipping Co
DAEWOO 4393	9963633	2025-11	157,000	MSC Mediterranean Shipping Co
DALIAN COSCO KHI DE135	9949716	2024-12	165,000	Orient Overseas Container Line
DALIAN COSCO KHI DE136	9949728	2025-04	165,000	Orient Overseas Container Line
DALIAN COSCO KHI DE137	9949730	2025-05	165,000	Orient Overseas Container Line
DALIAN COSCO KHI DE138	9949742	2025-10	165,000	Orient Overseas Container Line
DALIAN COSCO KHI DE139	9949754	2025-12	165,000	Orient Overseas Container Line
DALIAN COSCO KHI DE148	1037995	2027-01	225,000	COSCO Shipping Lines Co Ltd
DALIAN COSCO KHI DE149	1038004	2027-06	225,000	COSCO Shipping Lines Co Ltd
DALIAN COSCO KHI DE150	1038016	2027-10	225,000	COSCO Shipping Lines Co Ltd
DAMIETTA EXPRESS	9543108	2024-05	230,000	Hapag-Lloyd AG
EVER MASS	9935234	2024-05	156,000	Evergreen Marine Corp
EVER MAST	9935246	2024-05	156,000	Evergreen Marine Corp
GDANSK EXPRESS	9943877	2024-07	230,000	Hapag-Lloyd AG
GENOVA EXPRESS	9943906	2025-02	230,000	Hapag-Lloyd AG
GUANGZHOU 21110047	9946738	2024-08	170,500	MSC Mediterranean Shipping Co
GUANGZHOU 21110048	9946740	2024-11	170,500	MSC Mediterranean Shipping Co
HAMBURG EXPRESS	9943865	2024-06	230,000	Hapag-Lloyd AG
HD HYUNDAI ULSAN 3445	1019785	2026-04	159,654	Yang Ming Marine Transport
HD HYUNDAI ULSAN 3446	1019797	2026-07	159,654	Yang Ming Marine Transport
HD HYUNDAI ULSAN 3447	1019802	2026-09	159,654	Yang Ming Marine Transport
HD HYUNDAI ULSAN 3448	1019814	2026-12	159,654	Yang Ming Marine Transport
HD HYUNDAI ULSAN 3449	1019826	2027-03	159,654	Yang Ming Marine Transport
HUDONG ZHONGHUA H1906A	9987213	2026-08	221,000	CMA CGM SA The French Line
HUDONG-ZHONGHUA H1873A	9943279	2024-11	233,000	Evergreen Marine Corp
HUDONG-ZHONGHUA H1878A	9975791	2026-03	241,000	Evergreen Marine Corp
HUDONG-ZHONGHUA H1904A	9987196	2025-09	221,000	CMA CGM SA The French Line
HUDONG-ZHONGHUA H1905A	9987201	2025-12	221,000	CMA CGM SA The French Line
HUDONG-ZHONGHUA H1907A	9987225	2026-10	221,000	CMA CGM SA The French Line
HYUNDAI SAMHO 8168	9964235	2024-10	172,261	MSC Mediterranean Shipping Co
HYUNDAI SAMHO 8169	9964247	2024-12	172,261	MSC Mediterranean Shipping Co
HYUNDAI ULSAN 3327	9948798	2024-09	189,508	Maersk A/S
HYUNDAI ULSAN 3408	9984560	2026-06	198,229	Maersk A/S
HYUNDAI ULSAN 3409	9984572	2025-08	198,229	Maersk A/S
HYUNDAI ULSAN 3410	9984584	2025-09	198,229	Maersk A/S

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Container Ships Under Construction with an Air Draft Clearance Greater Than 185 Feet				
Name of Ship	**IMO**	**Build Date**	**Deadweight**	**Operator**
HYUNDAI ULSAN 3411	9984596	2025-10	198,229	Maersk A/S
HYUNDAI ULSAN 3412	9984601	2025-11	198,229	Maersk A/S
HYUNDAI ULSAN 3413	9984613	2025-12	198,229	Maersk A/S
IMABARI HIROSHIMA 2732	9976173	2025-05	160,200	Ocean Network Express Pte Ltd
IMABARI HIROSHIMA 2733	9976185	2025-07	160,200	Ocean Network Express Pte Ltd
IMABARI HIROSHIMA 2735	9976197	2025-09	160,200	Ocean Network Express Pte Ltd
IMABARI HIROSHIMA 2750	1023035	2025-11	160,200	Ocean Network Express Pte Ltd
IMABARI HIROSHIMA 2751	1023047	2026-01	160,200	Ocean Network Express Pte Ltd
IMABARI HIROSHIMA 2752	1023059	2026-03	160,200	Ocean Network Express Pte Ltd
IMABARI HIROSHIMA 2753	1023061	2026-05	160,200	Ocean Network Express Pte Ltd
IMABARI HIROSHIMA 2755	1023073	2026-07	160,200	Ocean Network Express Pte Ltd
IMABARI HIROSHIMA 2756	1023085	2026-09	160,200	Ocean Network Express Pte Ltd
IMABARI MARUGAME 1927	9976707	2025-05	160,200	Ocean Network Express Pte Ltd
IMABARI MARUGAME 1928	9976719	2025-09	160,200	Ocean Network Express Pte Ltd
IMABARI MARUGAME 1934	1023102	2025-12	160,200	Ocean Network Express Pte Ltd
IMABARI MARUGAME 1935	1023114	2026-03	160,200	Ocean Network Express Pte Ltd
IMABARI MARUGAME 1936	1023126	2026-06	160,200	Ocean Network Express Pte Ltd
IMABARI MARUGAME 1937	1023138	2026-09	160,200	Ocean Network Express Pte Ltd
JIANGNAN H2774	9938157	2024-07	155,000	CMA CGM SA The French Line
JIANGNAN H2789	9978729	2025-07	155,000	BAL Container Line Co Ltd
JIANGNAN H2790	9978731	2025-09	155,000	BAL Container Line Co Ltd
JIANGNAN H2791	9996989	2025-11	156,500	CMA CGM SA The French Line
JIANGNAN H2792	9996991	2026-01	156,500	CMA CGM SA The French Line
JIANGNAN H2793	9997000	2026-03	156,500	CMA CGM SA The French Line
JIANGNAN H2794	9997012	2026-05	156,500	CMA CGM SA The French Line
JIANGNAN H2795	9997024	2026-07	156,500	CMA CGM SA The French Line
JIANGNAN H2796	9997036	2026-09	156,500	CMA CGM SA The French Line
JIANGSU NEWYANGZI	9944833	2024-10	157,000	Seaspan Corp
JIANGSU NEWYANGZI	9944845	2024-11	157,000	Seaspan Corp
JIANGSU NEWYANGZI	9944821	2024-09	157,000	Seaspan Corp
JIANGSU YANGZI XINFU YZJ2021-1347	9944819	2024-06	157,000	Seaspan Corp
JIANGSU YANGZI XINFU YZJ2022-1472	9987366	2025-11	168,000	MSC Mediterranean Shipping Co
JIANGSU YANGZI XINFU YZJ2022-1473	9987378	2025-12	168,000	MSC Mediterranean Shipping Co
JIANGSU YANGZI XINFU YZJ2022-1474	9987380	2026-03	168,000	MSC Mediterranean Shipping Co
JIANGSU YANGZI XINFU YZJ2023-1545	1028035	2026-06	231,875	CMA CGM SA The French Line

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Container Ships Under Construction with an Air Draft Clearance Greater Than 185 Feet				
Name of Ship	**IMO**	**Build Date**	**Deadweight**	**Operator**
JIANGSU YANGZI XINFU YZJ2023-1546	1028047	2026-09	231,875	CMA CGM SA The French Line
JIANGSU YANGZI XINFU YZJ2023-1547	1028059	2026-12	231,875	CMA CGM SA The French Line
JIANGSU YANGZI XINFU YZJ2023-1548	1028061	2027-03	231,875	CMA CGM SA The French Line
JIANGSU YANGZI XINFU YZJ2023-1549	1028073	2027-06	231,875	CMA CGM SA The French Line
JIANGSU YANGZI XINFU YZJ2023-1550	1028085	2027-06	231,875	CMA CGM SA The French Line
JIANGSU YANGZI XINFU YZJ2023-1551	1028097	2027-09	231,875	CMA CGM SA The French Line
JIANGSU YANGZI XINFU YZJ2023-1552	1028102	2027-09	231,875	CMA CGM SA The French Line
JIANGSU YANGZI XINFU YZJ2023-1553	1028114	2027-12	231,875	CMA CGM SA The French Line
MSC CARMELA	9968281	2025-03	168,000	MSC Mediterranean Shipping Co
MSC CHIARA	9987330	2025-07	168,000	MSC Mediterranean Shipping Co
MSC ELENOIRE	9962603	2024-08	170,500	Seaspan Ship Management Ltd
MSC GIOVANNA	9987342	2025-08	168,000	MSC Mediterranean Shipping Co
MSC JASMINE	9987304	2025-02	168,000	MSC Mediterranean Shipping Co
MSC JULIETTE	9946893	2024-05	170,500	MSC Mediterranean Shipping Co
MSC LINZIE	9987354	2025-09	168,000	MSC Mediterranean Shipping Co
MSC LORENZA	9962598	2024-05	170,500	Seaspan Ship Management Ltd
MSC MARIACRISTINA	9968279	2025-01	168,000	MSC Mediterranean Shipping Co
MSC MAURA	9962536	2024-08	170,500	MSC Mediterranean Shipping Co
MSC NAPOLI	9964209	2024-05	172,261	MSC Mediterranean Shipping Co
MSC NICOLE	9968293	2025-06	168,000	MSC Mediterranean Shipping Co
MSC OLBIA	9987299	2024-12	168,000	MSC Mediterranean Shipping Co
MSC PALERMO	9964223	2024-08	172,261	MSC Mediterranean Shipping Co
MSC QUITTERIE	9946881	2024-05	170,500	MSC Mediterranean Shipping Co
MSC ROME	9964211	2024-06	172,261	MSC Mediterranean Shipping Co
MSC ROSSELLA	9987316	2025-04	168,000	MSC Mediterranean Shipping Co
MSC SALERNO	9947160	2024-07	170,500	MSC Mediterranean Shipping Co
MSC SIENA	9987275	2024-10	168,000	MSC Mediterranean Shipping Co
MSC SIMONA	9962615	2024-09	170,500	Seaspan Ship Management Ltd
MSC SOPHIE	9987328	2025-05	168,000	MSC Mediterranean Shipping Co
MSC VERONA	9987287	2024-11	168,000	MSC Mediterranean Shipping Co
MSC VIOLA	9947172	2024-10	170,500	MSC Mediterranean Shipping Co
NANTONG COSCO KHI 398	9922615	2024-09	215,000	Orient Overseas Container Line
NANTONG COSCO KHI 422	9949766	2025-01	165,000	Orient Overseas Container Line
NANTONG COSCO KHI 423	9949778	2025-04	165,000	Orient Overseas Container Line

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Container Ships Under Construction with an Air Draft Clearance Greater Than 185 Feet				
Name of Ship	**IMO**	**Build Date**	**Deadweight**	**Operator**
NANTONG COSCO KHI 424	9949780	2025-07	165,000	Orient Overseas Container Line
NANTONG COSCO KHI 425	9949792	2025-10	165,000	Orient Overseas Container Line
NANTONG COSCO KHI 426	9949807	2025-12	165,000	Orient Overseas Container Line
NANTONG COSCO KHI 456	9986324	2026-08	225,000	Orient Overseas Container Line
NANTONG COSCO KHI 457	9986336	2026-12	225,000	Orient Overseas Container Line
NANTONG COSCO KHI 458	9986348	2027-04	225,000	Orient Overseas Container Line
NANTONG COSCO KHI 459	9986350	2027-08	225,000	Orient Overseas Container Line
NANTONG COSCO KHI 460	9986362	2027-11	225,000	Orient Overseas Container Line
ONE FUTURE	9936393	2024-04	155,000	Seaspan Corp
OOCL ABU DHABI	9922524	2024-04	215,000	Orient Overseas Container Line
OOCL DENMARK	9922548	2024-06	215,000	Orient Overseas Container Line
OOCL FINLAND	9922536	2024-04	215,000	Orient Overseas Container Line
OOCL SWEDEN	9922603	2024-05	215,000	Orient Overseas Container Line
ROTTERDAM EXPRESS	9943891	2025-01	230,000	Hapag-Lloyd AG
SAMSUNG 2454	9935258	2024-06	156,000	Evergreen Marine Corp
SAMSUNG 2455	9935260	2024-07	156,000	Evergreen Marine Corp
SAMSUNG 2456	9935272	2024-10	156,000	Evergreen Marine Corp
SAMSUNG 2457	9935284	2024-08	156,000	Evergreen Marine Corp
SAMSUNG 2458	9935296	2024-09	156,000	Evergreen Marine Corp
SAMSUNG 2463	9935325	2024-11	156,000	Evergreen Marine Corp
SAMSUNG 2464	9935337	2024-12	156,000	Evergreen Marine Corp
SAMSUNG 2465	9935349	2024-11	156,000	Evergreen Marine Corp
SAMSUNG 2466	9935351	2024-12	156,000	Evergreen Marine Corp
SAMSUNG 2467	9935363	2025-04	156,000	Evergreen Marine Corp
SAMSUNG 2468	9935375	2025-06	156,000	Evergreen Marine Corp
SAMSUNG 2469	9935387	2025-03	156,000	Evergreen Marine Corp
SAMSUNG 2470	9935399	2025-04	156,000	Evergreen Marine Corp
SAMSUNG 2471	9935428	2025-08	156,000	Evergreen Marine Corp
SAMSUNG 2472	9935430	2025-10	156,000	Evergreen Marine Corp
SAMSUNG 2670	1025203	2025-11	182,000	Evergreen Marine Asia Pte Ltd
SAMSUNG 2671	1025215	2026-01	182,000	Evergreen Marine Asia Pte Ltd
SAMSUNG 2672	1025227	2026-03	182,000	Evergreen Marine Asia Pte Ltd
SAMSUNG 2673	1025239	2026-05	182,000	Evergreen Marine Asia Pte Ltd
SAMSUNG 2674	1025241	2026-06	182,000	Evergreen Marine Asia Pte Ltd
SAMSUNG 2675	1025253	2026-07	182,000	Evergreen Marine Asia Pte Ltd
SAMSUNG 2676	1025265	2026-11	182,000	Evergreen Marine Asia Pte Ltd
SAMSUNG 2677	1025277	2026-12	182,000	Evergreen Marine Asia Pte Ltd
SAMSUNG 2678	1025289	2027-03	182,000	Evergreen Marine Asia Pte Ltd

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Container Ships Under Construction with an Air Draft Clearance Greater Than 185 Feet				
Name of Ship	**IMO**	**Build Date**	**Deadweight**	**Operator**
SAMSUNG 2679	1025291	2027-05	182,000	Evergreen Marine Asia Pte Ltd
SAMSUNG 2680	1025306	2027-07	182,000	Evergreen Marine Asia Pte Ltd
SAMSUNG 2681	1025318	2027-08	182,000	Evergreen Marine Asia Pte Ltd
SAMSUNG 2682	1025370	2027-09	182,000	Evergreen Marine Asia Pte Ltd
SAMSUNG 2683	1025382	2027-10	182,000	Evergreen Marine Asia Pte Ltd
SAMSUNG 2684	1025394	2027-11	182,000	Evergreen Marine Asia Pte Ltd
SAMSUNG 2685	1025409	2027-12	182,000	Evergreen Marine Asia Pte Ltd
SINGAPORE EXPRESS	9543093	2024-05	229,348	Hapag-Lloyd AG
WILHELMSHAVEN EXPRESS	9943918	2025-04	230,000	Hapag-Lloyd AG

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Exhibit G - Present and Prospective Cruise Line Vessels

Cruise Line Fleet

Norwegian Cruise Lines Vessels							
NCL Vessel Name	**Year**	**IMO**	**GRT**	**LOA (FT)**	**Beam Extreme (FT)**	**Design Draft (FT)**	**Air Draft (FT)**
			Summary	**Maximum**			
				1135.86	**180.18**	**28.71**	**208.40**
Joy	2017	9703796	167,725	1100.418	157.905	27.72	199.42
Bliss	2018	9751509	168,028	1099.956	157.905	27.72	199.42
Encore	2019	9751511	169,116	1100.418	157.905	27.72	199.42
Breakaway	2013	9606912	145,655	1074.81	170.61	27.39	191.4
Getaway	2014	9606924	145,655	1074.81	170.61	27.39	181.5
Escape	2015	9677076	164,998	1075.47	180.18	27.489	202.85
Epic	2010	9410569	155,873	1087.185	172.92	28.71	201.3
Dawn	2002	9195169	92,250	970.629	125.73	28.05	169.29
Star	2001	9195157	91,740	970.629	125.73	28.05	169.29
Jewel	2005	9304045	93,502	970.629	125.73	28.05	169.29
Jade	2006	9304057	93,558	970.629	125.73	28.05	169.29
Pearl	2006	9342281	93,530	970.629	125.73	28.05	169.29
Gem	2007	9355733	93,530	970.629	125.73	28.05	169.29
Sky	1999	9128532	77,104	853.38	118.8	26.4	168.96
Sun	2001	9218131	78,309	853.38	124.74	26.4	168.96
Spirit	1998	9141065	75,904	891	121.44	27.72	162.03
America	2005	9209221	80,439	925.947	120.45	26.895	175.89
Prima	2022	9823986	143,535	968.22	166.98	28.017	207.9
Viva	2023	9823998	143,535	968.22	166.98	28.017	207.9
Aqua	TBD		156,300	1061.94	168.3	27.225	207.9
Leonardo 4	TBD						
Leonardo 5	TBD		169,000	1135.86	168.3	27.225	208.40
Leonardo 6	TBD						

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Carnival Cruise Lines Vessels				
Name	**Year Built**	**Capacity (2 / berth)**	**Draft (FT)**	**Air Draft (FT)**
		Summary	**Maximum**	**Maximum**
			28.87	**209.6**
Breeze	2012	3,650	27.88	205.05
Carnival Celebration	2022	5,400	28.87	209.60
Carnival Firenze	2020	3,936	28.05	207.51
Carnival Jubilee	2023	5,400	27.23	206.10
Carnival Venezia	2019	4,232	28.05	207.51
Dream	2009	3,650	27.62	205.05
Elation	1998	2,040	25.75	169.98
Freedom	2007	2,974	27.62	207.70
Glory	2003	2,974	27.23	208.30
Horizon	2018	3,960	28.05	207.51
Legend	2002	2,100	26.90	171.46
Liberty	2005	2,974	27.23	208.30
Magic	2011	3,650	27.62	205.05
Mardi Gras	2020	5,200	28.87	209.60
Miracle	2004	2,124	26.90	172.70
Panorama	2019	4,008	28.05	206.52
Paradise	1998	2,040	26.57	172.34
Pride	2002	2,100	26.90	171.60
Spirit	2001	2,100	26.90	172.70
Splendor	2008	3,000	27.79	195.47
Sunrise	1999	2,600	27.89	207.60
Sunshine	1996	2,964	28.28	207.15
Valor	2004	2,974	27.23	209.15
Victory	2000	2,758	28.05	207.51

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Celebrity Cruise Lines Vessels			
Name	**Ship #**	**Code**	**Air Draft Feet**
			Maximum
		Summary	**200.46**
Apex	68	AX	189.96
Ascent	70	AT	189.96
Beyond	69	BY	189.96
Celebrity Xcel	75	XC	189.96
Century	53	CN	176.66
Constellation	59	CS	178.40
Eclipse	64	EC	200.46
Edge	67	EG	189.96
Equinox	63	EQ	199.91
Infinity	57	IN	177.40
Millennium	56	ML	177.78
Reflection	66	RF	185.69
Silhouette	65	SI	200.45
Solstice	62	SL	199.97
Summit	58	SM	178.10

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Royal Caribbean Cruises Vessels				
Name	**Year Built**	**Capacity (2 / berth)**	**Draft (FT)**	**Air Draft (FT)**
		Summary	**Maximum**	
			54	**229.30**
Adventure of the Seas	2001	3,114	21	207.30
Allure of the Seas	2010	5,492	31	213.30
Anthem of the Seas	2015	4,180	33	206.36
Brillance of the Seas	2002	2,142	22	173.90
Enchantment of the Seas	1997	2,252	16	162.00
Explorer of the Seas	2000	3,114	19	208.10
Freedom of the Seas	2006	3,782	27	208.10
Grandeur of the Seas	1996	1,992	14	164.00
Harmony of the Seas	2016	5,497	34	212.90
Icon of the Seas	2024	5,610	39	229.30
Independence of the Seas	2008	3,634	29	208.30
Jewel of the Seas	2004	2,112	26	173.00
Liberty of the Seas	2007	3,798	28	208.20
Mariner of the Seas	2003	3,114	25	208.10
Navigator of the Seas	2002	3,686	23	208.10
Oasis of the Seas	2009	5,400	30	212.90
Odyssey of the Seas	2020	4,246	38	206.36
Ovation of the Seas	2016	4,180	35	206.36
Quantum of the Seas	2014	4,180	32	206.36
Radiance of the Seas	2001	2,143	20	173.90
Rhapsody of the Seas	1997	1,998	15	170.60
Serenade of the Seas	2003	2,146	24	173.22
Spectrum of the Seas	2019	4,246	37	206.36
Symphony of the Seas	2018	5,518	36	211.60
Utopia of the Seas	2024	5,714	54	211.60
Vision of the Seas	1998	2,050	17	170.60
Voyager of the Seas	1999	3,114	18	208.10
Wonder of the Seas	2022	5,734	41	211.60

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

Exhibit G - Present and Prospective Commercial Navigation and Cargo

Bayonne Bridge Air Draft Analysis

Bayonne Bridge Air Draft Analysis

Prepared for

The Port Commerce Department
The Port Authority of New York and New Jersey



Prepared by

United States Army Corps of Engineers
New York District

September 2009

US Army Corps
of Engineers®
New York District

EXECUTIVE SUMMARY

The Port Authority of New York and New Jersey (PANYNJ) commissioned the New York District of the U.S. Army Corps of Engineers to examine the commercial consequences of and the economic benefits generated by potential remedies for the air draft restriction imposed by the current height of the Bayonne Bridge. The air draft beneath the Bayonne Bridge varies with the tide between 151 and 156 feet. As more container ships of relatively large dimensions enter the world fleet, the frequency with which the Bridge will be an obstacle for large vessels to access container terminals west of the Bridge has the potential to increase. As a consequence, the Bayonne Bridge could become a detriment to the commercial attractiveness of the Port of New York and New Jersey.

The focus of the study is to assess whether these negative economic effects will occur (and if so, to what extent and when) in order for the PANYNJ to consider whether this issue warrants the conduct of further planning and environmental analysis that will inform future PANYNJ decisions. The major study findings are:

1. At its current height, the Bayonne Bridge is an obstruction to large container vessels (*i.e.*, most vessels greater than 7,000 TEUs) that might otherwise call the Port of New York and New Jersey within the 50-year planning horizon.
2. The economic benefits from removing the Bridge are independent of (*i.e.*, above and beyond) the benefits of providing 50-foot access to the container facilities throughout the harbor.
3. Preliminary estimates indicate that all of the proposed engineering alternatives considered in this report to deal with the air draft problem would result in considerably favorable benefit-to-cost ratios (BCR), on a National Economic Development basis (See summary table below).

The remainder of this paper follows as closely as practical the analytical path that the Corps of Engineers utilizes for deep-draft navigation studies. As a decision document, it is analogous to a Corps reconnaissance report, rather than a feasibility report, in that it does not include a recommended project or a cost-sharing plan. The purpose of a Corps reconnaissance report is to determine whether there is a water resource problem with an engineering solution that requires more detailed planning and environmental analyses to determine a specific project recommendation. In this case, the scope of the Corps' review was expanded beyond the scope of a typical Corps of Engineers reconnaissance study to meet the needs of the PANYNJ's project planning and decision-making process. The report suggests that further planning and environmental analyses by the PANYNJ are warranted for the identification of a preferred project alternative.

Summary of the Benefits to Costs

Alternative	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit
Jack to 215	2019	2033	3.0	10.7%	$3,270,679,702
New at 215	2022	2039	2.1	8.4%	$2,821,542,529
Bored Tunnel	2024	2042	1.9	7.7%	$2,585,424,669
Immersed Tunnel	2024	2051	1.4	6.1%	$1,517,453,940

Source: Costs from The Port Authority of New York and New Jersey TB&T; Construction cost estimates assume engineering and design begins in 2010.

Table of Contents

I. STUDY PURPOSE 1
II. PROBLEM IDENTIFICATION 3
III. ANALYSIS 12
A. OPERATIONAL CONSTRAINTS THAT COULD LIMIT BENEFITS 13
1. Global Constraints 13
2. Constraints at the Port of New York and New Jersey 14
B. BENEFITS CALCULATIONS 21
1. Commerce Forecast 22
2. The Future Fleet 22
3. Loading Pattern 27
4. Fleet Deployment 29
5. Vessel Operating Costs 31
6. Calculation of Project Benefits 32
C. COSTS OF POTENTIAL SOLUTIONS 33
IV. CONCLUSIONS 36
V. OTHER MATTERS AFFECTING THE PORT AUTHORITY'S DECISION PROCESS 37
VI. NEXT STEPS 38

Figures and Tables

Figure 1 - The New York and New Jersey Harbor Deepening Project and the Bayonne Bridge 2
Figure 2 - The Air Draft of the Bayonne Bridge 4
Figure 3 - Ship Dimensions 5
Figure 4 - PONYNJ Vessel Calls and Air Drafts, November 2008 to May 2009 6
Figure 5 - Correlation of Vessel Size and KTMH 9
Figure 6 - Variation in Vessel Height given Loading Pattern 10
Figure 7 - Proportions of the Existing World Fleet limited by the Bayonne Bridge by Hulls 11
Figure 8 - Proportions of the Existing World Fleet limited by the Bayonne Bridge by TEU's 11
Table 1 - Port Facilities with Significant Height Obstructions to Large Ships 13
Figure 9 - Percent of Asian Imports Moved Through the USEC by Year 16
Figure 10 - Navigating the Bergen Point Turn into Newark Bay 17
Figure 11 - Corps of Engineers Channel Width Design Guidance 18
Figure 12 - Cranes at Maher Terminal 20
Table 2 - Terminal Capacity Assumptions 20
Figure 13 - Flow Chart of Benefits Derivation 21
Figure 14 - The Commerce Forecast 22
Figure 15 - The Future Fleet 23
Figures 16 & 17 - Non-Fuel Vessel Operating Costs 24
Figure 18 & 19 - Trends in Newbuildings 25
Table 3 - Comparison of the *Emma Maersk* to the *MSC Daniela* 26
Figure 20 - Comparison of Panamax and New-Panamax Vessels 27
Figure 21 - Bayonne Bridge Air Draft Variation with Tidal Cycles 28
Figure 22 - The Loading Pattern 29

Figures 23 -Distribution of Cargo by Vessel Size by Year 30
Figures 24 & 25 - Vessel Operating Costs In Port and At Sea 32
Table 4 - Summary of Costs and Benefits 33
Figure 26 - Jacked Arch Alternatives Increase the Air Draft of the Existing Structure 34
Figure 27 - New Bridge with Existing Arch Remaining 34
Figure 28 - Bored Tunnel and Immersed Tunnel 35
Table 5 - Costs of Alternatives 35
Table 6 (repeat of Table 4) - Summary of Costs and Benefits 36
Figure 29 - Relative Efficiencies of Ship versus Truck 38

I. STUDY PURPOSE

This study assesses the commercial consequences of the failure to eliminate the air draft restriction caused by the Bayonne Bridge and quantifies, to the extent practicable and within reasonable but not excessively narrow confidence intervals, the most likely level of economic and other benefits associated with modifying or replacing the Bayonne Bridge. The New York District of the United States Army Corps of Engineers (USACE or "the Corps") has undertaken this effort on behalf of The Port Authority of New York and New Jersey (PANYNJ or "the Port Authority") through the Corps' Interagency and International Services Program as codified at 31 U.S.C. 6505[1] which states, in pertinent part:

> *The President may prescribe statistical and other studies and compilations, development projects, technical tests and evaluations, technical information, training activities, surveys, reports, documents, and other similar services that an executive agency is especially competent and authorized by law to provide. The services prescribed must be consistent with and further the policy of the United States Government of relying on the private enterprise system to provide services reasonably and quickly available through ordinary business channels.*

The Corps was asked to perform this effort in such a manner as to maintain comparability with the methods and procedures used in the economic analysis portion of the New York and New Jersey Harbor Navigation Study[2] (HNS), completed in 1999. That effort included a comprehensive analysis of alternatives and the preparation of an Environmental Impact Statement and resulted in the Report of the Chief of Engineers on the New York and New Jersey Harbor Navigation Study[3] (*Chief's Report*). All of these efforts were preceded by a reconnaissance report that recommended that the comprehensive analysis of the alternatives be conducted as a cost-shared feasibility study. The *Chief's Report* recommended deepening the navigation channels in the Port of New York and New Jersey (PONYNJ, or "the Port") to 50 feet. This 50-foot deepening was authorized as the "*Port of New York and New Jersey, New York and New Jersey*" (Harbor Deepening Project, HDP) in the Water Resources Development Act of 2000[4] and amended for consolidated implementation by the *Conference Report for the Fiscal Year (FY) 2002 Appropriations Act*.[5]

The Recommended Plan of the HDP was based on reasonable maximization of the National Economic Development (NED)[6] benefits that could accrue from deepening the navigation channels leading to the Port. The benefits are based on transportation costs avoided by using

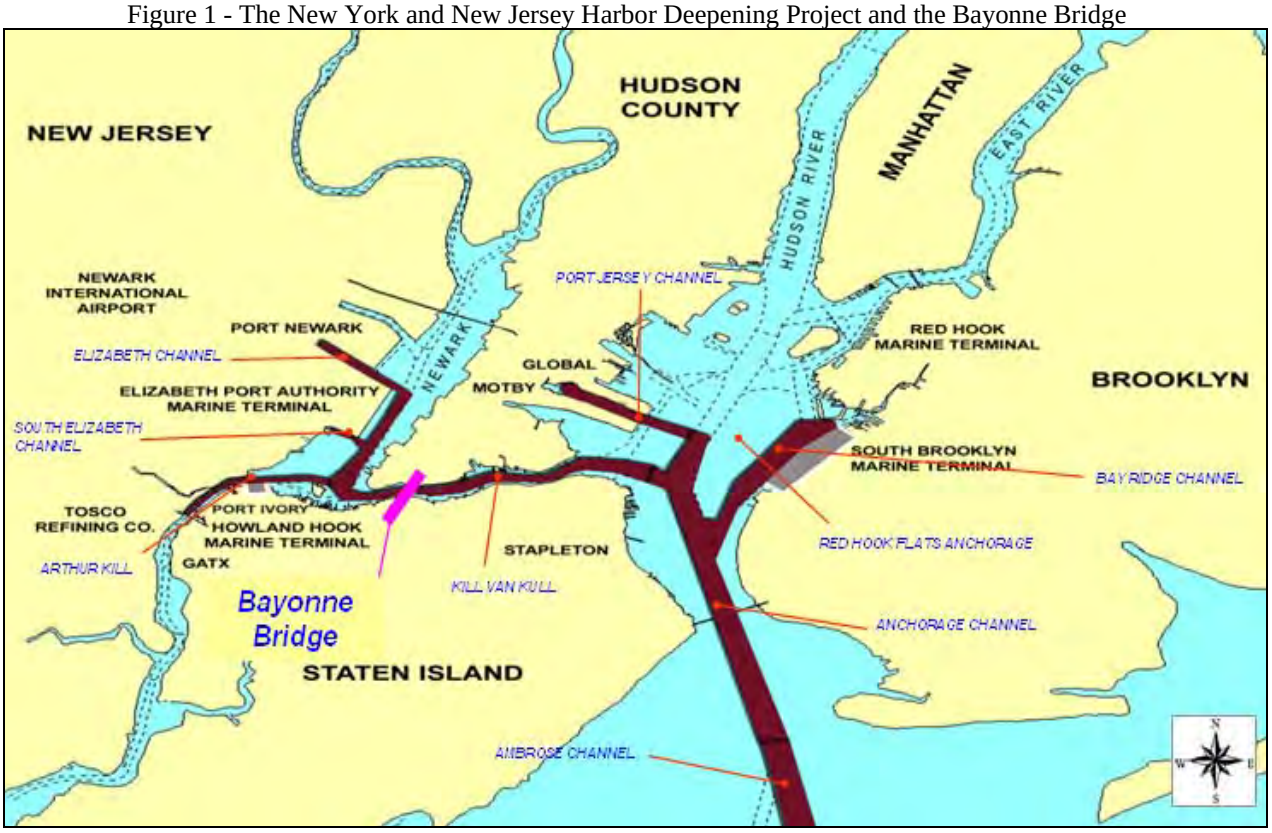
---

[1] The Interagency and International Services Program is authorized by §211 of the Water Resources Development Act of 2000 (P.L. 106-541), 114 Stat. 2592 (11 December 2000), as amended by §109 of the Energy and Water Development Appropriations Act of 2002 (P.L. 107-66) and codified as 31 U.S.C. 6505.
[2] *New York and New Jersey Harbor Navigation Study Feasibility Report*, December 1999.
[3] *Report of the Chief of Engineers on the New York and New Jersey Harbor Navigation Study*, May 2, 2000.
[4] P.L. 106-541, 11 December 2000.
[5] U.S. Congress, House. *Conference Report on the Energy and Water Appropriations Act of 2002*, 17th Cong., 1st Ses., 2002. H. Rpt. 107-258.
[6] Economics and Environmental Principles & Guidelines for Water and Related Land Resources Implementation Studies (P&G), Water Resources Council, 1983.

larger ships to carry the commerce forecasted for the New York and New Jersey catchment area - the domestic hinterlands served by the Port. They are based on transportation cost savings for waterborne transport - using larger ships to carry the projected commerce. The reader who would like to become more familiar with the HNS and HDP should consult the summary of its findings and recommendations, presented in *Appendix A, Summary of Findings and Recommendations of the New York and New Jersey Harbor Navigation Study* or, for even greater detail the *New York and New Jersey Harbor Navigation Study Feasibility Report*, December 1999.

In 1999, the Recommended Plan of the 50-foot study was forecasted to produce $238,500,000 in total NED benefits discounted and annualized over the 50-year planning horizon. The benefit/cost ratio was 1.4. In 2004, in forecasting the effects of consolidated implementation, NED benefits were reevaluated and forecasted to be $244,200,000 after discounting and annualizing.[7] The source of the increase in NED benefits was greater than anticipated commerce growth in the intervening 5 years. Those benefits are associated with the elimination of water draft limitations for ships up to 7,000 TEU's whereas the benefits of the current study are associated with the elimination of air draft limitations, which mostly affect ships greater than 7,000 TEU's.[8]

Figure 1 - The New York and New Jersey Harbor Deepening Project and the Bayonne Bridge



[7] *New York and New Jersey Harbor Navigation Study Post Authorization Economic Reevaluation*, September 2004.
[8] As will be explained in a later section of this document, and more rigorously in the *Appendix B, Sensitivity and Alternative Scenario Analyses*, there are cases when a vessel smaller than 7,000 and with keel-to-mast-heights that under normal loading conditions would be able to transit beneath the Bayonne Bridge will height restricted.

To remain consistent with the prior economic analyses, this Bayonne Bridge air draft analysis focused exclusively on NED benefits. In a typical Corps deep-draft navigation study, NED benefits are those benefits that accrue to the Nation from the transportation cost savings derived from the project. In the HDP and this study, the benefits are attributable to the economies of scale that may be realized by using larger vessels to carry cargo destined for the markets served by the PONYNJ. They do not include increases in market share that might result from taking cargo from another facility. The benefits are the transportation cost savings derived from getting those goods to and from their local destinations and origins in the most economically efficient manner. NED benefits differ from Regional Economic Development (RED) benefits because they do not consider impacts that are limited in their effects to the particular region, for example, local jobs retained or created, toll revenue collected or air quality impacts generated by using regional roadways, or increases in local tax bases or property values. These real, but regional benefits - and any "multiplier effects" attributable to them - are the subject of a forthcoming study to be conducted by the Port Authority and can be added to the NED benefits for a more complete description of benefits that would be attributable to removing the obstruction. While an appendix to this document will quantify the extra truck miles and costs that could occur if some of the cargo bound for a destination within the PONYNJ catchment area had to be diverted to a neighboring port, in this case, Norfolk - this should be seen solely as a departure point for further analyses[9] and not a conclusion.

II. PROBLEM IDENTIFICATION

The Bayonne Bridge crosses the Kill van Kull, one of the busiest shipping channels in the world. The Bridge connects the southern tip of the Bayonne Peninsula in New Jersey to Port Richmond on Staten Island, New York. The Kill van Kull is the access channel from the sea to the Newark Bay,[10] where the vast majority of the PONYNJ's container throughput capacity lies. In 2008, the PONYNJ accommodated 2,671 vessel calls carrying 5,265,053 TEU's. Terminals in the PONYNJ requiring transit beneath the Bayonne Bridge accommodated 2,185 of those vessel calls and 4,654,567 of the TEU's carried.[11] At mean high water (MHW), the tide condition in which air draft is most limited, the Bayonne Bridge limits the air draft available for vessels transiting the Kill van Kull to 151 feet.[12]

With the forthcoming 50-foot channel, the keel to mast height (KTMH) of ships traversing the Kill van Kull will be limited to 204 feet; however, the loading, design, and operation of vessels may further restrict access to Newark Bay because a ship transiting with a 204-foot KTMH must be perfectly loaded at a 48-foot draft, leaving two feet for underkeel clearance. As container

[9] For example, extra truck miles also produce extra truck emissions, which may be correlated with increased incidence of pulmonary disease. Increased incidence of pulmonary disease may correlate to more missed work days, which will have an effect on the labor market.

[10] The Newark Bay Complex includes the Port Newark and Elizabeth container terminals in Newark Bay as well as the New York Container Terminal on the Arthur Kill.

[11] Note that while 2008 throughput was lower than previous years, it is used here because it the most current information available. This number, and the benefits derived from rebasing the commerce forecast on it, are still of a magnitude that produces a high level of net benefits even if they are considered a conservative base for the commerce forecast used in this study.

[12] The air draft is 156 feet at mean low water, the least restrictive condition.

vessel sailing drafts are a function of a variety of factors, only one of which is design draft - other factors (including fleet deployment, loading patterns, ship schedules, and prior port-next port considerations) would all have to align perfectly to assume that vessels would arrive in the Port consistently at 48 feet. In fact, vessel entry data into the PONYNJ used for this study has shown that perfect loading is rarely practiced.

Figure 2 - The Air Draft of the Bayonne Bridge

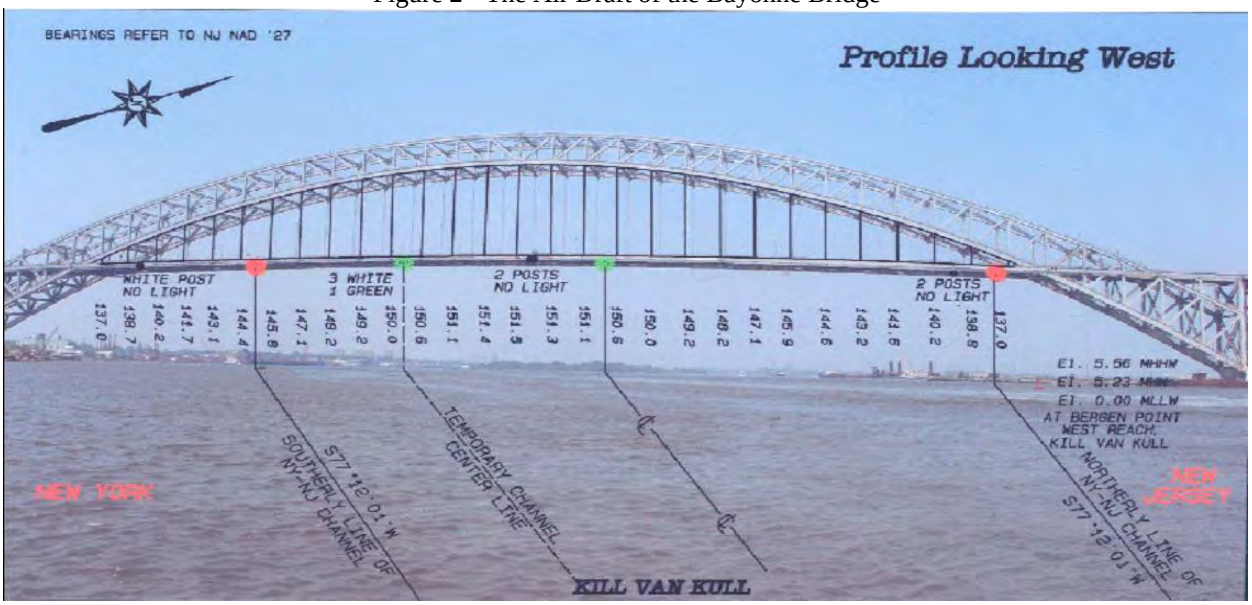
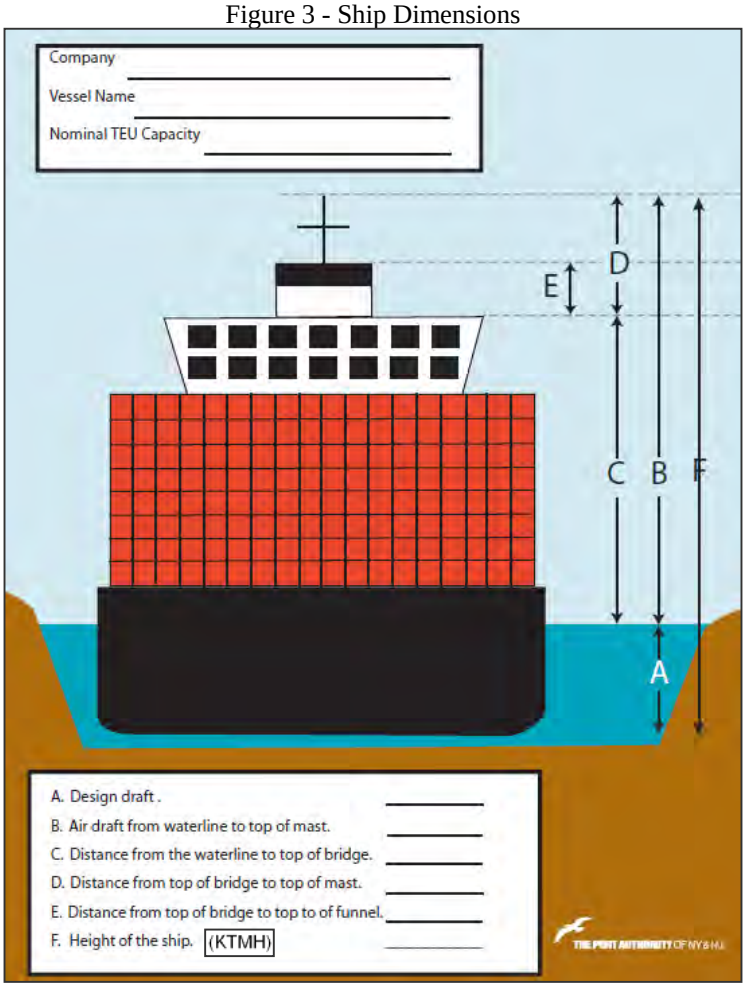


Figure 3 - Ship Dimensions

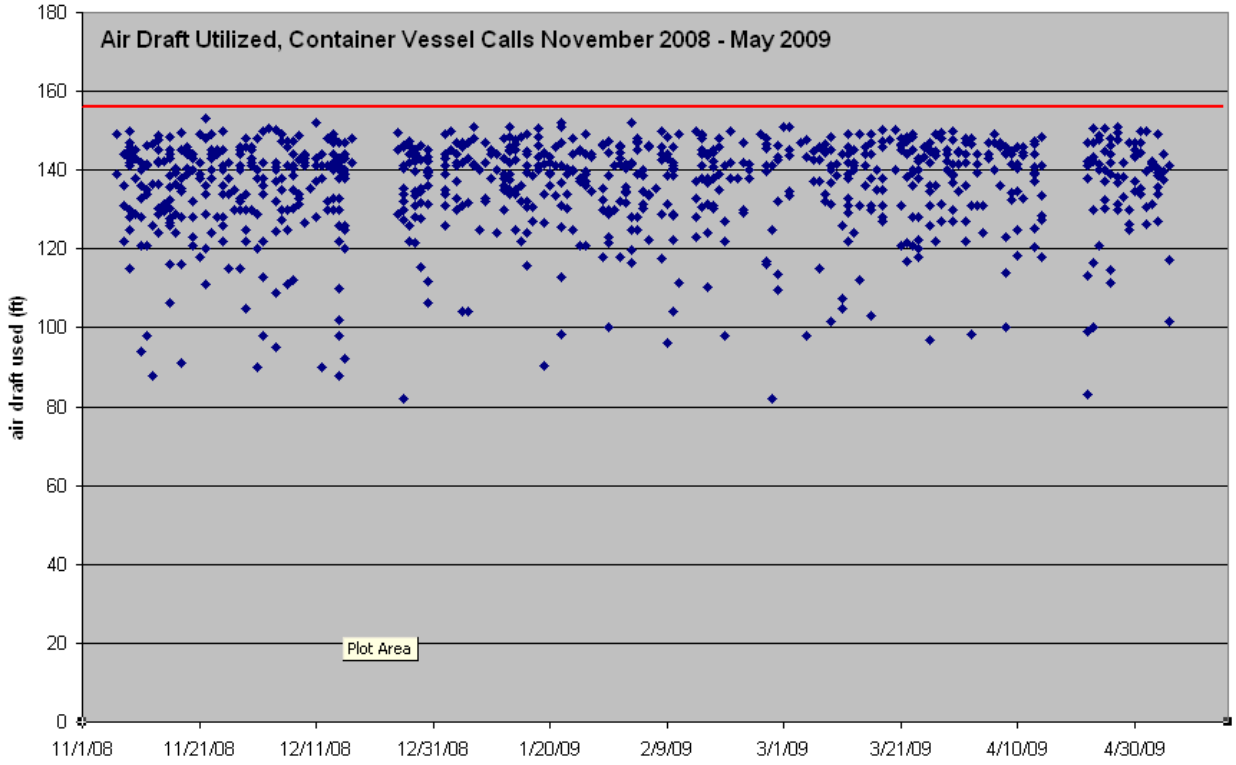


Corps deepening studies rely on the concept of a design vessel to guide the planning and design processes. The HNS used the *Regina Maersk* (now the *Maersk Kure*) as its design vessel. The design vessel is a hypothetical or real ship with dimensions of the largest vessels that the navigation project is designed to accommodate.[13] When fully loaded and underway, the *Regina Maersk* had a dynamic draft of 48 feet and has a KTMH of 198 feet. On July 22, 1998 - in the midst of the HNS - the *Regina Maersk* made an inaugural call at Newark Bay. At that time, the channels into New York and New Jersey Harbor were only dredged to 40 feet so the ship arrived carrying only 20% of her 6,418 TEU capacity and was timed to arrive at high tide so that she could transit the channels leading to Newark Bay without encountering depth limitation. As a result, the ship rode higher in the water and the communications mast had to be detached and lowered in order for the ship to clear the Bayonne Bridge. With the mast down, the distance between the bottom of the bridge span and the top of ship's funnel was reported to be approximately 5 feet.[14] Ships regularly traverse the Kill van Kull with that level of air draft

[13] EM 1110-2-1613, Hydraulic Design of Deep Draft Navigation Projects
[14] Frank, Al. "It's a Close Call for the Regina." Newark Star Ledger 23 July 1998.

clearance, as evidenced by the record of vessel air drafts of container vessels calling the PONYNJ recorded by the Sandy Hook Pilots between November 2008 and May 2009.[15]

Figure 4 - PONYNJ Vessel Calls and Air Drafts, November 2008 to May 2009



During the course of the 1999 HNS, the *Regina Maersk* was considered the leading edge of container ship size. The *Regina Maersk's* size was the first real jump in TEU capacity since American President Lines introduced the post-Panamax *President Truman* and her sisters in 1988. While *Regina Maersk's* 1998 call was mainly ceremonial, it showed the commercial navigation planning community in the Port what it would be expected to accommodate in the future. Any doubt that ships the size of the *Regina Maersk* or larger would call the PONYNJ regularly has been removed by subsequent events. The maritime community is already on notice that the operators of even larger ships would like to use them on services calling PONYNJ. The volume of commerce has grown far faster than anticipated in the 1999 HNS and the shipbuilding industry has kept pace with this development. Two of the largest vessels in service today are the *Emma Maersk* and *MSC Daniela*, which hold 12,508 to 14,000 TEU's and have KTMH's of 251 and 221 feet, respectively.[16] This document considers the use of ships the size of the *Regina Maersk*, appropriately loaded, as part of the without-project condition. Benefits from alteration, replacement, or removal of the Bayonne Bridge are limited to those benefits derived from ships

[15] This data was gathered by the Sandy Hook Pilots as a courtesy to the study team. This was a significant undertaking and while not entirely comprehensive, it does include specific transit details for 1,008 of the 1,049 container vessel calls during that six month period.

[16] Note that the KTMH of the *MSC Daniela* is significantly lower than that of the *Emma Maersk*. This is because the *MSC Daniela* has a split bridge, which is an innovation that will be discussed further later in the main text. Nonetheless, it will not fit beneath the Bayonne Bridge at its current height.

that could not pass beneath the Bridge without such measures being taken for vessels with air drafts greater than the *Regina Maersk*.

With a 50-foot channel, 151 feet of air draft at MHW, and a 198 foot KTMH - a ship like the *Regina Maersk/Maersk Kure* will be physically able to call the PONYNJ under certain loading conditions; however, on March 8, 2009 the *NYK Nebula* (4,886 TEU's and KTMH of 197 feet) attempted to call the New York Container Terminal (Howland Hook) on the Arthur Kill and could not enter Newark Bay because it was riding too high to pass beneath the Bayonne Bridge.[17] While the *NYK Nebula* calls the Port frequently,[18] in this instance the ship had go to Norfolk to add containers, then return to deliver her New York bound TEU's. This diversion was reported by industry sources to have cost approximately $80,000, not including the inventory costs of the goods the late call delayed. The *NYK Nebula* incident illustrates that ships that would not be considered limited by KTMH may not be able to call the PONYNJ under certain loading conditions. The loading pattern and its relevance to the benefits calculation is discussed in further detail in a later section of this document. The benefits derivation does not include cases like the *NYK Nebula* which is limited in some situations, depending on loading, but potential impacts of these cases to the benefits stream is discussed in *Appendix B, Sensitivity and Alternative Scenario Analyses*.

At the inception of this study, the Corps consulted the United States Coast Guard (USCG) to begin to derive the frequency of allisions between the current PONYNJ fleet and the Bayonne Bridge. Over the ten year period before the study began for which data was provided, there were a total of ten events reported through the Coast Guard Marine Information for Safety and Law Enforcement (MISLE) system that could have been related to Bayonne Bridge height.[19] This number of incidents appeared low given the frequency of arrivals with close margins between the height of the ship and the air draft of the ship reported by the Sandy Hook Pilots in the prior figure as well as anecdotal reports of contact between ship antennae and the bottom of the road deck.[20] While the *NYK Nebula* incident provided some empirical information about the costs of diversion, the most insightful evidence about the frequency of the problem was derived from a series of interviews with the carriers using the Port.

Early in the study process, the containership carriers serving the PONYNJ were sent an introductory letter stating the purpose of this study and asking for dimensional details of each class of that carrier's fleet of post-Panamax vessels, as well as the number of ships of that size

---

[17] The *NYK Nebula* does not have a collapsible mast.

[18] The *NYK Nebula* called New York 4 times within the 6 months of entrance data provided by the Pilots. The carrier is now having problems with the Bayonne Bridge for all ships on this string. According to NYK's vessel operations staff, to trim that ship in the stern (by the mast), it must take on 55 tons of ballast water to enter and leave New York Harbor. That ballast water must be taken for 200 miles out at sea because of regulatory requirements, so that ballast water remains for a large part of the journey adding to overall fuel consumption for the voyage.

[19] The MISLE data did not specify clearly whether the incident was a collision with the Bayonne Bridge. From the list of events provided by the Coast Guard, incidents for which the PANYNJ also has a record were counted, then any listed incident specifically characterized as a head-on allision over the ten year period. Incidents not listed as head-on were not subtracted from the pool, even if they included barges since there is some anecdotal record of barge mounted cranes hitting the underside of the Bridge. This estimate should be considered to have a positive bias, if any.

[20] As of this writing, the most recent incident occurred on 18 July 2009 when the antenna of the *MSC Tokyo* hit the underside of the Bridge upon entrance into the PONYNJ.

that they operate.[21] Of the 17 major carriers serving the PONYNJ, 15 responded to the survey,[22] a clear indication that the height of the Bridge is a pressing issue. Carrier surveys were completed through a series of in-person interviews that revealed that the USCG reported frequency of allisions is not an accurate representation of the situation. The frequency of the problem is far greater than reported because it is being masked by clever operational techniques being employed by the carriers.[23]

By carefully using the tide cycles the vessel can gain some combination of extra underkeel clearance and less over the mast clearance (or *vice-versa*) that totals approximately five feet. There are two additional ways make a ship that is "calling it close" fit under the Bayonne Bridge. The first is to alter the ship itself by taking down equipment. For example, the *Regina Maersk* had her communications mast detached so that she could pass. In other cases, carriers have been reported to deliberately sacrifice GPS units or antennae. The second set of solutions is loading based. They involve practices like adding cargo - the remedy used in the *NYK Nebula* incident - or taking on ballast water or bunker to make a ship heavier so that it will sit lower in the water. These trimming solutions add cost to the movement of goods. In the case of overloading, carrying extra cargo costs the carrier fuel and may add inventory delay in the delivery of containers. In the case of taking on ballast water, the extra weight adds to fuel consumption and adds environmental risk to the ship operation. Both are sub-optimal situations.

Furthermore, these operational methods are less effective as KTMH increases. For the purposes of this study, the most relevant dimension of the future fleet is its KTMH. KTMH information provided by the carriers was analyzed to determine trends in vessel height and correlations with vessel size and capacity. Plotting KTMH against the most commonly reported dimension of size of a containership, nominal TEU capacity, reveals a clear positive correlation between increasing size in terms of TEU capacity and corresponding overall vessel height, as represented in Figure 5, below. [24]

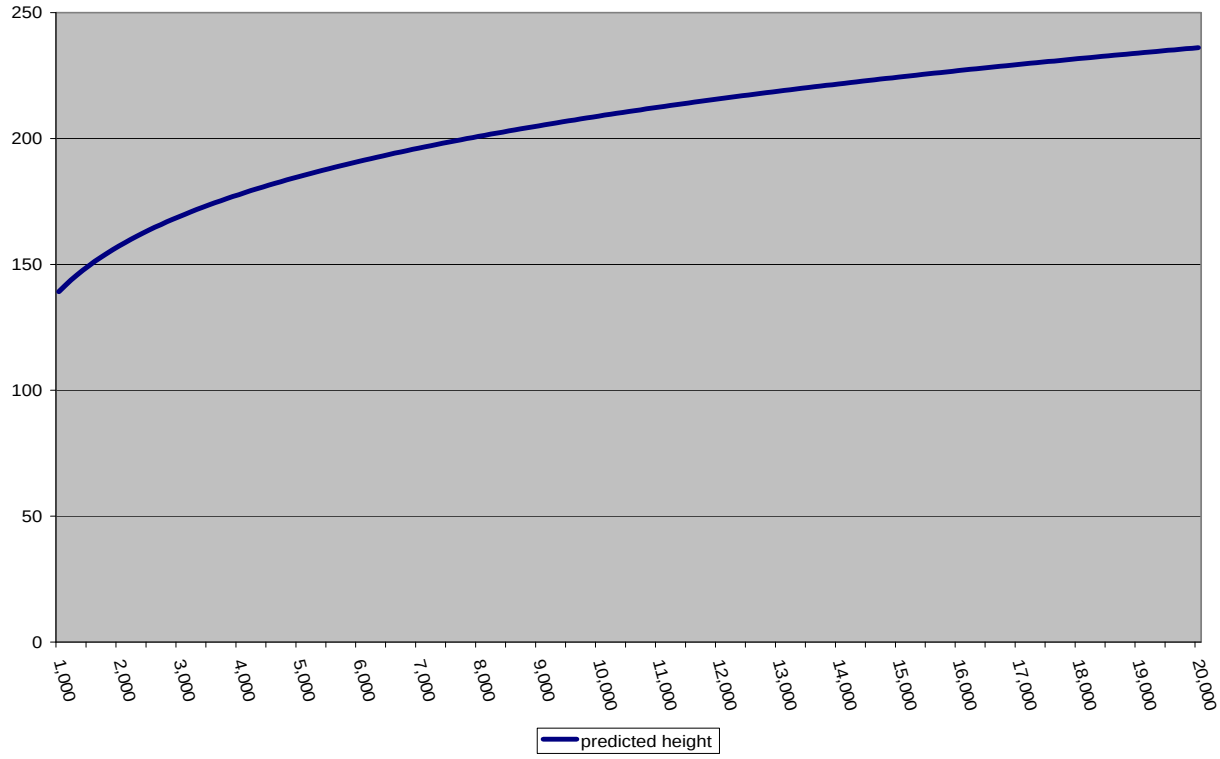
[21] Some carriers also provided information about ships on order.

[22] Individual carrier responses are not included with this submission as carriers were told that their information would only be used in summary form.

[23] A vessel like the *NYK Nebula*, with a design draft of 44 feet, would have to be loaded to 43 feet or greater, which only happens about 1% of the time. The reason there are few incidents of the *NYK Nebula*, or ships like her, hitting the Bayonne Bridge is that the operators are taking measures to manipulate the ships air draft, such as taking on ballast water or installing a collapsible mast.

[24] The specification estimated was $KTMH = e^{\alpha} \times TEU^{\beta}$. Notice that while it is true that there are ships, most notably the *MSC Daniela*, with approximately the same number of TEU's as the *Emma Maersk*, that do not conform to this relationship in the overwhelming majority of container vessels in operation today, KTMH increases with TEU capacity.

Figure 5 - Correlation of Vessel Size and KTMH

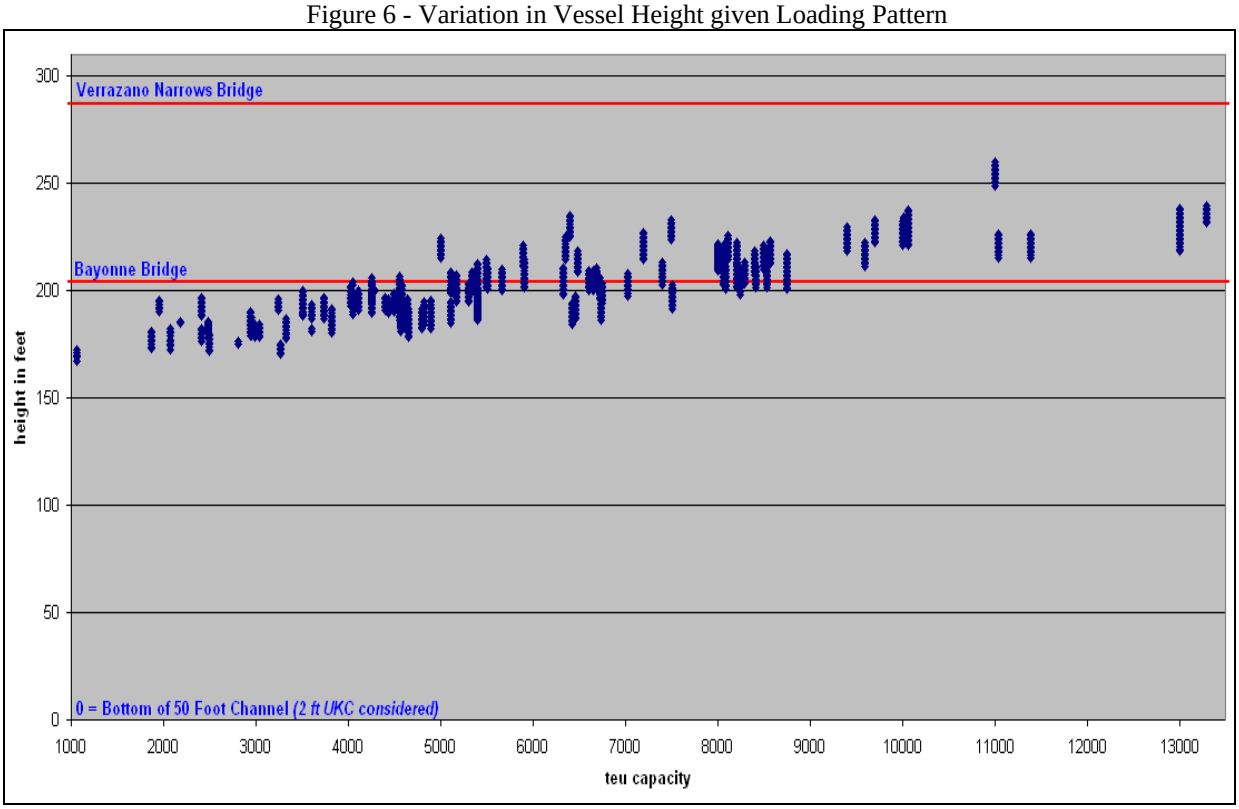


Ship height data was collected from the carrier surveys and supplemented by Lloyds Register represented over 600 existing vessels, approximately 10% of the existing world fleet.[25] The vessels in the sample were plotted by their varying loading pattern to show the impacts of the Bayonne Bridge air draft restriction. In the figure, the horizontal lines represent the Bayonne Bridge and the Verrazano Narrows Bridge at mean low water (MLW) to illustrate what segment of the fleet can fit under those bridges.[26]

[25] The study team tested the null hypothesis that the 616 vessel sample world fleet was not drawn from or representative of the entire world fleet by comparing the design drafts of the sample with the design drafts of the population. Specifically, the null hypothesis tests is that the sample mean is not equal to the population mean, $H_0 : \bar{x} \neq \mu$. The study team could reject the null hypothesis at the 95% confidence level.

[26] Note that even the largest vessels of the existing container fleet will not have trouble getting under the Verrazano Narrows Bridge.

Figure 6 - Variation in Vessel Height given Loading Pattern



Further analysis of this data shows that only 57% of the hulls in this sample would be able to fit under the Bayonne Bridge at low tide with 22% of the hulls within that vessel pool being within 5 feet of the bottom of the road deck when passing beneath it which may precipitate some delay to wait for favorable tide conditions. Of the sample, which has been verified to be representative of the entire fleet, 43% would not be able to transit the channel solely because of the Bayonne Bridge restriction.[27]

Looking at this same sample in terms of world TEU capacity, only 38% is able to serve terminals in the PONYNJ west of the Bayonne Bridge. From the sample, all of the vessels larger than 10,000 TEU, 92% of the world fleet of vessels between 8,000 and 9,999 TEU, and 56% of the world fleet of vessels between 6,000 and 7,999 TEU could not call Newark Bay with the current height of the Bayonne Bridge. This translates to more than 62% of total existing world TEU capacity physically restricted from calling the terminals in Newark Bay and along the Arthur Kill. This is represented graphically in figures 6 and 7, below. The middle bands indicate vessels whose ability to pass beneath the Bayonne Bridge is dependent on tide conditions.

[27] This assumes that ships that might otherwise draft more than 48 feet are considered to be light-loaded so as not to hit the channel bottom; however, in practice these vessels would be impeded by the Bayonne Bridge even if there was further channel deepening that would allow them to utilize their full design draft.

Figure 7 - Proportions of the Existing World Fleet limited by the Bayonne Bridge by Hulls

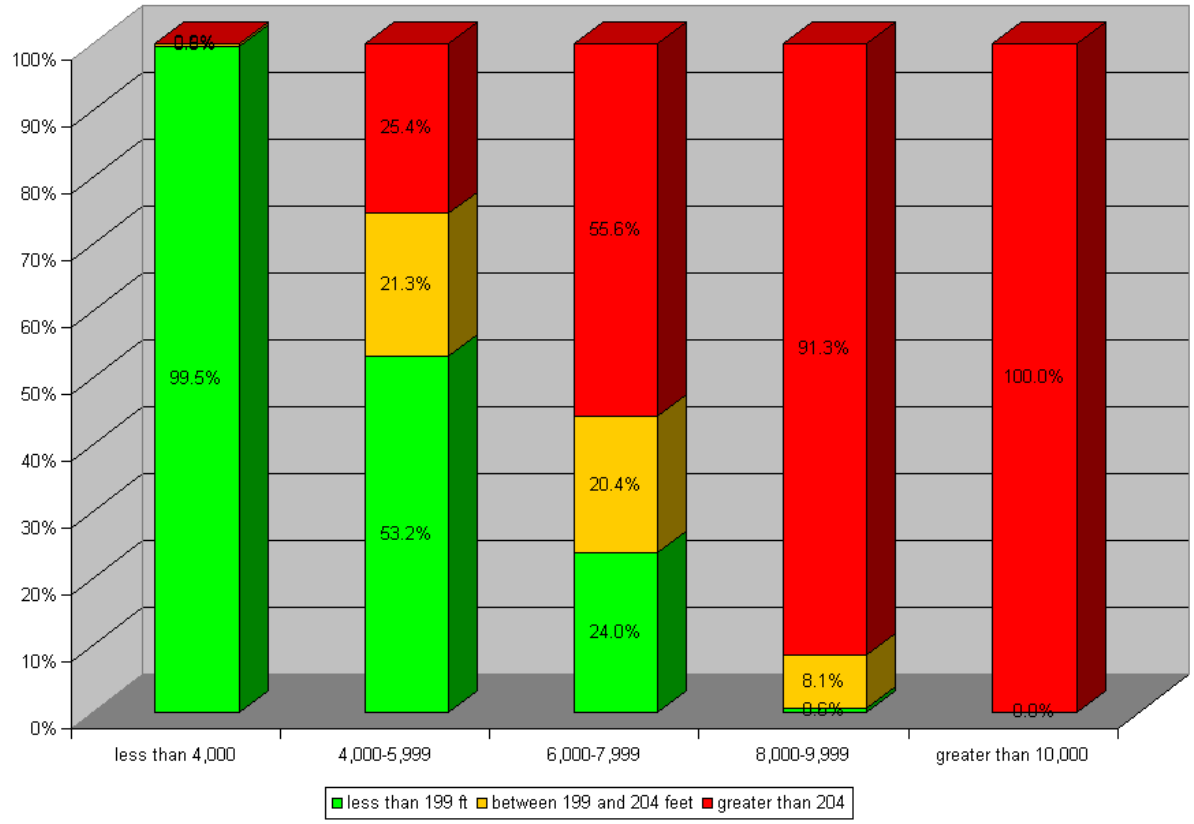
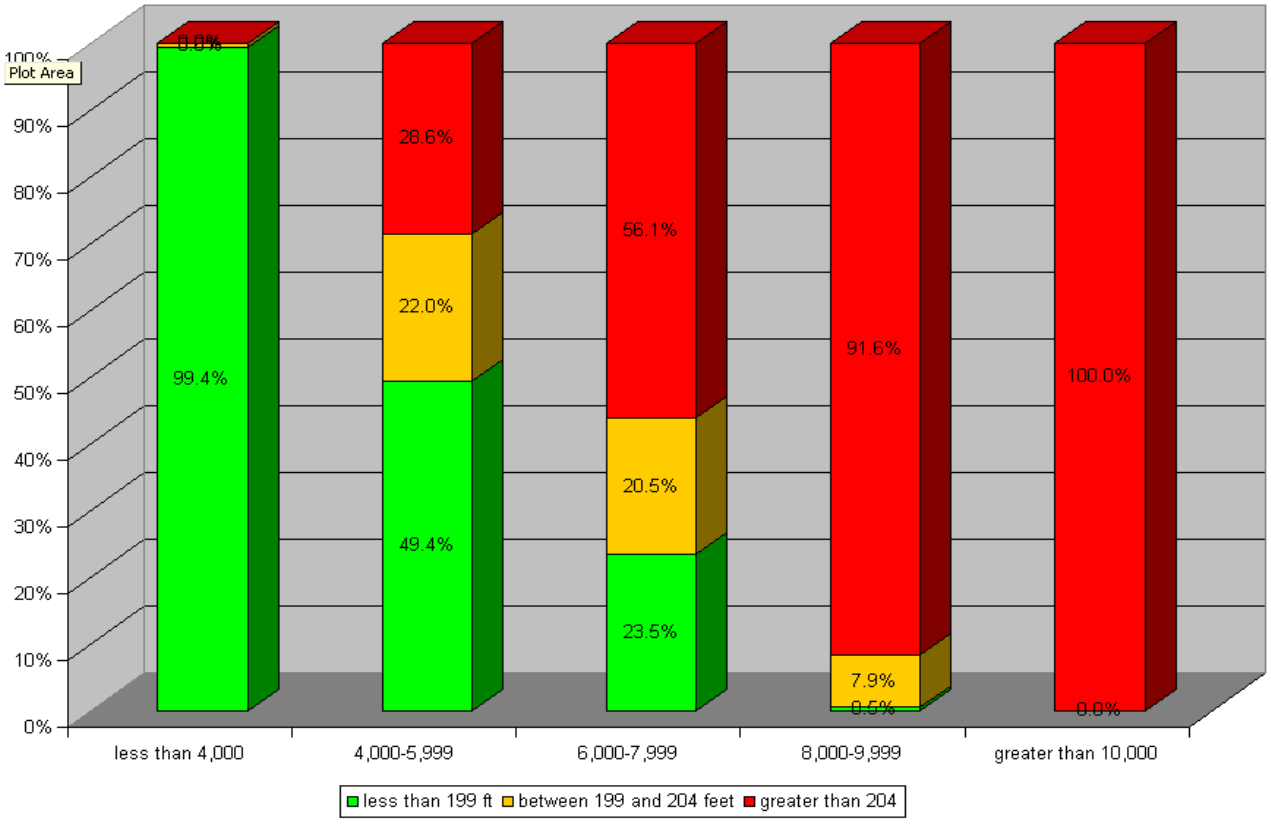


Figure 8 - Proportions of the Existing World Fleet limited by the Bayonne Bridge by TEU's



The interviews revealed information that helped to illustrate the magnitude of the obstruction caused by the Bayonne Bridge air draft restriction and the relative importance it has in their future deployment planning. Of primary importance to the carriers was the question of whether the PONYNJ would be able to support the larger vessels they would like to deploy on Far East – United States East Coast (USEC) routings once the Panama Canal expansion is complete.[28] The expansion of the Panama Canal will allow carriers to deploy larger vessels on major routings which may have the effect of allowing fewer ships to carry the projected commerce (an NED benefit) and has the potential to upset the current land-bridge arrangement by which cargo arrives at a United States West Coast (USWC) port and is transloaded onto the U.S. rail network to be carried nearer to its ultimate destination, which could have the effect of adding demand for all-water Far East - USEC routed vessels. Many carriers reported that they intend to deploy 10,000 TEU vessels on these routings once the Canal enlargement is complete. These vessels are far taller than the vessels currently used on these routes and the ship-based and loading solutions will not be adequate to remedy the Bayonne Bridge restriction.

The Bayonne Bridge is clearly an obstacle, but it might not be a restriction on the realization of benefits. For example, the Bayonne Bridge does not restrict container handling capacity at terminals on the east side of the Bridge, namely those terminals on the Port Jersey peninsula so benefits of bridge alteration or removal can only be counted after full utilization of facilities at Port Jersey.[29] It would also not be a restriction on the realization of benefits if there were one or more other restrictions west of the Bridge that would limit the realization of benefits. Some examples of possible restrictions would be insufficient rail capacity, insufficient roadway capacity, insufficient crane capacity in terms of number and outreach, insufficient berthing space, or insufficient yard capacity. The analysis presented below shows that the Bayonne Bridge is restricting the realization of deep-draft NED benefits beyond what was estimated in the HNS.

III. ANALYSIS

The analysis used to determine the NED benefits attributable to the removal of the Bayonne Bridge air draft obstruction had three distinct components. First, the extent to which the Bayonne Bridge will restrict the realization of NED benefits was evaluated at the global and local levels. At the global level, it had to be shown the extent to which the Bayonne Bridge is the most restrictive height constraint faced by ships that call the PONYNJ. At the local level, it had to be determined that the Bayonne Bridge is, in fact, the only constraint within the port limiting the full realization of NED benefits. Second, benefits were calculated by the same method as in the HNS and included the commerce forecast, fleet forecast, and loading patterns.

[28] This is expected to occur in 2015.

[29] In its current configuration, Port Jersey is only 8% of the container terminal acreage in the Port. Red Hook Terminal in Brooklyn provides another 5%. Even with huge productivity increases on their current footprints, these facilities would not be able to handle more than about 12% of PONYNJ bound commerce (not 13% as might be inferred by adding acreages because Red Hook has other constraints). Carrier interviews also revealed that, in fact, the existing capacity at Global Terminal in Port Jersey is already nearly exhausted. However, the PANYNJ has indicated that plans are already underway to expand capacity at this location by 70 acres in the next several years.

The commerce was loaded onto the fleet that could call with and without the Bayonne Bridge air draft restriction (the with- and without-project conditions) and the vessel operating costs of the with-project fleet were subtracted from those of the without-project fleet. The difference in vessel operating costs of these fleets is the economic benefit of the air draft restriction removal. Third, these benefits were compared to the costs of potential alteration and replacement alternatives to derive a benefit cost ratio and estimate net benefits to the Nation.

A. OPERATIONAL CONSTRAINTS THAT COULD LIMIT BENEFITS

There are two levels at which these operational constraints could occur. Outside of the PONYNJ, benefits could be limited by obstructions on major ship routings that impact ships calling PONYNJ. Those obstructions would limit the benefits that could be counted by this study. These are referred to below as global constraints. Operational constraints within the port, such as berths, cranes, rail and roadway capacity, and throughput are referred to as local constraints.

1. Global Constraints

A bridge as an operational constraint in marine commerce is not a new problem facing the shipping community. As infrastructure of older port cities ages and capital replacement is considered, ports around the world have had to consider how to cope with larger and taller ships. The PONYNJ is not the only port that faces an air draft constraint, but the constraint it faces is, by far, the most restrictive.

Table 1 - Port Facilities with Significant Height Obstructions to Large Ships[30]

Location	**Obstruction**	**Height of Restriction MHW**
Hong Kong	Stonecutters Bridge	241 ft.[31]
Suez Canal, Egypt	Mubarak Peace Bridge	230 ft.
New York & New Jersey	Verrazano Narrows Bridge	219 ft.
San Francisco/Oakland	Golden Gate Bridge	225 ft.
Oakland	Oakland Bay Bridge	220 ft.
Panama Canal	Bridge of the Americas	201 ft.
Los Angeles	Vincent Thomas Bridge	185 ft.
Yokohama	Yokohama Bay Bridge	184 ft.
Savannah	Talmadge Bridge	185 ft.
Hamburg	Kolnsbrucke	174 ft.
Long Beach	Gerald Desmond Bridge	156 ft (to 200 ft.)[32]
New York & New Jersey	Bayonne Bridge	151 ft.

[30] This list is compiled from the top 50 container ports, by volume, plus well known navigational choke points. The Ports of Halifax, Philadelphia, and Charleston also have air draft restrictions, but are not in this list because they are not among the top 50 container ports, by volume.

[31] The air draft beneath Tuen Mun, the bridge leading from the Port of Hong Kong to the river terminals, is 203 feet.

[32] The Port of Long Beach has indicated that the Gerald Desmond Bridge will be raised to provide an air draft of 200 feet; however, no specific timeline has been given. Furthermore, it poses less of a restriction to the Port of Long Beach than the Bayonne Bridge does to the PONYNJ because Long Beach has a large amount of terminal capacity in areas that do not require transit under the Gerald Desmond Bridge.

Of the world's largest container ports, by volume, there are a number that have air draft restrictions. The Suez Canal is restricted by the Mubarak Peace Bridge, which rises 230 feet over the waterway. The Bridge of the Americas, in Balboa, Panama, which links the northern and southern shores of the Panama Canal, has a height of 201 feet at MHW. These facts are relevant to the question of how to limit benefits because of how liner services are operated. Unlike airlines, which generally run on a hub-and-spoke model, container vessels operate on rotations, which allow carriers to call multiple ports with the same ship at scheduled intervals. What this means is that the same ship could be calling PONYNJ and Norfolk, transiting the Panama Canal, then calling Long Beach, Oakland, and Hong Kong, then returning to the west coast of the United States, back through the Panama Canal, and again to Norfolk and PONYNJ on a single voyage. A carrier puts multiple ships on this loop, each at a different stage within it, so that each port on the rotation can have weekly service. While the journey itself may take 30 days for a container to arrive at the PONYNJ from Hong Kong compared to 18 days if it was moved with direct point-to-point service because of the multiple calls between the origin and destination - the shipper is assured that his cargo is loaded at its point of origin and unloaded at its destination at weekly intervals. The extra transaction cost for this forced delay (*i.e.*, inventory cost) is ultimately built into the price of the goods once it reaches the consumer.

What this means is that alteration of the Bayonne Bridge could not accrue the same level of benefits if, in fact, there was another constraint outside of the Port that limited the fleet that could call the Port. For example, many of the liner services serving the PONYNJ pass beneath the Bridge of the Americas over the Panama Canal. For this reason, NED benefits attributable to ships requiring an air draft larger than the height of the Bridge of the Americas cannot be counted for ships on Panama routings.[33] In the same vein, the overall limitation to benefits accruing to ships calling the PONYNJ can only be attributed to ships that can pass beneath the Verrazano Narrows Bridge at the entrance to the PONYNJ.

2. Constraints at the Port of New York and New Jersey

Benefits to removal or alteration of the Bayonne Bridge might also be curtailed by constraints within the PONYNJ. To comprehensively assess the without-project condition, the Corps had to consider factors that could potentially limit the benefits of Bayonne Bridge alteration or removal. These fell at three levels - the rail and roadway network, the channel, and the wharf. Assumptions used in the benefits calculations, and the reasoning behind them, are summarized below.

[33] In the period between the completion of the HNS, when benefits were originally calculated for the 50-foot deepening, and this study - a deepening and widening of the Panama Canal was proposed and is now well underway. This deepening effort will allow ships with a 160 foot beam, 1200 foot length, and 50 foot draft (allowing approximately 12,000 TEU's, but dependent on loading) to transit the Canal. The enlarged Panama Canal is expected to open to traffic in 2015. The effect of this may be that the shippers that use current Post-Panamax vessels to move goods from the Far East to the West Coast of the United States, then to ultimate East Coast destinations using rail or truck could choose to move those goods all-water from the Far East; however, this depends on whether rail rates can keep pace with this development by making it price competitive for those TEU's to remain on the land-bridge. Because this is yet undetermined, the extent of the "Panama Bump" in commerce coming directly to the PONYNJ is not included in the benefits calculation directly, but is included in the sensitivity analysis accompanying this report.

a. Land-Side Movements

Rail

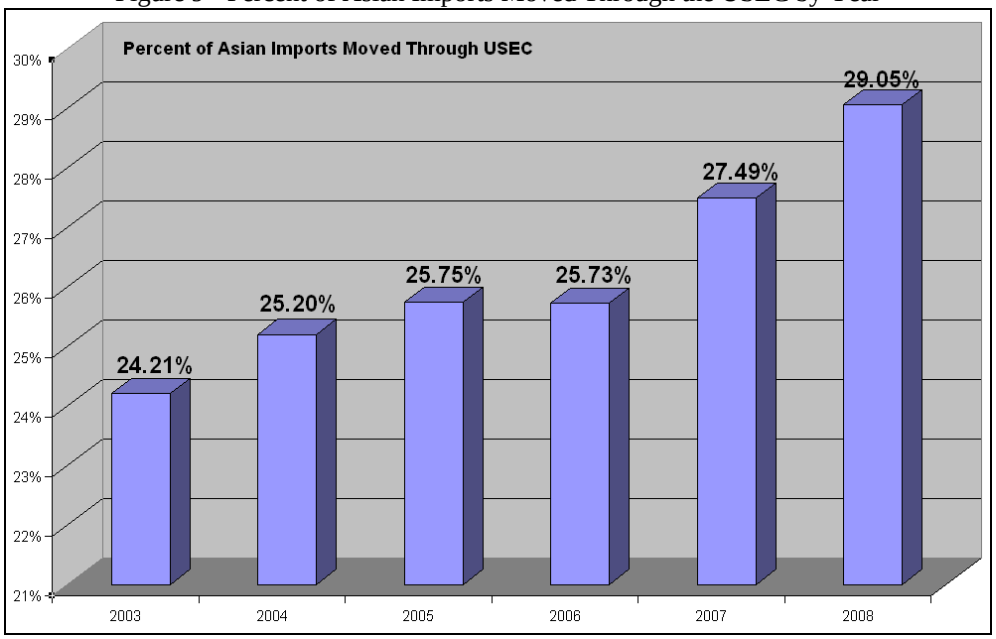
Capacity limitations on US railroads could affect the benefits to alteration or removal in a number of ways. If rail capacity from the USWC was limited, all water routes would become relatively more attractive, especially if there was idle or underutilized rail capacity from the USEC to move goods into the Midwest. Even with limited rail access out of the New York metropolitan area, there could be significant cargo moving by all water routes to the USEC as most of what comes through the PONYNJ stays in the 31-county metropolitan area surrounding the Port.[34]

Rail capacity could be limited by a number of factors. The ones most likely to specifically affect the PONYNJ are capacity of on-dock or near-dock facilities, limitations in line haul capacity, traffic constriction at various junctions within the system, and competition for rolling stock from other goods. Goods that are taken by rail to East Coast and Midwest destinations, which might otherwise have traveled to the USEC by all water routes are generally landed at the USWC ports of Los Angeles/ Long Beach (LA/LB), Seattle, and Tacoma.[35] The proportion of Asian imports moved through the USEC versus the USWC is increasing, as evidenced below.

[34] The 31-county metropolitan area was one of the delineations of catchment area used in the 1999 Study. Those 31 counties are those counties within the 25-mile radius from the Statue of Liberty and those counties bordering them At that time, it was determined that approximately 70% of containerized cargo moving through the Port was destined for or originated in the 31-County metropolitan area. This area consists of 31 counties, includes 14 counties in southern New York State (five in New York City, two in Long Island, and seven in the Mid-Hudson region); 14 counties in northern New Jersey; and three counties in southwestern Connecticut. The US Census estimated the total population of these counties to be 22,281,153 in 2008. This was the narrowest of the four definitions of PONYNJ hinterland used in that document. The HNS also considered the 260-mile radius from the Port used by the New York Shipping Association from which approximately 82% of the containerized cargo that moved through the Port was destined for or originated at the time of that writing and the 17-state region extending from New York to Missouri and Maryland to Maine that could be serviced by the Port of New York for less cost and within a reasonable time disadvantage than from the Ports of Los Angeles and Long Beach. The remaining 31 of the lower 48 states were considered secondary economic hinterlands for which the Port of New York and New Jersey has a minor share of international trade but over which it actively competes with other ports for market share.

[35] This is known as *mini-land bridge* which is an intermodal movement in which the shipment is moved from a foreign country to the U.S. by water and then moved across the U.S. by railroad to a destination that is a port city, or vice versa for exports from a U.S. port city. *Land bridge* refers to the movement of containers by ship-rail-ship on Japan-to-Europe moves; ships move containers to the U.S. Pacific Coast, rails move containers to an East Coast port, and ships deliver containers to Europe. *Micro-land bridge* refers to an intermodal movement in which the shipment is moved from a foreign country to the U.S. by water and then moved across the U.S. by railroad to an interior, non-port city, or vice versa for exports from a non-port city.

Figure 9 - Percent of Asian Imports Moved Through the USEC by Year



There could be several reasons for this increase, including demographic shifts and issues of rail infrastructure in and around Chicago, the locus of the U.S. rail network. Rail capacity is not the primary subject of this report and was not critically analyzed beyond determining the extent to which rail constraints within the PONYNJ could limit benefits to Bayonne Bridge alteration. Rail is not expected to constrain NED benefits. Furthermore, interviews with rail industry stakeholders[36] indicate that the 1999 HNS estimates of the Port's economic hinterland are likely to be conservative given the current state of east-west rail infrastructure and the demands upon it. The proportion of commerce bound for East Coast and Midwest destinations landed at USWC ports could decline further as a result of the expansion of the Panama Canal, which is likely to make all water service between the Far East and USEC more attractive to shippers. This report assumes in its calculations that the rail industry will undertake any structural changes that would allow it to remain competitive with all-water service, which is a bias against project justification and does not constrain benefits because of rail capacity limitations. More information on rail and the PONYNJ may be found in *Appendix C, Notes on Rail Transit as a Partial Substitute for All Water Routes.*

Roadways

Following the 1999 HNS there was a multi-stakeholder assessment of potential land side constraints to the movement of goods. This effort, the *Comprehensive Port Improvement Plan,* determined that the Port's container handling capacity, including roadways, would not be exceeded by the volume of containerized commerce until at least 2037. Because this is far enough into the future, the net present value of the costs of any improvements are not likely to

[36] Interviews with the American Association of Railroads (AAR) and a number of intermodal carriers have illuminated many of the rail issues that will have effects on the Port of New York and New Jersey. This anecdotal information has been checked for consistency using other sources.

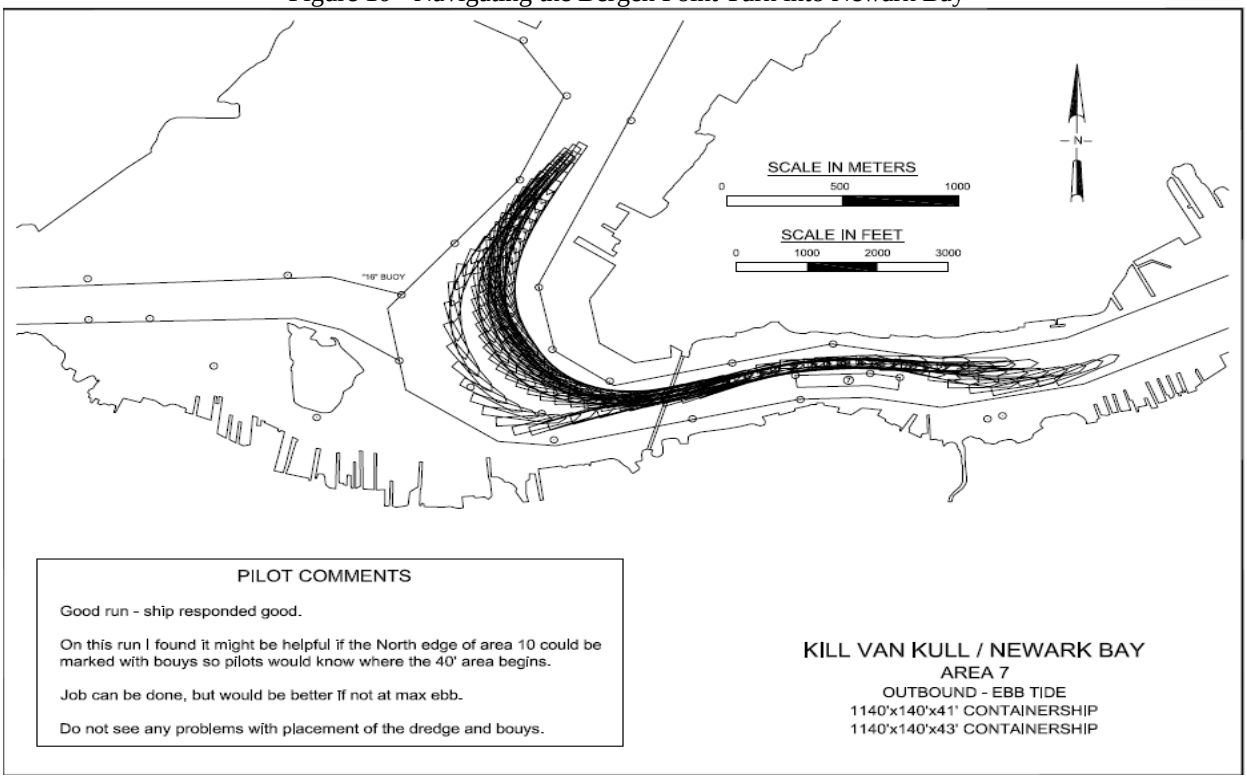
significantly alter the evaluation of the benefits stream, it is assumed that roadway capacity will not constrain the benefits presented here.[37]

b. Channel Constraints [Modeling Report Summary]

Bergen Point Turn

Between the Bayonne Bridge and the container terminals in Newark Bay is Bergen Point, New Jersey. Bergen Point lies immediately to the west of the Bayonne Bridge on the northern shore of the Kill van Kull at the southern tip of the Bayonne Peninsula. Once ships have transited beneath the Bayonne Bridge, they must make a 135 degree turn around Bergen Point to enter Newark Bay.

Figure 10 - Navigating the Bergen Point Turn into Newark Bay



To rule out the Bergen Point Turn as a constraint, the District employed the Corps' Engineer Research and Development Center (ERDC) in Vicksburg, Mississippi. ERDC performs channel

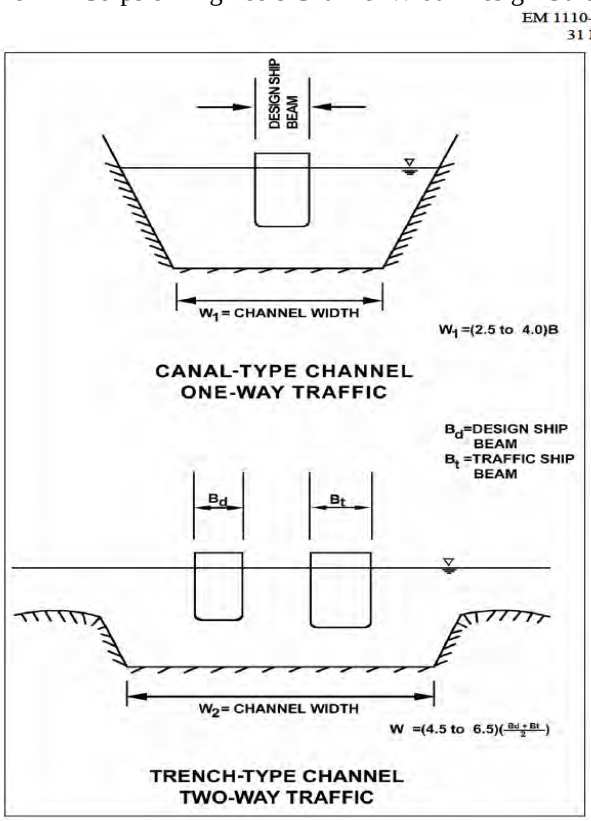
[37] The Port Authority of New York and New Jersey partnered with the States of New York and New Jersey, the City of New York, the US Environmental Protection Agency, US Army Corps of Engineers, and Federal Highways Administration, in the first ever multi-agency effort to create a long-term port development plan that is both economically efficient and environmentally sustainable. This effort, referred to as the Comprehensive Port Improvement Plan (CPIP), identified specific water and landside infrastructure development scenarios and recommends associated transportation enhancements that are required to accommodate growing cargo demand out to the year 2060. CPIP was funded by the States of New York and New Jersey, using the bi-state dredging fund, the Port Authority and the City of New York. The CPIP and the accompanying Environmental Assessment provided a framework for the consideration and evaluation of future regional port improvement projects.

design simulations and modeling for Corps deepening studies and is used regularly by the HDP with input from the New York Harbor Pilots[38] and the Coast Guard to design the navigation channels in the Port. Simulations using *Emma Maersk*-sized vessels[39] occurred in May and June 2009. The modeling determined that while the Bergen Point Turn is awkward for a very large vessel, it is not insurmountable as larger, more modern vessels are generally equipped with more powerful bow and stern thrusters, which allow for greater maneuverability. When necessary, an extra tug boat could be employed to help the inbound or outbound ship. The extra expense for the added tug is minimal compared to the transportation cost benefit from bringing in a larger ship. Modeling results are summarized in *Appendix D, Vessel Simulations*.

Channel Dimensions

The design of Corps of Engineers deep draft navigation channels is guided by Engineering Manual 1110-2-1613 (EM 1613). The Corps generally uses a beam multiplier of 5.5 for preliminary design for two-way traffic and a beam multiplier of 3 for one-way traffic for a trench channel with moderate currents like the Kill van Kull.[40] This is similar to the guidance provided by the World Association for Waterborne Transport Infrastructure (PIANC) for channel design.

Figure 11 - Corps of Engineers Channel Width Design Guidance



[38] This term refers to the Sandy Hook Pilots, whose data was cited earlier, the Metropolitan Pilots, and McAllister Pilots.

[39] The *Emma Maersk*, lightly loaded, was assumed to be the largest ship to potentially traverse the Kill van Kull at its future 50-foot depth.

[40] See EM 1110-2-1613, Table 8-3.

Nonetheless, the guidance itself says that the standard is conservative. Detailed design is based on simulator studies. The ultimate decision of whether ships can pass is left to the pilots, although the Coast Guard can supersede the pilot's decision if it foresees a safety threat. The Coast Guard manages the Vessel Traffic System (VTS) and can use it to determine whether traffic needs to be limited to one way at specified times or on demand, but this is generally an operational decision rather than a policy one.

The Kill van Kull is the narrowest channel leading from the sea to Newark Bay. At its narrowest point, the Kill van Kull is 800 feet wide and in that area the channel is bank-to-bank. During construction of the 50-foot channel some of excavation of the sideslopes resulted in impacts to the littoral zone.[41] As of this writing, the *Emma Maersk*, with a static draft of 51 feet, is the largest foreseeable ship to transit the Kill van Kull, albeit lightly loaded. The beam of the *Emma Maersk* is 185 feet. This is greater than one-fifth the width of the channel, which might result in a restriction to one-way traffic while she is transiting. The benefits analysis presented here assumes that a ship the size of the *Emma Maersk* will be allowed to use the channel and that given the frequency of vessel arrivals of that size, there would be few situations when two vessels of that size will be required to pass. In situations when two ships of that size had to pass, it is assumed that one would be held in Newark Bay or on the east side of the channel until the other is through the narrowest part of the Kill van Kull. In summary, the benefits calculations assume channel dimensions are not a limiting factor.

c. Handling Constraints - Cranes, Berths, and Yard Capacity

Cranes

A ship the size of the *Emma Maersk* requires 22-box outreach cranes for efficient unloading. Currently, the Maher and APM have cranes that have a 22-box outreach and the berths at Elizabeth and Port Newark are strong enough to support cranes of that size if needed in the future. For this reason, it is assumed that crane capacity does not limit benefits. (See Figure 12 for a view of the cranes.)

Berths

Berths at terminals in Newark Bay were reinforced to 52 feet as a requirement of the HDP. The combination of the 50-foot channel, plus tide, plus an adequately deepened berth would allow the *Emma Maersk* or a similar ship to be operated in the Port in at least half of its loading conditions. These conditions are assumed in the benefits calculation so it is assumed that berths do not constrain benefits to Bayonne Bridge replacement or alteration.

[41] The littoral zone is the area from mean low water seaward to six feet deep at mean low water. The littoral zone has a complex biological and ecological function and impacts to it are regulated stringently at the State level.

Figure 12 - Cranes at Maher Terminal



Terminal Capacity

Concurrent with this effort, the PANYNJ undertook a Strategic Business Assessment of the Port. To retain consistency between the two studies, assumptions about current and future terminal capacity were given to the study team by the Port Authority. The assumptions are as follows:

Table 2 - Terminal Capacity Assumptions

	Terminal Size	Lifts/Acre/ Year	Anticipated Expansion	Lifts/Acre/Year EXPANDED	Total Available Acreage	Total Available Annual Throughput (LIFTS)	Total Available Annual Throughput (TEU's)
Port Newark/Elizabeth	975	4500	80	5000	1055	4,787,500	8,138,750
Howland Hook	180	4500	40	6000	220	1,050,000	1,785,000
Port Jersey Peninsula	100	4500	70	6000	170	870,000	1,479,000
Red Hook	66	4500	0	6000	66	297,000	504,900

Using these assumptions it was determined that terminal capacity will be a constraint under the current commerce forecast [described in the next section] beginning in Newark Bay in 2030 and in the Harbor overall (*i.e.*, including capacity improvements expected on the Port Jersey peninsula) in 2032. To remedy this, the Port Authority will need to make increases in terminal capacity in increments of 600,000 lifts/year in Newark Bay in each of 2030, 2035, 2040, and 2042 or in the Port overall in 2032, 2036, 2039, and 2042.[42] These improvements may add to

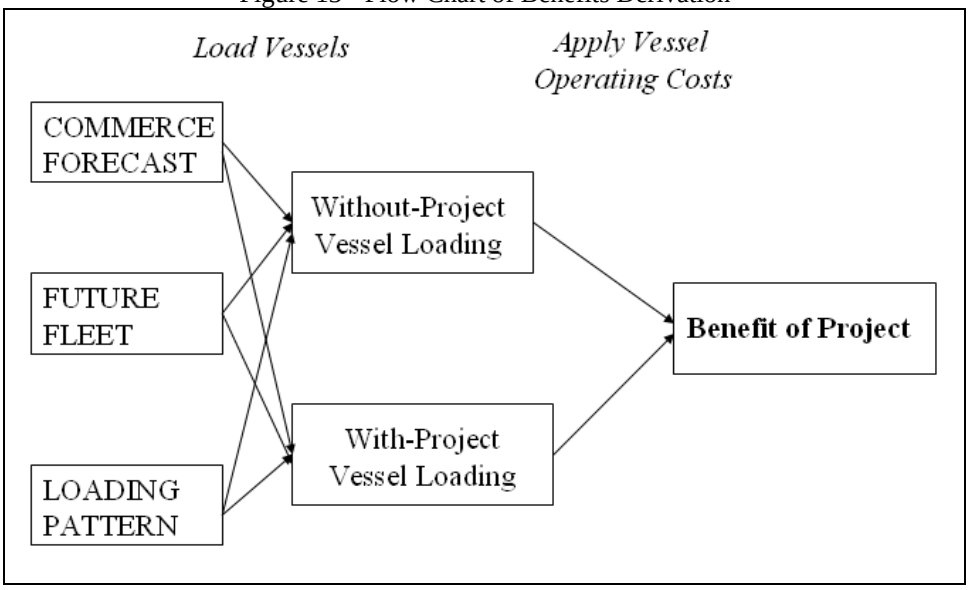
[42] These increases in terminal capacity are calculated assuming that throughput is 6000 lifts/acre/year, the highest terminal capacity increases predicted in the planned improvements. These improvement levels are stated in

project cost,[43] but they are so distant that their net present value is not likely to change the benefits calculation presented here.

B. BENEFITS CALCULATIONS

This flow diagram presents the method of benefits calculations used in this study.

Figure 13 - Flow Chart of Benefits Derivation



The commerce over the 50-year project horizon is calculated and the with- and without-project future New York fleet projected. In this case, the without-project condition is that the Bayonne Bridge remains at its current height and the New York fleet is limited to vessels that are not height limited by it. The with-project condition assumes there is some modification that will allow larger vessels to pass beneath the Bridge. The forecasted commerce is loaded onto each of the two fleets according to observations of the loading pattern. The result is an estimate of how many trips and container miles of transportation will be required to carry that commerce in both the with- and without-project conditions. Then, the vessel operating costs are used to estimate the cost of the marine transportation produced to carry the commerce in the with- and without-project condition. The difference between these two costs of production is the NED benefit to the project. In order to compare bridge alternatives that have different time patterns in their construction, the NED benefits need to be discounted to a common base year[44] before they are arrayed over the sum of the construction costs (with interest)[45] and the net discounted costs of project operation and maintenance. The inputs to this calculation are summarized, below.

---

lifts/year so as not to imply land creation is essential for them to occur. Given efficiency improvements in yard machinery, it is possible that these improvements will occur without land creation or land acquisition.

[43] They add to project costs in the sense that they are investments necessary for the realization of all benefits. Assuming that the Bayonne Bridge had been removed as an obstacle prior to 2030, these terminal capacity increases would be separable incremental investments assumed to be financially self-sustaining.

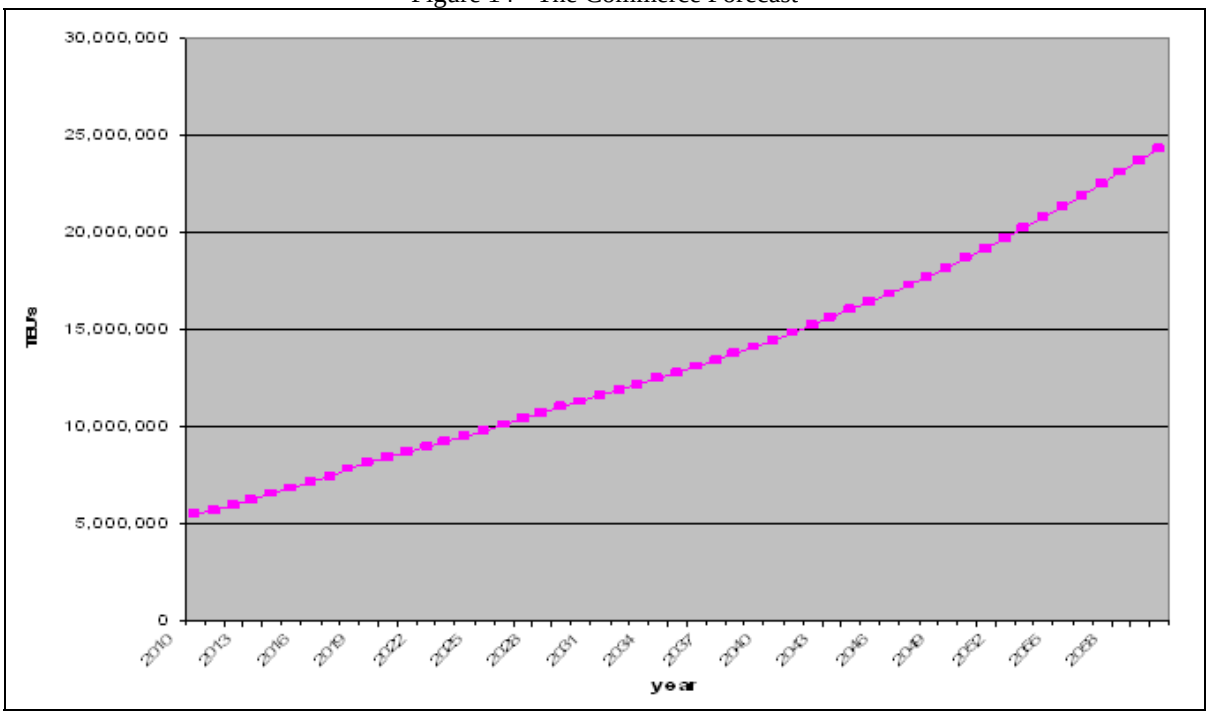
[44] The base year is the first year benefits can be realized.

[45] Interest during construction is not a transaction for which money changes hands, but rather an accounting of the time value of the potential other uses of the resources being used for this effort.

1. Commerce Forecast

To maintain consistency of method with the 1999 Study, the commerce forecast was derived by applying the growth rates used in the HNS and applied to the observed commerce coming through the Port. At the time of modeling, the most recent observation was for annual TEU's was from 2008 (5,265,053). The ten-year average annual growth rate (AAGR) used in the 1999 HNS Study is applied to that number and calibrated to become the 2010 base forecast, 5,538,626 TEU's, and for each year afterward, the AAGR from prior ten year span is applied.[46]

Figure 14 - The Commerce Forecast



The values generated by other analytical approaches were within the range of those expected by concurrent Halcrow and Cambridge Systematics commerce forecasts, which are being produced independently and by other methods for other PONYNJ studies.[47]

2. The Future Fleet

The expected future fleet was provided by the Port Authority. It was compiled by taking the number of service strings for the last known year by trade route[48] and projecting the growth rates

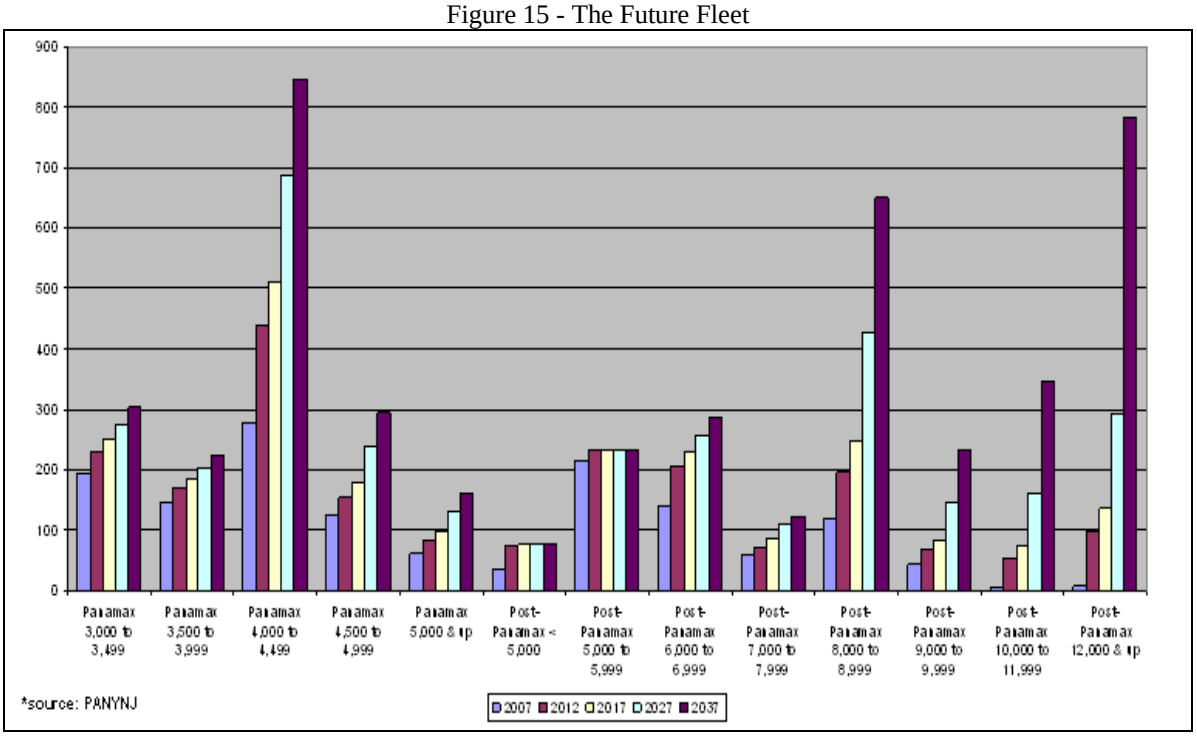
[46] The 1999 forecast was based on the World Trade Model, which at that time was the state-of-the-art method used for commerce forecasting for harbor deepening efforts Corps-wide.

[47] The Study Team met with members of the Halcrow and Cambridge Systematics teams (employed by the Port Authority and New York City Economic Development Corporation respectively) on 16 January 2009 to compare commerce forecasts. At that time, it was confirmed that the forecasts presented by the three parties essentially similar one another.

[48] In this case, the last known year was 2008.

in commerce on each route provided by the quarterly forecast prepared by Global Insight[49] onto those regions. From this projection, the number of larger and/or extra vessels, then extra strings to meet that demand is estimated. It takes into consideration the number of vessels on order.[50]

Figure 15 - The Future Fleet



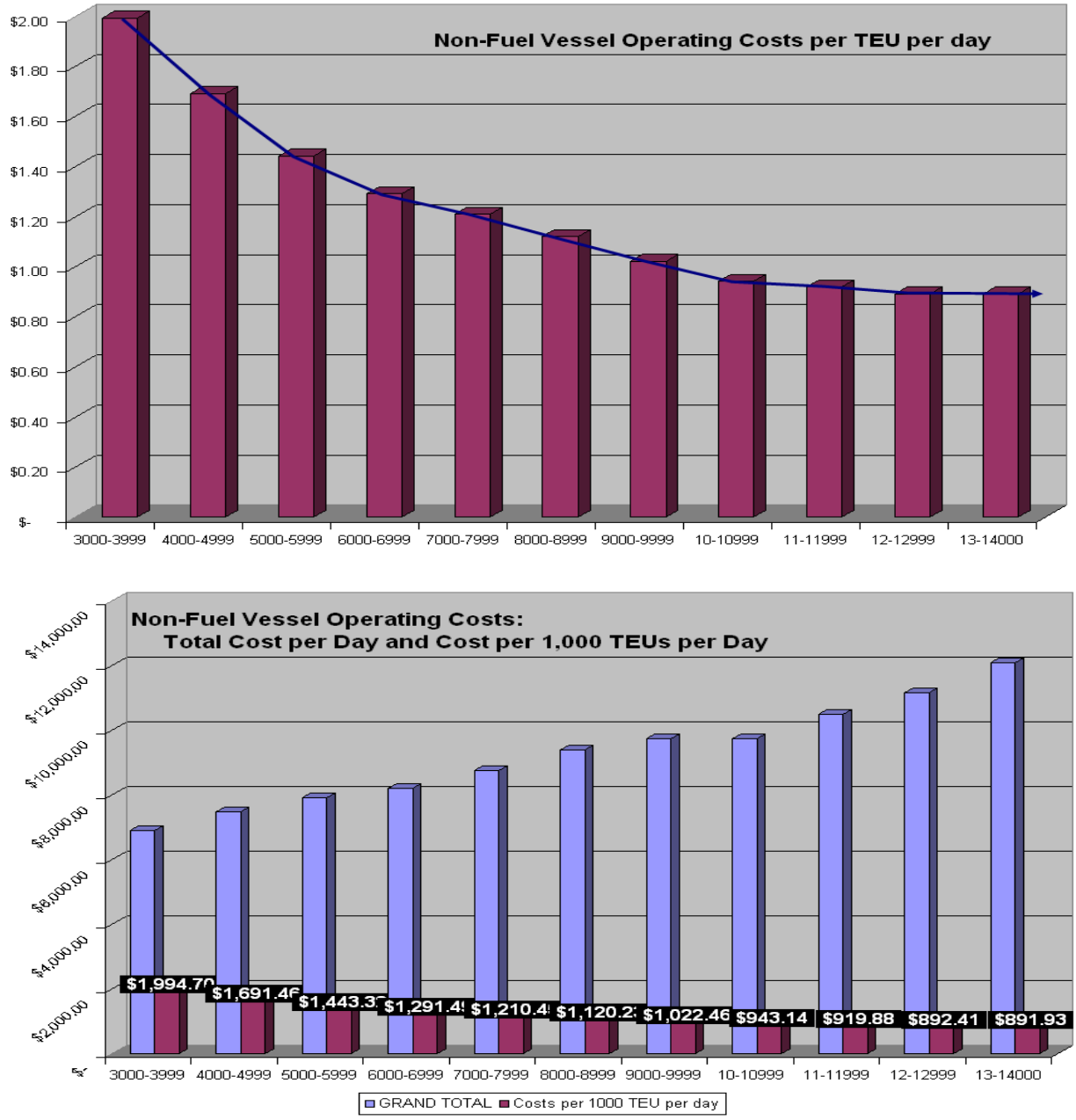
Like a channel depth restriction, the Bayonne Bridge impedes the carriers' ability to realize economies of scale associated with the use of economically efficiently loaded larger vessels, which adds to the transportation cost associated with the Port. While the average cost of operating any class of containership will increase as the size of vessel and, presumably, capacity increase,[51] vessel operating costs decrease on a per TEU basis with the size of vessel. This is because large and small vessels have similar crewing requirements and because larger, longer vessels are generally more fuel efficient because their hydrodynamics allow them to operate at a higher speed for the same amount of power resulting in less fuel expended per TEU so long as the volume of commerce carried remains sufficient.

[49] Global Insight is an econometrics consulting firm.

[50] It is important to note that the fleet used here was derived in late 2008, before a large number of vessel cancellations were made in response to the slowing economy. As determined in Section 9 of *Appendix B - Sensitivity and Alternative Scenario Analyses*, placing a two-year delay on orders or cancelling half of all ships on order in July 2008 does not change the result of the benefits calculation enough to give any of the alternatives considered an NED BCR less than 1.0. As fleet construction is driven by carrier demand, the benefits to utilization of larger ships - our concern in this document - is driven by the commerce forecast. The Corps' commerce forecast does not specifically account for the current economic slowdown because, as with all Corps reports, it is based on a 50-year planning horizon. Because of the length of the planning period, there will be multiple ups and downs, even large ones, in the economy that are subsumed in the general trend. For instance, the current economic downturn is, in fact, the 12th depression since the end of World War II according to the National Bureau of Economic Research's business cycle dating methods.

[51] Independent of fuel costs, larger ships cost more to operate in terms of total cost but unless there are very few containers, they cost less on an average per TEU basis.

Figures 16 & 17 - Non-Fuel Vessel Operating Costs

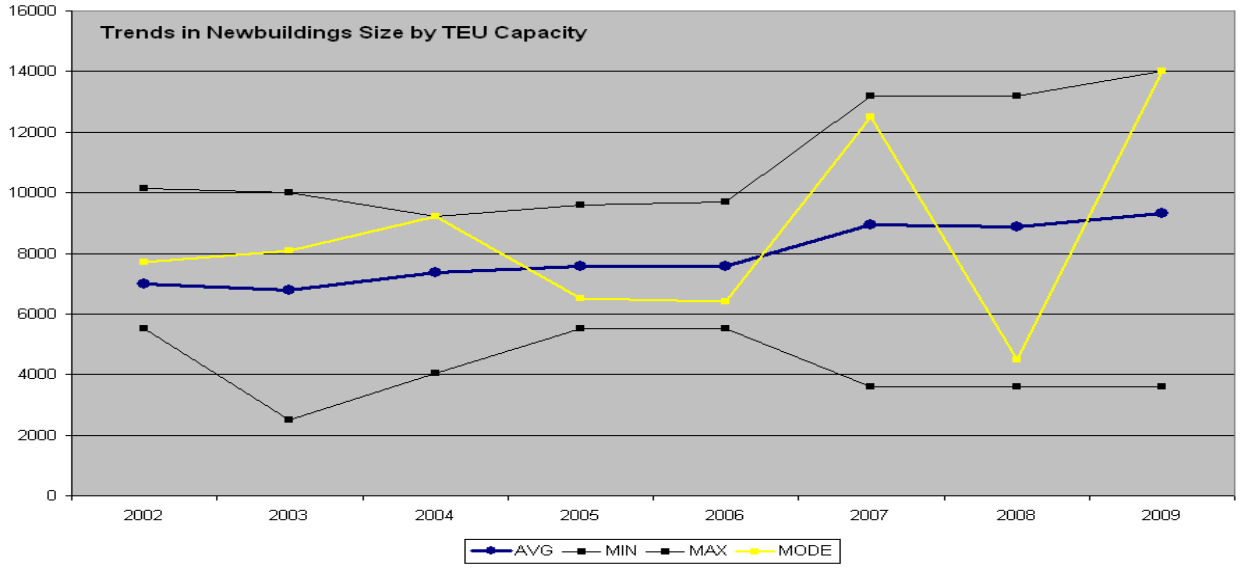


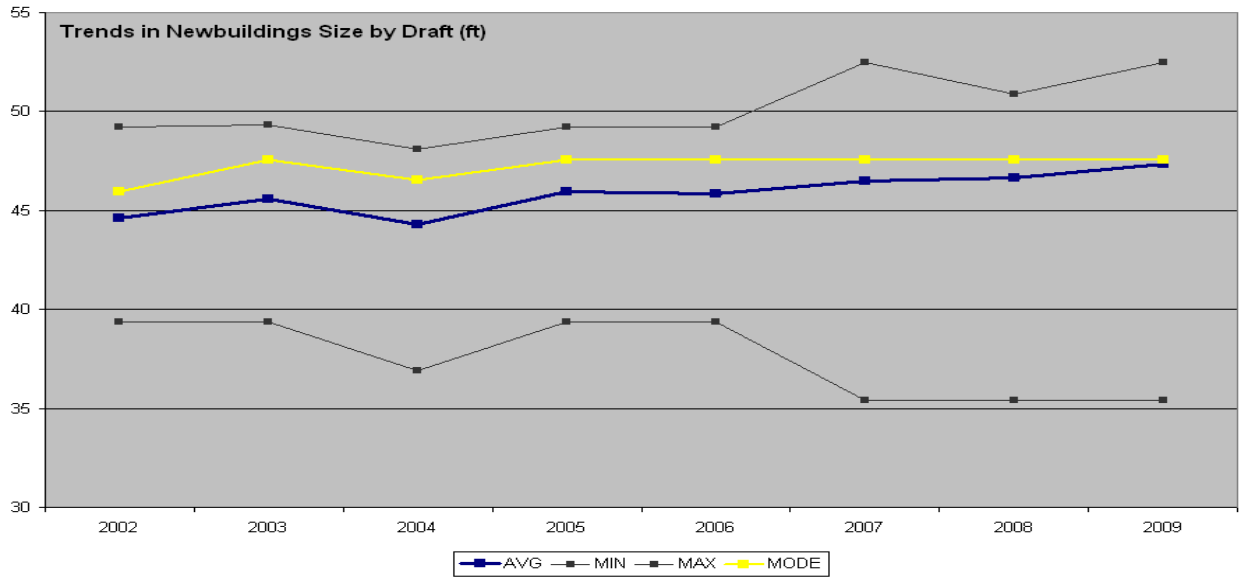
This fact is evidenced by data collected for new buildings orders.[52] Over the period 2002 to 2009, total fleet capacity has increased greatly. The average TEU capacity per ship ordered has increased from just less than seven thousand to ninety-three hundred TEU's, and with average TEU capacity for new vessel orders increasing each year, in spite of variation in year-to-year

[52] This is Lloyds Newbuildings data provided by the PANYNJ.

trends of the most popular ship size.[53] Average values for dead weight tons, length overall, beam, and design draft for new containership orders all increased each year over the same period, as evidenced by the figure, below.

Figure 18 & 19 - Trends in Newbuildings





Carriers were also asked during the interview process about the extent to which they had used or intended to use ship-based solutions to the Bayonne Bridge air draft restriction, for example, collapsible masts or retractable antennae. The general consensus gathered from those interviews was that these are solutions that are used in some cases now but which only add a few feet of clearance and will not serve as a long-term solution given the size of the ships that will most

[53] For example, from 2002 to 2004, most orders were for 8000 and 9000 TEU vessels, but in 2005 and 2006 it was the 6500 TEU vessels. In 2007 and 2009, the most popular size for a new vessel was 12,500 TEU's and 14,000 TEU's, respectively, but in 2008 a smaller vessel, 4,500 TEU's, was most commonly ordered.

efficiently carry the projected future commerce on major east coast routes.[54] In an innovative response to the set of design problems associated with larger container vessels, the Mediterranean Shipping Company launched the *MSC Daniela* in December 2008. At 14,000 TEU's, the *MSC Daniela* has greater nominal TEU capacity than the *Emma Maersk*, but has a significantly shorter KTMH because it has split accommodations to allow more containers on the deck with increased visibility and to allow further use of high-cube containers. Furthermore, this split accommodation is designed to better protect the fuel tanks in light of increased environmental regulation.[55] Even with these innovations, the *MSC Daniela* has a KTMH of 221 feet and would not fit under the current Bayonne Bridge under any loading condition.

Table 3 - Comparison of the *Emma Maersk* to the *MSC Daniela*

	Emma Maersk	*MSC Daniela*
TEU Capacity[56]	12,508	14,000
Length Over All (LOA)	1306 feet	1201 feet
Beam	185 feet	168 feet
Design Draft	52.5 feet	52.5 feet
KTMH	251 feet	221 feet
Deadweight Tonnage	156,907	156,301

Finally, carriers were asked what their future deployment plans were for East Coast routes, especially in light of the expanded Panama Canal. All of the carriers revealed that they are consistently looking to use newer, larger, more fuel efficient vessels in an effort to keep their costs low and operate optimally. Upon the completion of the Panama Canal expansion in 2015, the carriers that are currently using the Canal intend to deploy a set of larger vessels on trans-Panama routes in order to take advantage of the economies of scale afforded by the larger vessels. Ships built to operate within the dimensions of the new locks[57] are designated new-Panamax vessels.

Many of the carriers propose to use larger vessels, usually vessels of sizes ranging from 5,500 to 8,600 TEU's on East Coast routes. It is likely that these larger vessels will not call as many East Coast ports as current services with smaller vessels do now. The larger vessels are either new or existing vessels that will be shifted from transpacific services as even larger vessels are introduced on those routes. The carriers agree that there will be a great deal of competition for berths at Port Jersey facilities to service these vessels as these facilities are not height encumbered. Eleven of the 15 carriers interviewed say that they may need to bypass the

[54] Carriers were asked whether deployment of a specially built Bayonnemax vessel was considered in their capital plans; however, deployment plans for such a vessel was limited to 1 carrier, with other carriers using those ships under vessel sharing agreements.

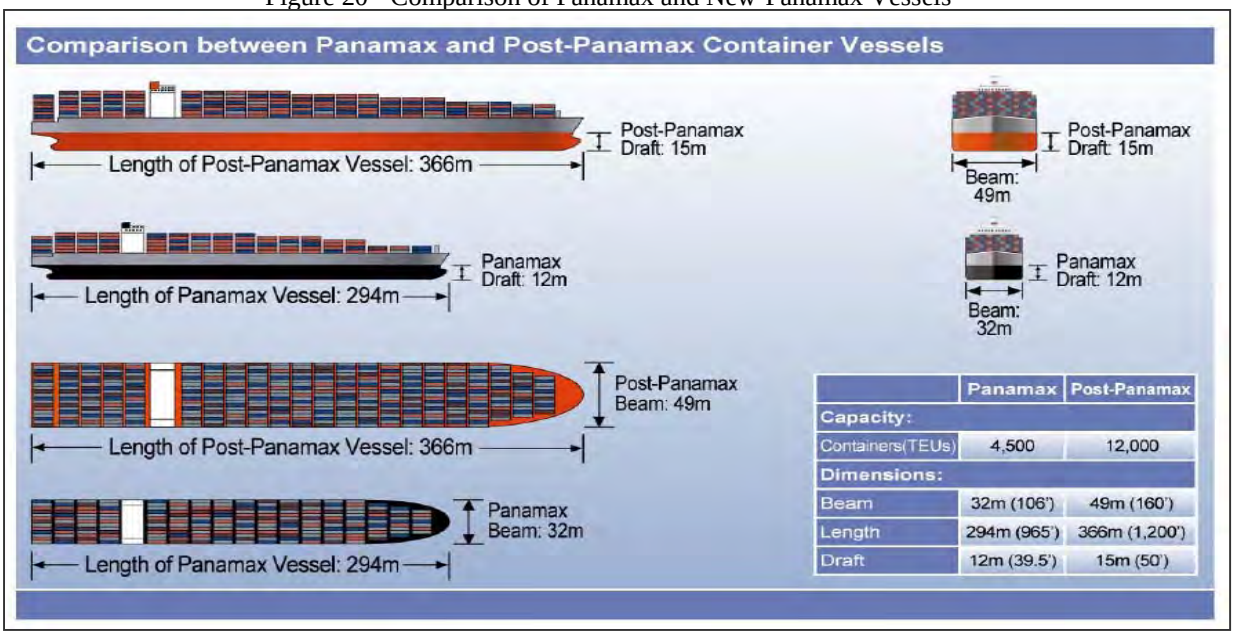
[55] The most relevant example of this is the addition of Regulation 12A on oil fuel tank protection to Annex I of the International Maritime Organization's (IMO) Convention for the Prevention of Pollution from Ships (MARPOL). This amendment applies to apply to all ships delivered on or after 1 August 2010 with an aggregate oil fuel capacity of 600m^3 and above. It includes requirements for the protected location of fuel tanks.

[56] These are latest Lloyd's *World Shipping Encyclopedia* figures. Maersk rates TEU's at 14t/TEU, which would give the *Emma Maersk* 11,000 TEU and the *MSC Daniela* 10,640 TEU.

[57] Maximum draft of 50 feet, 160 foot beam, and length of 1200 feet

PONYNJ in the future if the Bayonne Bridge remains a restriction.[58] The only carriers who are not citing the Bayonne Bridge as a problem are carriers for which the Panama Canal is not currently a limiting factor for vessels deployed.

Figure 20 - Comparison of Panamax and New-Panamax Vessels[59]



3. Loading Pattern

As described in the prior section entitled *Global Constraints*, the worldwide distribution system of containerized cargo is characterized by a model of regularly scheduled service. Because of the commercial importance of schedule keeping, vessels will not delay their departures in order to leave in a fully loaded condition. A vessel may be constrained on one voyage, but not constrained on the next, resulting, over time, in a statistically discoverable loading pattern. This is why examination of KTMH is the clearest characteristic to use to determine whether a ship may be constrained by the Bayonne Bridge.

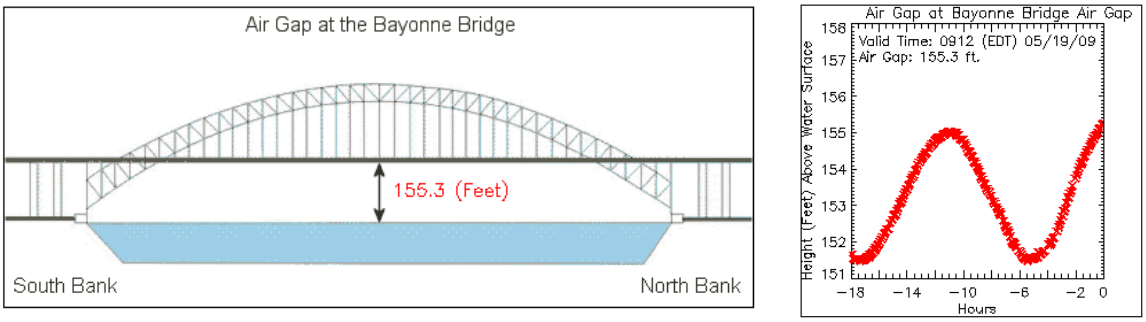
A useful way to think about the restriction imposed by the Bridge is to consider the analogy of a needle. The space between the bottom of the channel and the bottom of the roadway of the Bridge is the eye of the needle through which the ship must thread. Unlike deepening efforts where the distance to the channel bottom is the main consideration and when the restriction is generally limited to the direction for which loading is heaviest - the restriction imposed by the Bayonne Bridge is added to the restriction of the channel bottom. While a ship that is only depth limited could operate sub-optimally, entering or exiting the PONYNJ either light-loaded or riding the tides, the existence of the Bayonne Bridge limits passage in two dimensions. Beyond

[58] While this is a PANYNJ Study and this effort presents an opportunity for the carriers to make such threats, the reality is that the economic logic of carrier and vessel economics makes the prospect credible.

[59] From *Autoridad del Canal de Panama*, http://www.pancanal.com/eng/plan/documentos/propuesta/acp-expansion-proposal.pdf. Note that while this diagram document uses the term "Post-Panamax," this text uses Post-Panamax to refer to ships that cannot transit the Panama Canal under current conditions (*i.e.*, pre-expansion).

ruling out passage of ships that have a KTMH greater than the sum of the channel depth and the air draft clearance, it also precludes the passage of ships that might otherwise fit given KTMH if they were loaded to their design draft but which, given current loading, are riding too high to pass beneath the Bridge. This was the case of the *NYK Nebula* presented earlier in this document.

Figure 21 - Bayonne Bridge Air Draft Variation with Tidal Cycles



It is for this reason that the loading pattern is integral to this benefits calculation. NED benefits are derived not only from the use of ships that absolutely cannot call with the Bridge in place, but which would be expected to call if it were to be removed, but they also accrue in situations where a ship can only enter or clear the Newark Bay Complex under specific loading conditions. To develop an accurate representation of how vessels are being operated on New York calls, the record of operating drafts for all vessel entrances into New York Harbor was collected.[60] From this data set, a "New York Fleet" compiling all container vessels calling New York Harbor twenty or more times in the five-year period between 1 January 2002 and 31 December 2006[61] was developed.

For each of the 7,211 calls made by the 220 ships in the New York fleet during this period, the percent of the ship's design draft utilized was plotted against call date. This produced a series of curves that was used to verify that, indeed, the percentage of available design draft used increased over time, but that on average a ship will use about 86% of its design draft on each call and this is the load factor used in the benefits calculations. This is the load factor at the end of the period for which data is available and produces a conservative bias, if any, in the calculations.[62] This statistic is analogous to the Federal Reserve's capacity utilization statistics

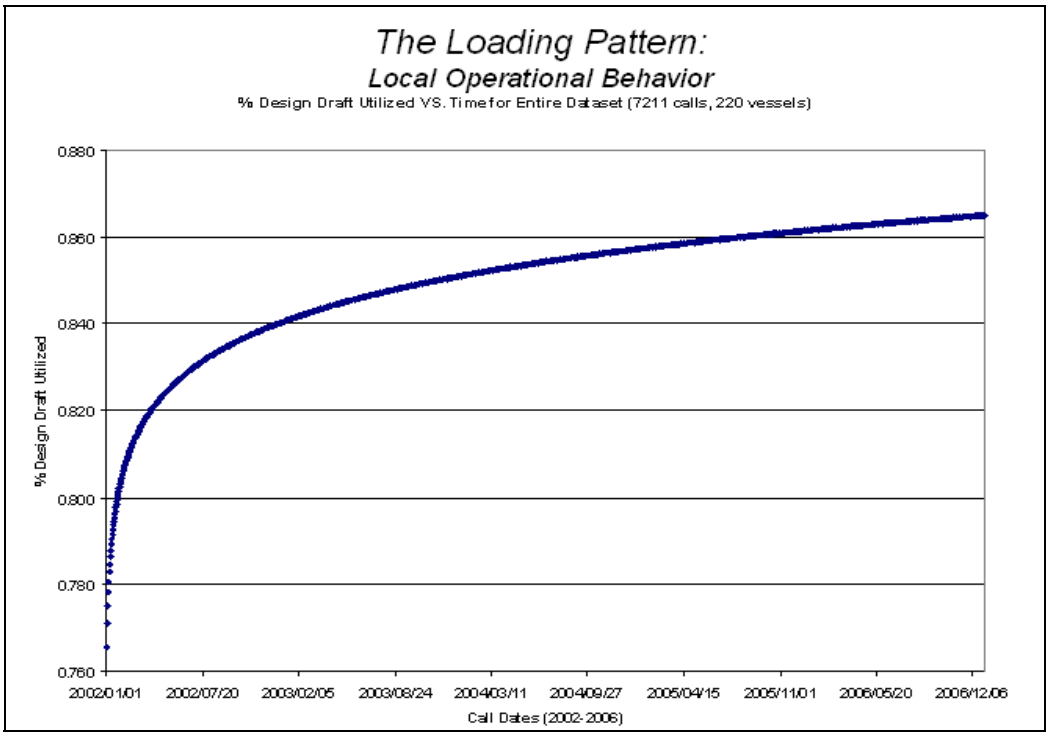
[60] This data set was developed from Corps of Engineers Institute for Water Resources Navigation Data Center (NDC) records. The NDC collects U.S. Customs Bureau data on vessel entries, clearances, and cargo for all U.S. commercial ports. At the time of writing, 2006 entrances were the latest available from the NDC.

[61] This allowed the study team to determine what changes, if any, occurred as a result of effective change in available channel depth from 38 to 43 feet marked by the availability 45 feet of depth in the Kill van Kull beginning in November 2004. This type of operational change was assumed to occur again with the availability of 50-foot access in 2013.

[62] Although arguably outside the scope of the present study, one potential extension that this statistic suggests is the use of a leading indicator approach to predicting when a larger ship will be added to a rotation. In this study, the deployment of a larger ship is expected to occur when commerce "overflows" from the existing fleet. This method of fleet deployment is described in the next section but the availability of a fairly complete record of call data and desktop processing software may allow the use of current empirical observations in projecting when larger ships will be deployed on specific routes.

that measure how much of the Nation's installed, productive capacity is being used.[63] The summary curve is presented below.

Figure 22 - The Loading Pattern

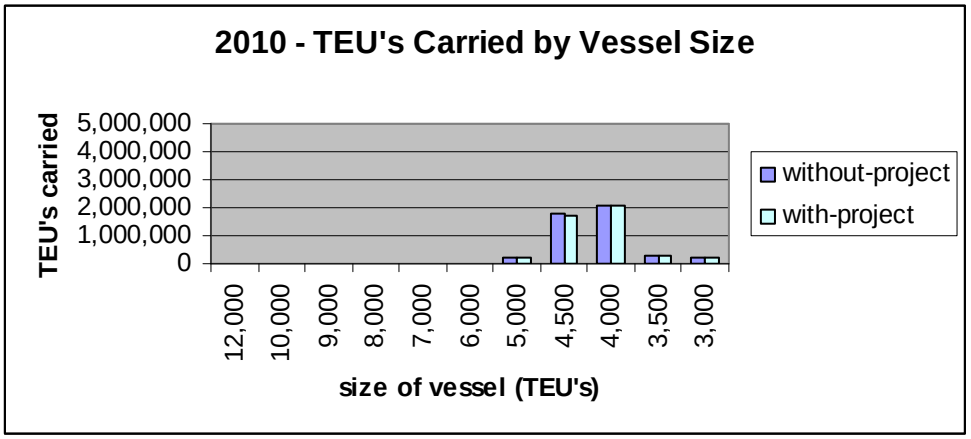


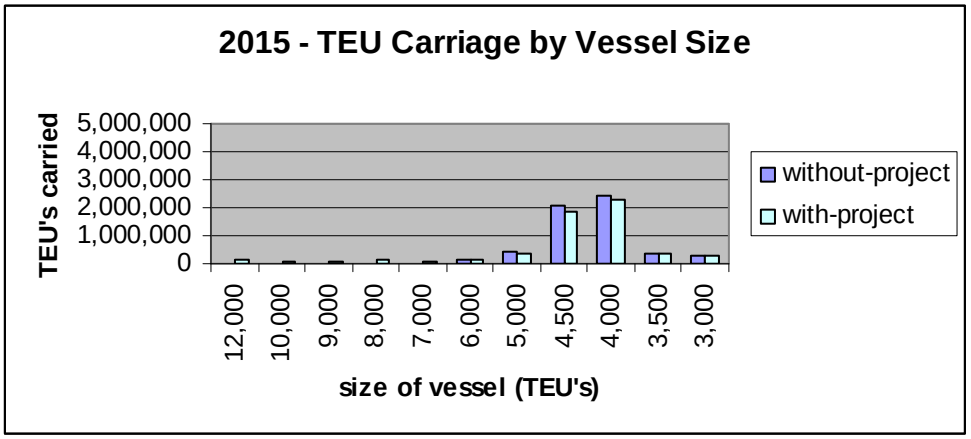
4. Fleet Deployment

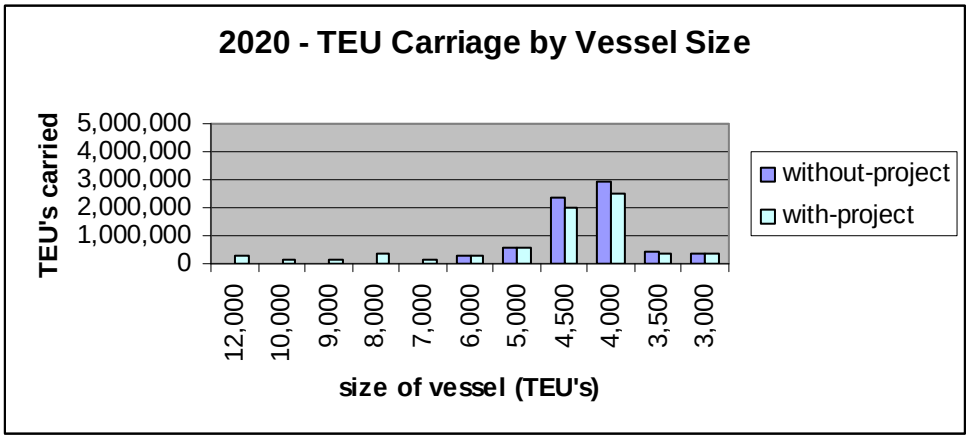
The methodological objective of the Bayonne Bridge Air Draft study thus far has been to maintain maximum comparability with the 1999 HNS. The HNS used what is commonly referred to as "The Overflow Method" to determine benefits to the project. The Overflow Method takes the commerce forecast, the fleet forecast, and the loading pattern and loads commerce onto the fleet by the loading pattern. As commerce grows, each year's forecasted current commerce beyond what was forecasted for the previous year is loaded proportionally onto the expected with and without project fleet. Recall from earlier in this section that the fleet will differ depending on the with- and without-project condition.

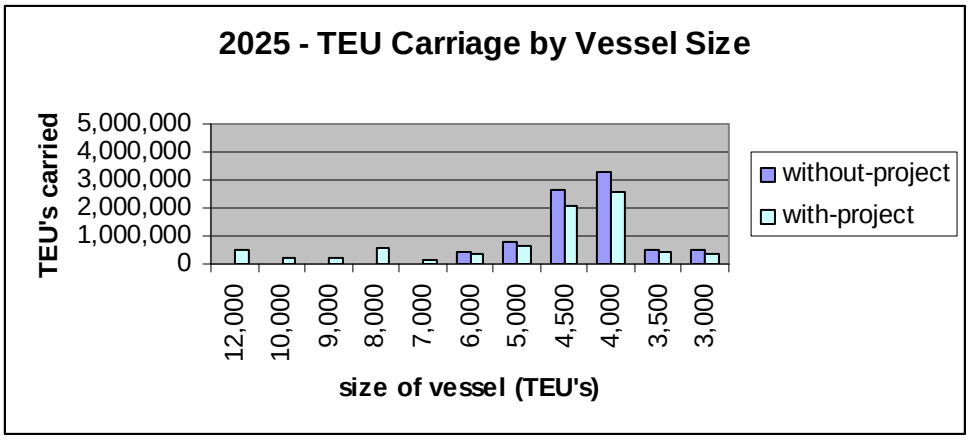
[63] Capacity Utilization data can be found on the Federal Reserve Board's (FRB) website at http://www.federalreserve.gov/releases/g17/Current/table7.htm. The rate of capacity utilization in the goods producing part of the macroeconomy is called the "total index" in the FRB survey. From 1986 to the present (see the historical tables at the FRB website), the total index has reached peaks of 85.1 (January, 1989) and 84.9 (January, 1995). This suggests that the rate of utilization of vessel design draft at the end of 2006 is probably at the high end of the scale. The idea behind looking at capacity utilization is that when it reaches high levels, it is a harbinger of an increase in the capital stock. In the case of containerships, this would, presumably, take the form of replacing the current fleet with larger units. The flurry of orders of large containerships in the 2007-2008 period is evidence supporting this hypothesis.

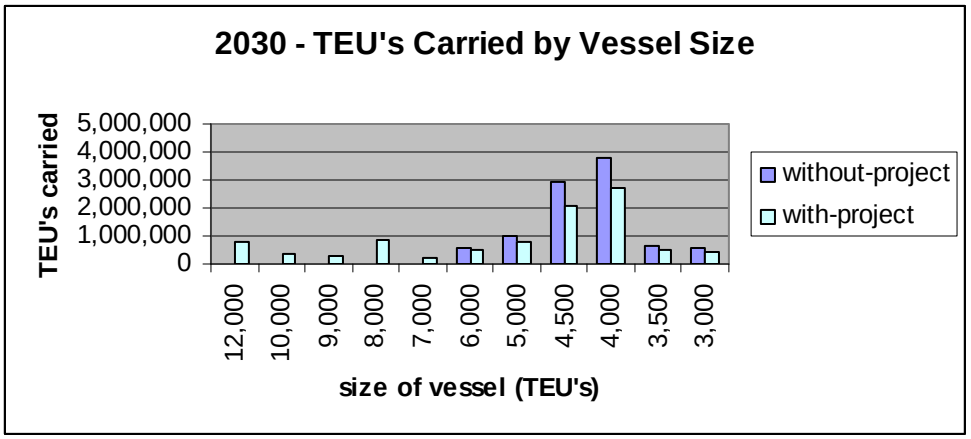
Figures 23 -Distribution of Cargo by Vessel Size by Year

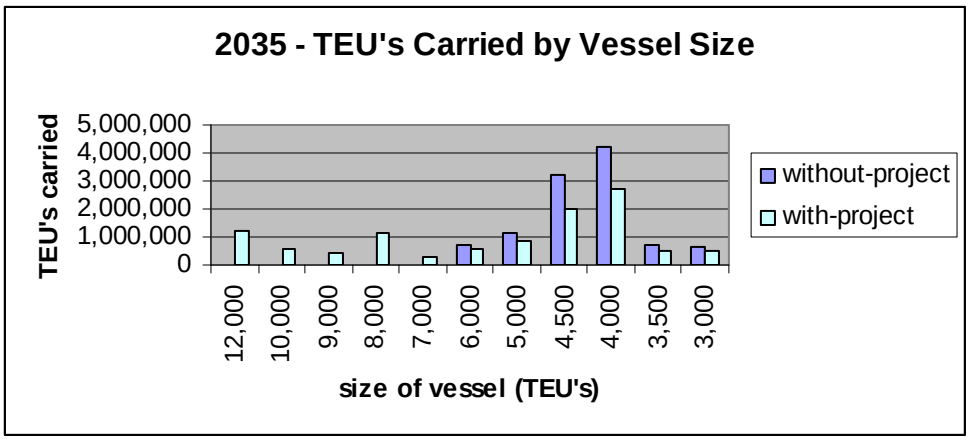










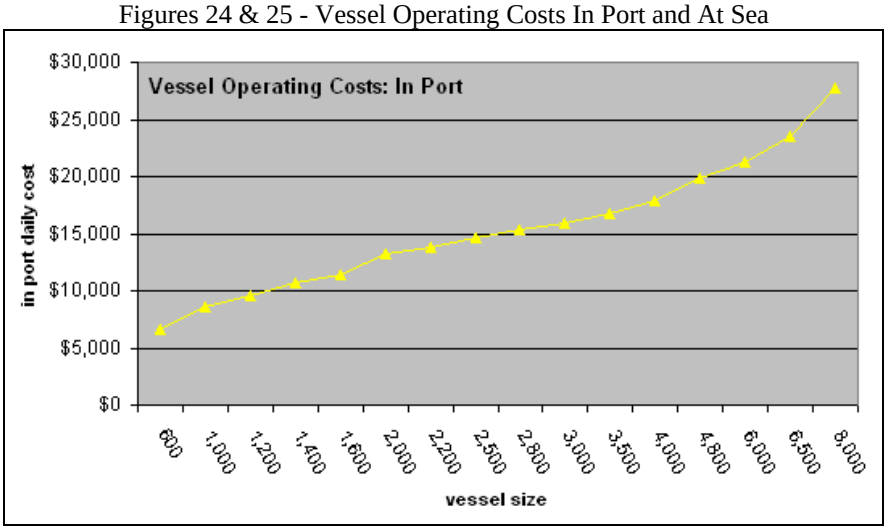


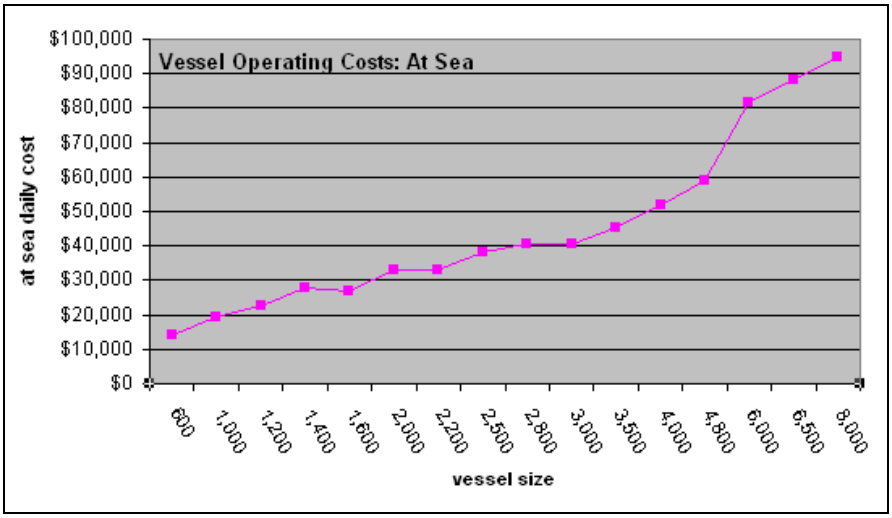
5. Vessel Operating Costs

Vessel operating costs (VOC's) are supplied by the Corps' Institute for Water Resources (IWR). For Corps navigation studies, IWR supplies a series of VOC's for each size and type of vessel forecasted to call in the with- and without-project condition. Because these large vessels are relatively new, IWR has not had the opportunity to develop specific VOC's for this study. Instead, the study team relied on the VOC's generated for the Corps' most current ongoing deep-

draft study focusing on container vessels, Savannah Harbor.[64] Because the vessels presented for that study were limited to those carrying up to 8000 TEU's, operating costs for larger vessels were extrapolated from the curve produced by the empirical data from IWR.[65] These VOC's were then applied to the with- and without-project New York fleets.

Figures 24 & 25 - Vessel Operating Costs In Port and At Sea





6. Calculation of Project Benefits

The with- and without-project conditions produce two different ways by which the commerce projected to pass through the PONYNJ will be carried. In the without-project condition, the commerce is carried in smaller, less economically efficient vessels that are not constrained by the Bayonne Bridge. In the with-project condition, the New York fleet is unrestricted by air draft and as the composition of the world fleet gets taller and commerce grows, larger vessels are added to New York routes. The difference in cost between operating the with- and without-project New York fleet carrying the projected commerce is the benefit of the project. It will

[64] VOC's are from 2008.

[65] At sea and in port operating costs were estimated separately as there was no reason for fixed costs to vary with vessel size.

require fewer but larger vessels in the with-project condition to carry the same amount of commerce as is carried in the without-project conditions. The difference in total operating costs, discounted as described earlier, of these fleets required to carry that amount of commerce is the NED benefit of the deepening derived from altering or removing the Bayonne Bridge.

Table 4 - Summary of Costs and Benefits

Alternative	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit
jack to 215	2019	2033	3.0	10.7%	$ 3,270,679,702
new at 215	2022	2039	2.1	8.4%	$ 2,821,542,529
bored tunnel	2024	2042	1.9	7.7%	$ 2,585,424,669
immersed tunnel	2024	2051	1.4	6.1%	$ 1,517,453,940
Source: Costs from Port Authority of New York and New Jersey, TB&T; Construction includes engineering and design and begins in 2010.					

C. COSTS OF POTENTIAL SOLUTIONS

Beyond the no-build alternative, which would be to maintain the Bayonne Bridge at its current height, there were four alternative solutions considered which included alteration of the present bridge, new bridge construction, and replacing the existing roadway with a tunnel. The alternative solutions were, including no-build, in order of scale:

No-Build **-** The no-build alternative would be to keep the Bayonne Bridge in place at its current height. The costs associated with this alternative would be the operation and maintenance of the existing facility as well as any safety upgrades required.

Jacking Arch **-** This alternative would keep the existing steel arch structure but raise the piers and rebuild the roadway at 215 feet.[66] (See Figure 26)

New Bridge **-** This alternative is based on construction of an entirely different bridge. This alternative would keep the existing steel arch of the current Bayonne Bridge, but remove the roadway. The two bridges would be adjacent to one another. (See Figure 27)

[66] Different heights were considered in *Appendix B, Sensitivity and Alternative Scenario Analyses*

Figure 26 - Jacked Arch Alternatives Increase the Air Draft of the Existing Structure

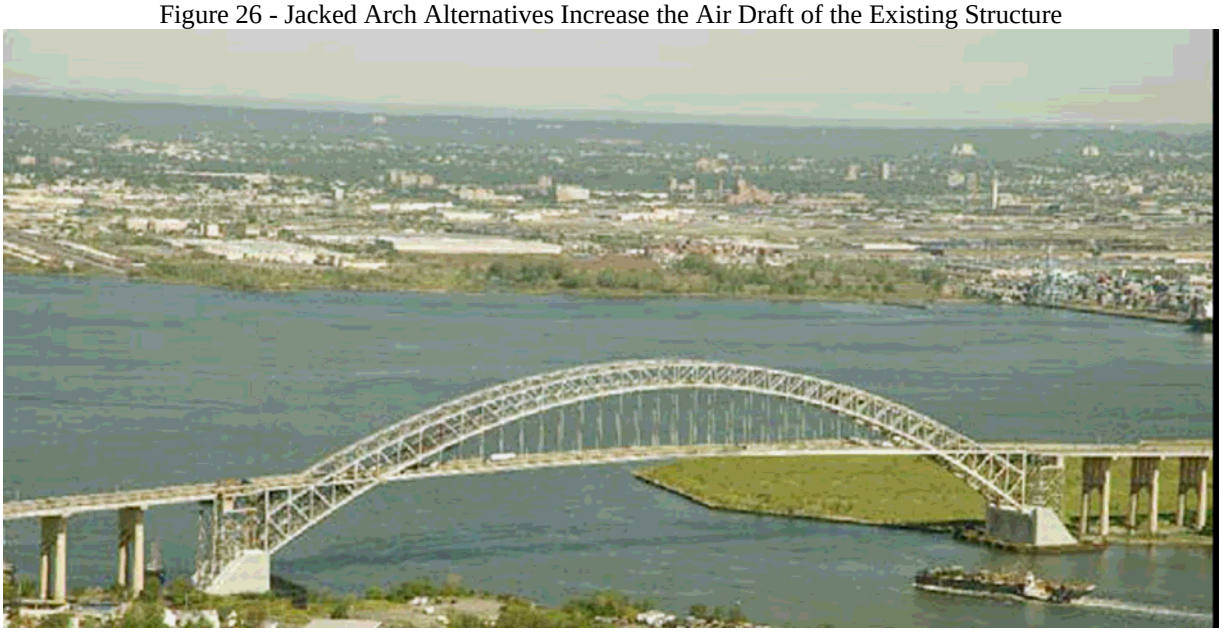
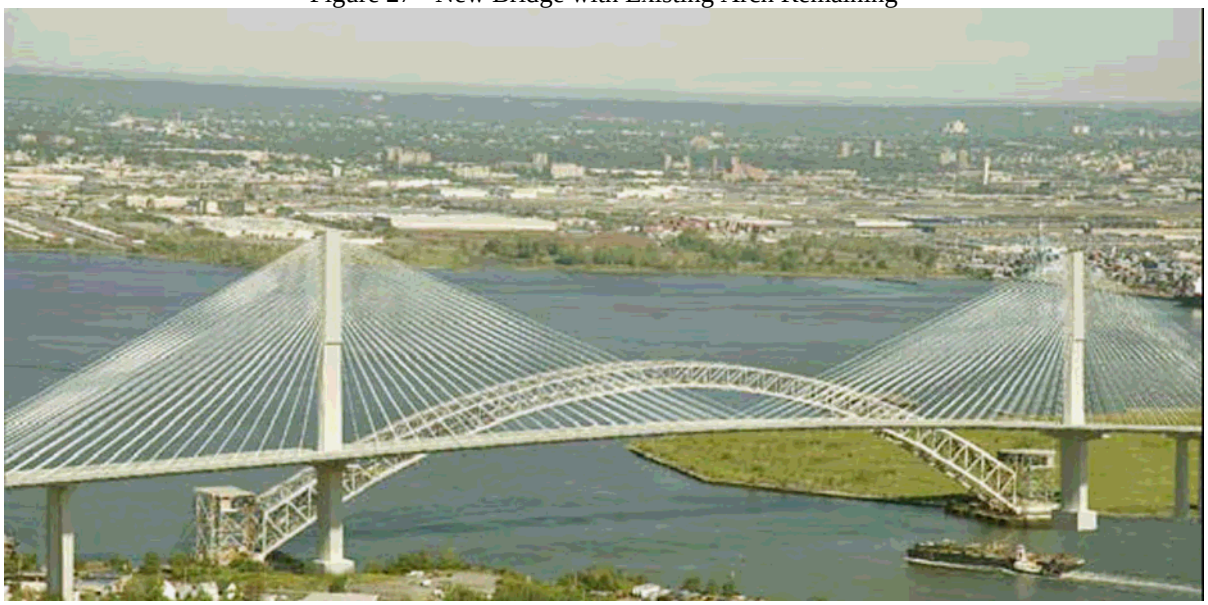


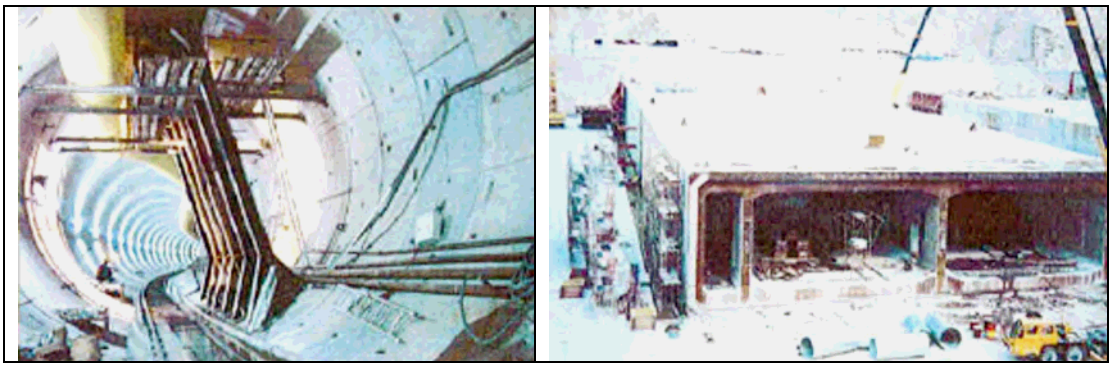
Figure 27 - New Bridge with Existing Arch Remaining



Bored Tunnel - This alternative consists of removing the roadway of the existing bridge, keeping the superstructure in place, and diverting road traffic to a newly constructed bored tunnel.

Immersed Tunnel - This alternative consists of removing the roadway of the existing bridge, keeping its superstructure in place, and diverting road traffic to a newly constructed immersed tunnel.

Figure 28 - Bored Tunnel and Immersed Tunnel



Costs of options for the four types of measures options were provided by the Port Authority's Tunnels, Bridges, & Terminals Department and are presented below and include discounted future operation and maintenance of the alternative as well as the pieces of the existing Bayonne Bridge that remain in place. Scenario analyses for the heights initially considered for the "jacking" and "new bridge" options are included in Appendix *B, Sensitivity and Scenario Analyses*.

Table 5 – Comparative Costs of Alternatives[67]

	Const-ruction duration[68]	Total yearly construction costs[69]	Total yearly costs with IDC applied	Total IDC	Total O&M costs over project life	Total discounted O&M costs	Total NPV of Construction + IDC + O&M costs	Average Annual Costs Over 50-Year Project Life
		Costs in Millions $						
NO BUILD	0	0	$ -	$ -	$494.20	$209.46	$209.46	$ 10.82
Jack 215	9	$1,316.17	$1,504.21	$188.03	$277.10	$99.26	$1,603.46	$82.79
New Bridge 215	12	$2,155.40	$2,517.15	$361.74	$361.74	$88.56	$2,564.16	$132.40
Bored Tunnel	14	$2,208.76	$2,753.85	$545.08	$545.08	$127.92	$2,881.76	$148.80
Immersed Tunnel	14	$3,096.48	$3,849.37	$752.89	$752.89	$100.36	$3,949.73	$203.94
all at t=0, 50 year project life								
Costs provided by the Port Authority of New York and New Jersey, TB&T; Construction includes engineering and design and begins in 2010; Dollar amounts are nominal.								

D. SUMMARY OF NED COST/BENEFIT ANALYSIS

[67] The no-build alternative is integral to Corps of Engineers benefits calculations and serves as a base of comparison of alternatives. In this case, no-build does not mean doing nothing but rather retaining the existing facility.
[68] The construction duration includes the removal of the existing bridge deck in the jacking and new bridge alternatives.
[69] Includes all costs associated with construction including engineering/design and financial expense.

The net benefits of the alternatives and other pertinent details are presented below. All cases assume that detailed engineering and design start in 2010 and physical construction follows when that phase is complete. There is no onset of benefits until construction of the alternative is completed and the existing impediment, the roadway at its current height, is removed from the channel.

Table 6 (repeat of Table 4) - Summary of Costs and Benefits

Alternative	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit
jack to 215	2019	2033	3.0	10.7%	$ 3,270,679,702
new at 215	2022	2039	2.1	8.4%	$ 2,821,542,529
bored tunnel	2024	2042	1.9	7.7%	$ 2,585,424,669
immersed tunnel	2024	2051	1.4	6.1%	$ 1,517,453,940
Source: Costs from Port Authority of New York and New Jersey, TB&T; Construction includes engineering and design and begins in 2010.					

The "year in place" column is based on the anticipated construction duration. For those years until construction is complete and the existing obstruction is removed, benefits cannot be realized and must be considered foregone. The "break even year" is when the net present value of the benefits realized first overtakes the net present value of the cost of the project. That happens earlier in the less expensive alternatives - the jacked and new bridges - than in the more costly ones as the costs that need to be recouped are smaller. The internal rate of return is the discount rate that renders the present value of the cash inflows and cash outflows equal. It is presented so that these alternatives can be compared to other investments the Port Authority may consider making. Strict application of the NED analysis would lead the evaluator to select the jacking option, but there are other considerations that need to be recognized.

IV. CONCLUSIONS

This analysis was scoped in such a way as the method by which benefits were calculated would remain consistent with the 1999 and 2004 deepening studies and for that reason it is focused on NED benefits. Like the prior studies of New York Harbor, those benefits are transportation cost savings to the nation that are attributable to the economies of scale that may be captured using larger vessels. They do not include increases in market share that might result from taking cargo from another facility, which may be a future scenario for the Port as a result of the current widening and deepening of the Panama Canal which will allow larger ships to pass through it and which may add some cargo volume that would otherwise have arrived in the New York economic hinterland via mini-land bridge from the West Coast had the Canal expansion not occurred. Potential benefits that might result from additional cargo landing at the USEC are considered below and described in further detail in *Appendix B, Sensitivity and Alternative Scenario Analyses.*

This effort has determined that removal or alternation of the Bayonne Bridge would produce NED benefits of a magnitude that would justify the cost of doing so. It was performed by the Corps of Engineers so that it could be compared to benefits calculation performed for the HNS and to ensure that the NED benefits that were estimated to accrue to the HDP are not restricted

by the existence of the Bayonne Bridge.[70] The design vessel for the HNS, the 198-foot KTMH *Regina Maersk*, while fully loaded and with a 50-foot channel is able to call the terminals west of the Bayonne Bridge. Therefore, all of the benefits presented in the HNS are still fully attributable to the HDP. All of the NED benefits described in this study are attributable to vessels larger than the *Regina Maersk* and are in addition to the HDP benefits. This study concludes that the removal of the Bayonne Bridge would produce $169 million in average annual net benefits over the 50-year project life for the jacking option, $148 million in average annual net benefits over the 50-year project life for the new bridge option, $150 million in average annual net benefits over the 50-year project life for the bored tunnel, and $93 million in average annual net benefits for the immersed tunnel. These benefits outweigh the cost of each alternative considered in the base case as well as in each of the alternative scenarios examined.

V. OTHER MATTERS AFFECTING THE PORT AUTHORITY'S DECISION PROCESS

There are considerations outside of the original scope of this effort that will inform the Port Authority's decision of whether, how, and when to address the restriction imposed by the Bayonne Bridge.

A. REGIONAL ECONOMIC DEVELOPMENT BENEFITS AND LOCAL IMPACTS

NED benefits are different from Regional Economic Development (RED) benefits because they do not consider effects felt in one region, but counterbalanced by opposite effects felt elsewhere. As mentioned earlier, examples might be local jobs retained or created, toll revenue or air quality impacts generated by using regional roadways, or increases in local tax bases or property values. These real, but regional benefits - and any "multiplier effects" attributable to them - are the subject of a future study being conducted by the Port Authority and can be added to the NED benefits for a more complete description of benefits that could accrue to the region if the obstruction is removed. Those RED benefits would be considered additive to the NED benefits from the decision-making point of view of the PANYNJ.

B. POTENTIAL NED BENEFITS NOT COMPREHENSIVELY CONSIDERED HERE

Transportation cost savings, as derived here, are a relatively conservative estimate of the impact of a project even at the national level, but they are often used to justify Corps deepening efforts because they are easier to estimate than other sources of benefit. One obvious source of additional benefit that is not comprehensively quantified here is the alternative cost of movement if, in fact, carriers were to decide not to call the PONYNJ but instead to call a substitute port and move goods to the PONYNJ catchment area by truck. There would be multiple potential detrimental impacts to such a scenario occurring both at the regional and national levels. While regional scenarios of port substitution will be discussed in a document being produced separately by the Port Authority, the national consequences of such a scenario are worth some discussion.

[70] If the Bridge had been discovered to be an impediment to realization of 50-foot benefits, then its alteration should have been considered part of the cost of the 50-foot project.

Figure 29 - Relative Efficiencies of Ship versus Truck



A potential consequence of substituting another port, say the Port of Norfolk, for the PONYNJ for locally destined goods could be the extra truck miles required to transport that cargo from Port of Norfolk to its local destination. As ships are more energy efficient on a per TEU basis than trucks, the detrimental emissions and their health effects caused by carrying those TEU's through an alternative port and consequently producing a net increase in truck miles driven. These costs are very hard to quantify to a narrow confidence interval in a study of this scale. Nonetheless, the study team did provide sample calculations of the extra truck miles and costs that would be incurred if cargo destined for select locations was diverted to the Port of Norfolk because of the Bayonne Bridge air draft restriction. These calculations are included as *Appendix E, Port Cargo and Truck Diversion Analysis*.

C. OTHER BENEFICIARIES

While this report uses the general terms "Port of New York and New Jersey" or "PONYNJ" throughout, it should be made clear that the Port is comprised of multiple stakeholders including ocean carriers, terminal operators, labor interests, land-side transportation providers, and regional consumers. These parties will be impacted by any decision about or remedy for the Bayonne Bridge air draft obstruction. This study was commissioned by the PANYNJ in its role as public authority responsible for many of the facilities in the Port. The scope of that responsibility includes decision-making about the Bayonne Bridge; however, any remedy will have multiple stakeholder beneficiaries.

VI. NEXT STEPS

The Corps' Civil Works mission[71] does not take a direct role in bridge alteration except to the extent to which such alterations were an incrementally justified part of a channel deepening project. In case where allisions have occurred, the US Coast Guard has authority to take action through their Truman-Hobbs authority.[72] Nonetheless, the Coast Guard only has record of seven

[71] Deep-draft navigation is considered a Civil Works mission. The Corps might have a different role if the Bayonne Bridge was an obstruction to military-related navigation. This situation was explored and it was determined that the Bayonne Bridge at its current height is not an obstruction to military vessels that might deploy from the Port in the near future. More details may be found in *Appendix G, National Security Implications*.
[72] 33 U.S.C. 511 *et seq.*

such allisions, all of which were reported to produce relatively slight damage. The study team has been advised that it is unlikely that the Coast Guard would replace the Bayonne Bridge under its Truman-Hobbs authority. If the PANYNJ were to pursue replacement or modification of the Bridge, the Coast Guard would act as the lead Federal regulatory agency. Likely environmental considerations associated with alternatives beyond the no-build condition are catalogued in *Appendix F, Regulatory Considerations for Bridge Alteration.*

LIST OF APPENDICES -

Appendix A, Summary of Findings and Recommendations of the New York and New Jersey Harbor Navigation Study

Appendix B, Sensitivity and Alternative Scenario Analyses

Appendix C, Notes on Rail Transit as a Partial Substitute for All Water Routes

Appendix D, Vessel Simulations

Appendix E, Port Cargo and Truck Diversion Analysis

Appendix F, Regulatory Considerations for Bridge Alteration

Appendix G, National Security Implications

Appendix H, Acronyms

Summary of Findings and Recommendations of the New York and New Jersey Harbor Navigation Study

The Recommended Plan in the *Feasibility Report*, identified as the National Economic Development (NED) Plan, formed the basis of the *Report of the Chief of Engineers*,[1] and was authorized for construction by Congress as "Port of New York and New Jersey, New York and New Jersey" in §101(a)(2) of the WRDA of 2000.[2] It consisted of the following channel deepening, environmental compliance, and project implementation components:

- Construction of a 53 ft Mean Low Water (MLW) navigation channel to deepen the entire length of the existing Ambrose Channel;
- Construction of a 50 ft MLW (52 ft in rock or otherwise hard material) navigation channel to deepen portions of the existing Anchorage Channel, from the Narrows to 1000 feet past its juncture with the Port Jersey Channel;
- Construction of a 50 ft MLW (52 ft in rock or otherwise hard material) navigation channel to deepen the existing Port Jersey Channel, from its juncture with Anchorage Channel to the Global Terminal and Military Ocean Terminal-Bayonne (MOTBY) facilities;
- Construction of a 50 ft MLW (52 ft in rock or otherwise hard material) navigation channel to deepen the existing Kill Van Kull, from its juncture with Anchorage Channel to the Arthur Kill;
- Construction of a 50 foot MLW (52 ft in rock or otherwise hard material) navigation channel to deepen the existing Newark Bay Channel, from its juncture with the Kill Van Kull to the juncture with the Elizabeth Channel, and including deepening the existing Elizabeth, South Elizabeth, and Elizabeth Pierhead Channels to 50 ft MLW (52 ft in rock or otherwise hard material);
- Construction of a 50 ft MLW (52 ft in rock or otherwise hard material) navigation channel to deepen the existing Arthur Kill, from its juncture with the Kill Van Kull and Newark Bay to the southernmost berth at the Howland Hook marine terminal; and
- Construction of a 50 ft MLW (52 ft in rock or otherwise hard material) navigation channel to deepen the existing Bay Ridge Channel, from its juncture with Anchorage Channel to the South Brooklyn Marine Terminal, subject to commitment to rehabilitate the South Brooklyn Marine Terminal and transportation infrastructure needed to realize project benefits.
- Implementation of mitigation measures for unavoidable impacts, to include the restoration of 11 acres of intertidal wetlands, and construction of 7.6 acres of littoral habitat.

It was further recommended that the District be granted the authority to utilize innovative measures in its design, management, and execution, including alteration of the types of contracts entered into and the administration of those contracts, as necessary in order to expedite the construction of the project, and thereby maximize the value of the Federal investment.

[1] *Report of the Chief of Engineers on the New York and New Jersey Harbor Navigation Study*, May 2000.
[2] P.L. 106–541, 11 December 2000.

Sensitivity and Alternative Scenario Analyses

As with any estimate, there are multiple sources of uncertainty. For this reason, the study team decided to consider alternative scenarios. This appendix catalogues a number of alternative scenarios that attempts to quantify the extent to which they would affect the benefits of the project. The base case to compare all of these scenarios to is:

Alternative	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2033	3.0	10.7%	$ 3,270,679,702	$ 251,675,320	$ 168,880,864
new at 215	2022	2039	2.1	8.4%	$ 2,821,542,529	$ 280,235,090	$ 147,835,233
bored tunnel	2024	2042	1.9	7.7%	$ 2,585,424,669	$ 298,674,770	$ 149,875,612
immersed tunnel	2024	2051	1.4	6.1%	$ 1,517,453,940	$ 298,674,770	$ 94,731,166

Scenario 1 - Commerce forecast is too high or too low

To maintain consistency of method with the 1999 Study, the commerce forecast used by the Corps was generated by applying the out-year growth rates used in the HNS and calibrating them to the observed commerce coming through the Port. At the time of modeling, the most recent observation of annual TEU's passing through the PONYNJ was from 2008 (5,265,053). The ten-year average annual growth rate (AAGR) used in the 1999 HNS Study is applied to that number to become the 2010 base forecast, 5,538,626 TEU's, and for each year afterward, the AAGR from prior ten year span is applied.[1] The Study Team met with members of the Halcrow and Cambridge Systematics teams on 16 January 2009 to compare commerce forecasts. At that time, it was confirmed that the forecasts presented by the three parties tracked very closely with one another over the commerce period so there is little to be gained by repeating this sensitivity analysis using those forecasts as a basis.

Nonetheless, a forecast is solely a prediction based on assumptions, not the least of which is that the future will be like the past. The benefits calculations were performed again to determine what benefits to alteration of the Bayonne Bridge would be if the commerce forecast varied widely from its central tendency. This analysis found that if the commerce forecast fell by 30% below forecast (*i.e.,* each year had 30% fewer TEU's than predicted in the base case) starting in 2010, the only alternative that would not have a BCR greater than 1.0 would be the immersed tunnel. If the commerce forecast dropped by 50% starting in 2010, the jacking options would still have a BCR of greater than 1.0. Commerce would have to drop by 55% starting in 2010 for none of the alternatives to have a BCR greater than 1.0

A more likely circumstance would be that commerce grew faster than predicted starting in 2015 with the opening of the Panama Canal. In order to remain comparable with the method used in the 1999 HNS, the forecast model kept the same growth rates as were predicted in 1999, before the Panama Canal Expansion was considered. For that reason, the commerce forecast used here

[1] That forecast was based on the World Trade Model which is a large-scale macroeconomic econometric approach used for commerce forecasting for many harbor deepening studies Corps-wide.

did not consider an increase in commerce attributable to Far East imports being carried by all water routes to the USEC rather than by mini-land bridge from the USWC.

The tables below present the impact to the benefits calculations from increases in commerce coming to the PONYNJ on Far East routings as a result of the expansion of the Panama Canal. The level of increase is in the top left corner of the table. Comparisons should be made with the first table in this appendix.

10%	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2033	3.1	10.8%	$3,385,384,780	$257,598,093	$174,803,637
new at 215	2022	2039	2.1	8.6%	$2,948,679,416	$286,799,776	$154,399,920
bored tunnel	2024	2042	1.9	7.8%	$2,713,502,012	$305,648,799	$156,849,641
immersed tunnel	2024	2050	1.4	6.2%	$1,645,531,283	$305,648,799	$101,705,195

20%	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2032	3.2	11.0%	$3,500,089,857	$263,520,865	$180,726,409
new at 215	2022	2038	2.2	8.7%	$3,075,816,304	$293,364,463	$160,964,607
bored tunnel	2024	2042	2.0	7.9%	$2,841,579,355	$312,622,828	$163,823,670
immersed tunnel	2024	2049	1.4	6.3%	$1,773,608,626	$312,622,828	$108,679,224

30%	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2032	3.3	11.1%	$3,614,794,934	$269,443,638	$186,649,182
new at 215	2022	2038	2.2	8.6%	$3,202,953,191	$299,929,150	$167,529,293
bored tunnel	2024	2041	2.0	8.1%	$2,969,656,697	$319,596,857	$170,797,699
immersed tunnel	2024	2049	1.5	6.4%	$1,901,685,968	$319,596,857	$115,653,253

50%	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2032	3.4	11.4%	$3,844,205,089	$281,289,184	$198,494,727
new at 215	2022	2037	2.3	9.1%	$3,457,226,966	$313,058,523	$180,658,667
bored tunnel	2024	2041	2.1	8.3%	$3,225,811,383	$333,544,915	$184,745,756
immersed tunnel	2024	2047	1.5	6.6%	$2,157,840,654	$333,544,915	$129,601,311

Scenario 2 - Manufacturing continues to migrate from the Far East to the Southeast and South Asia

The base case of this document is predicated on the assumption that the process of an eastward movement of containers from the USWC will remain competitive with all-water routes upon completion of the Panama Canal expansion. Migration of manufacturing from the Far East to Southeast and South Asia would have the likely result of shifting cargo from Panama to Suez routes since the USEC is closer to those origins via the Suez. The result of such a migration would be that the effect of the expansion of the Panama would have little effect on the volume of commerce coming from the Far East to the USEC - as assumed in the base case. For that reason, the base case could be considered to implicitly encompass this scenario. That said, *Appendix C - Notes on Rail Transit as a Partial Substitute for All Water Routes*, presents some likelihood that, in fact, there will be some "bump" attributable to a switch from mini-land bridge to all-water routes from the Far East. The effect of that, even with some manufacturing shift to Southeast and South Asia presents a situation like what would occur with one of the smaller bumps in cargo coming directly to the PONYNJ on Far East routings, presented at the end of *Scenario 1*, above.

Scenario 3 - Project cost estimates are too low or too high

Costs for each of these options were provided by the Port Authority's Tunnels, Bridges, and Terminals Department (TB&T). Presented below is the effect on benefits if those estimates are low or high.

Alternative	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit
jack to 215	**2019**	**2033**	**3.0**	**10.7%**	**$ 3,270,679,702**
cost -20%		2031	3.8	12.2%	$ 3,591,372,219
cost -10%		2032	3.4	11.4%	$ 3,431,025,961
cost +10%		2034	2.8	10.0%	$ 3,110,333,443
cost +20%		2035	2.5	9.5%	$ 2,949,987,185
new at 215	**2022**	**2039**	**2.1**	**8.4%**	**$ 2,821,542,529**
cost -20%		2036	2.6	9.8%	$ 3,342,684,677
cost -10%		2038	2.3	9.1%	$ 3,082,113,603
cost +10%		2041	1.9	7.9%	$ 2,560,971,455
cost +20%		2042	1.7	7.4%	$ 2,300,400,381
bored tunnel	**2024**	**2042**	**1.9**	**7.7%**	**$ 2,585,424,669**
cost -20%		2039	2.4	8.9%	$ 3,161,776,987
cost -10%		2041	2.1	8.3%	$ 2,873,600,828
cost +10%		2044	1.7	7.2%	$ 2,297,248,510
cost +20%		2046	1.6	6.8%	$ 2,009,072,351
immersed tunnel	**2024**	**2051**	**1.4**	**6.1%**	**$ 1,517,453,940**
cost -20%		2045	1.7	7.2%	$ 2,307,400,404
cost -10%		2047	1.5	6.6%	$ 1,912,427,172
cost +10%		2055	1.3	5.6%	$ 1,122,480,708
cost +20%		2060	1.2	5.3%	$ 727,507,476

Scenario 4 - Jacking and new bridge options occurred at different heights

The initial analysis included jacking and new bridge options at 185' and 200'. In those scenarios, some of the largest ships that might otherwise call terminals in Newark Bay continued to be limited by air draft. The benefits for all cases, including the lower heights of the new spans:

Alternative	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit
jack to 185	2019	2042	1.5	6.8%	$ 721,013,143
jack to 200	2019	2038	2.0	8.2%	$ 1,446,703,944
jack to 215	2019	2033	3.0	10.7%	$ 3,270,679,702
new at 185	2022	2072+	1.0	4.5%	$ (47,548,670)
new at 200	2022	2050	1.3	6.0%	$ 789,086,243
new at 215	2022	2039	2.1	8.4%	$ 2,821,542,529
bored tunnel	2024	2042	1.9	7.7%	$ 2,585,424,669
immersed tunnel	2024	2051	1.4	6.1%	$ 1,517,453,940

Scenario 5 - The NYK Nebula Effect

The *NYK Nebula* (4,886 TEUs) incident of 8 March 2009 presented a situation in which a ship that would have been able to call at a facility west of the Bayonne Bridge under most loading conditions was air draft limited because it was light-loaded on that particular call and riding higher in the water than usual. While the base case for benefits presented above and throughout the document assumes that benefits generated by remedy of the Bayonne Bridge air draft restriction is limited to ships 7000 TEU's or greater, the study team used empirical loading pattern information to estimate additional benefits that might be attributable to removal of the obstruction for ships smaller than 7000 TEU's.

Consistently limited vessels <7000 TEU's	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2032	3.3	11.3%	$ 3,739,951,589	$ 275,906,076	$ 193,111,620
new at 215	2022	2038	2.3	9.0%	$ 3,333,606,409	$ 306,675,401	$ 174,275,545
bored tunnel	2024	2041	2.1	8.2%	$ 3,101,922,586	$ 326,477,023	$ 177,677,864
immersed tunnel	2024	2048	1.5	6.5%	$ 2,033,951,857	$ 326,477,023	$ 122,533,418

If there was no tide-riding	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2031	3.6	11.9%	$ 4,155,281,647	$ 297,351,557	$ 214,557,101
new at 215	2022	2037	2.5	9.5%	$ 3,786,486,298	$ 330,059,760	$ 197,659,904
bored tunnel	2024	2040	2.2	8.6%	$ 3,558,773,857	$ 351,047,923	$ 202,248,765
immersed tunnel	2024	2046	1.6	6.9%	$ 2,490,803,128	$ 351,047,923	$ 147,104,319

If 2 foot over - mast clearance was required	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2031	3.7	12.1%	$ 4,305,296,965	$ 305,097,566	$ 222,303,110
new at 215	2022	2036	2.5	9.7%	$ 3,950,121,787	$ 338,509,044	$ 206,109,188
bored tunnel	2024	2039	2.3	8.8%	$ 3,723,857,198	$ 359,926,727	$ 211,127,568
immersed tunnel	2024	2045	1.7	7.0%	$ 2,655,886,469	$ 359,926,727	$ 155,983,122

Scenario 6 - The discount rate changes

The benefits calculations developed throughout the course of the study incorporated a discount rate that is provided to the Corps in annual guidance in accordance with 42 U.S.C. 1962d-17. This rate is obtained by the Corps from the U.S. Treasury and is composed of the average yield on interest-bearing marketable securities of the United States having 15 or more years to maturity. This discount rate allows benefits and costs of projects being evaluated against each other to be compared on a common time basis.

The discount rate used for the calculations presented in this report was $4^{5/8}$ %, which was the discount rate for Federal water resource projects in FY 2009, the study period. Because this is not currently considered to be constructible as a Corps project, it may not be the case that the various project alternatives would be evaluated using this discount rate but rather a rate that is higher or lower reflecting the cost of capital at the time the investment decision is made. Presented below are benefit-cost ratio summaries calculated at different discount rates.

Discount rate 3%	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2031	4.4	10.7%	$ 5,380,498,813	$ 270,008,157	$ 187,213,701
new at 215	2022	2037	3.0	8.4%	$ 5,068,309,034	$ 294,649,998	$ 162,250,142
bored tunnel	2024	2039	2.8	7.7%	$ 4,890,299,853	$ 310,231,607	$ 161,432,449
immersed tunnel	2024	2044	2.1	6.1%	$ 3,915,499,038	$ 310,231,607	$ 106,288,003

Discount rate 4%	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2032	3.5	10.7%	$ 3,968,763,163	$ 258,617,490	$ 175,823,034
new at 215	2022	2038	2.4	8.4%	$ 3,571,604,997	$ 285,726,153	$ 153,326,297
bored tunnel	2024	2041	2.2	7.7%	$ 3,360,193,360	$ 303,093,378	$ 154,294,219
immersed tunnel	2024	2048	1.6	6.1%	$ 2,327,734,709	$ 303,093,378	$ 99,149,774

Discount rate 5%	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2033	2.8	10.7%	$ 2,905,609,910	$ 247,600,456	$ 164,806,000
new at 215	2022	2040	1.9	8.4%	$ 2,425,672,196	$ 276,993,139	$ 144,593,283
bored tunnel	2024	2043	1.7	7.7%	$ 2,173,496,676	$ 296,056,517	$ 147,257,359
immersed tunnel	2024	2054	1.3	6.1%	$ 1,084,239,656	$ 296,056,517	$ 92,112,913

Discount rate 6%	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2035	2.3	10.7%	$ 2,090,033,102	$ 237,136,818	$ 154,342,362
new at 215	2022	2042	1.6	8.4%	$ 1,529,227,918	$ 268,602,645	$ 136,202,788
bored tunnel	2024	2047	1.4	7.7%	$ 1,230,120,099	$ 289,246,989	$ 140,447,831
immersed tunnel	2024	2070	1.0	6.1%	$ 83,711,055	$ 289,246,989	$ 85,303,385

Discount rate 7%	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2036	1.9	10.7%	$ 1,452,620,921	$ 227,346,589	$ 144,552,133
new at 215	2022	2047	1.3	8.4%	$ 812,488,199	$260,663,191	$ 128,263,334
bored tunnel	2024	2055	1.1	7.7%	$ 460,892,839	$ 282,758,295	$ 133,959,137
immersed tunnel	2024	2074+	0.8	6.1%	$ (743,841,388)	$ 282,758,295	$ 78,814,691

Discount rate 8%	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2038	1.5	10.7%	$ 945,089,241	$ 218,296,008	$ 135,501,552
new at 215	2022	2057	1.1	8.4%	$ 226,757,053	$ 253,242,799	$ 120,842,942
bored tunnel	2024	2074+	0.9	7.7%	$ (182,620,946)	$ 276,652,617	$ 127,853,459
immersed tunnel	2024	2074+	0.7	6.1%	$ (1,447,430,580)	$ 276,652,617	$ 72,709,013

Discount rate 9%	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2042	1.3	10.7%	$ 533,436,127	$ 210,007,729	$ 127,213,273
new at 215	2022	2072+	0.9	8.4%	$ (262,388,027)	$ 246,375,360	$ 113,975,504
bored tunnel	2024	2074+	0.8	7.7%	$ (734,802,228)	$ 270,965,097	$ 122,165,938
immersed tunnel	2024	2074+	0.6	6.1%	$ (2,061,864,580)	$ 270,965,097	$ 67,021,492

Scenario 7 - Delay in start of detailed design and construction

The report assumes that detailed design and construction begins in 2010. The durations of these phases were provided by the PANYNJ's TB&T department. As with any construction effort, especially one requiring extensive environmental review, there is always threat of delay. For this reason, the study team considered the time by which the specific action had to begin detailed design and construction to maximize net benefits of that action. The results are presented below. The optimal year to begin is highlighted.

	jacking	new	bored tunnel	immersed tunnel
year	NET BENEFITS	NET BENEFITS	NET BENEFITS	NET BENEFITS
2010	$ 2,177,302,527	$ 1,640,064,577	$ 1,541,316,930	$ 974,212,871
2011	$ 2,198,348,718	$ 1,664,980,891	$ 1,562,880,977	$ 1,020,846,035

2012	$ 2,213,386,437	$ 1,687,902,931	$ 1,576,487,843	$ 1,058,413,823
2013	$ 2,222,636,584	$ 1,702,987,072	$ 1,582,315,669	$ 1,087,143,368
2014	$ 2,221,800,013	$ 1,710,400,478	$ 1,580,538,215	$ 1,107,255,252
2015	$ 2,220,107,588	$ 1,710,308,629	$ 1,571,327,105	$ 1,118,965,849
2016	$ 2,211,665,358	$ 1,702,873,184	$ 1,557,304,820	$ 1,124,940,418
2017	$ 2,196,592,388	$ 1,688,254,195	$ 1,539,171,310	$ 1,125,919,791
2018	$ 2,175,008,185	$ 1,669,063,090	$ 1,517,126,597	$ 1,122,143,066

Scenario 8 - Container handling capacity is increased in areas of the PONYNJ that do not require transit beneath the Bayonne Bridge

The following analysis puts aside the practicalities of actually finding places where a container handling facility could be located east of the Bayonne Bridge within the PONYNJ to estimate what size increment of added capacity would have to be added for specific air draft increasing alternatives not to be justified on an NED basis. In this analysis, capacity increments were added east of the Bridge in 100 acre increments. The analysis shows that there would need to be 400 acres of terminal capacity with 6000 lifts/year added east of the Bridge for the most expensive alternative, the immersed tunnel, to have a BCR of 1.0. Results are presented, below:

ADD 100 acres	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2034	2.8	10.1%	$ 2,886,106,703	$ 231,817,973	$149,023,517
new at 215	2022	2040	1.9	8.0%	$ 2,393,328,713	$ 258,124,359	$125,724,502
bored tunnel	2024	2044	1.7	7.3%	$ 2,154,060,114	$ 275,109,136	$126,309,978
immersed tunnel	2024	2054	1.3	5.7%	$ 1,086,089,385	$ 275,109,136	$ 71,165,532

ADD 200 acres	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2035	2.6	9.6%	$ 2,557,781,811	$ 214,864,986	$132,070,530
new at 215	2022	2042	1.8	7.5%	$ 2,027,745,963	$ 239,247,570	$106,847,713
bored tunnel	2024	2046	1.6	6.9%	$ 1,785,787,456	$ 254,990,240	$106,191,082
immersed tunnel	2024	2058	1.2	5.4%	$ 717,816,727	$ 254,990,240	$ 51,046,636

ADD 300 acres	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2036	2.4	9.2%	$ 2,274,205,613	$200,222,588	$117,428,132
new at 215	2022	2043	1.7	7.1%	$ 1,711,989,927	$ 222,943,573	$90,543,716
bored tunnel	2024	2048	1.5	6.5%	$ 1,467,708,130	$237,613,428	$88,814,270
immersed tunnel	2024	2063	1.1	5.0%	$ 399,737,401	$ 237,613,428	$33,669,824

ADD 400 acres	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2037	2.3	8.8%	$ 2,026,813,309	$187,448,538	$104,654,082
new at 215	2022	2045	1.6	6.8%	$ 1,436,523,884	$ 208,719,941	$ 76,320,085
bored tunnel	2024	2050	1.4	6.2%	$ 1,190,215,245	$222,453,871	$ 73,654,712
immersed tunnel	2024	2070	1.0	4.8%	$ 122,244,516	$222,453,871	$18,510,267

Scenario 9 - The fleet does not come on line as predicted

During the study period, there were many reports of ship orders being cancelled or delivery postponed. Sensitivity analysis was performed on the benefits calculations to account for the potential results of these cancellations. They are presented below.

If half of the ships on order in July 2008 were altogether cancelled, the benefits would be:

Alternative	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2037	2.3	8.8%	$ 2,020,104,506	$ 187,102,131	$ 104,307,675
new at 215	2022	2045	1.6	6.8%	$ 1,438,690,188	$ 208,831,798	$ 76,431,941
bored tunnel	2024	2050	1.4	6.2%	$ 1,194,181,663	$ 222,909,682	$ 74,110,524
immersed tunnel	2024	2070	1.0	4.8%	$ 126,210,934	$ 222,909,682	$ 18,966,078

If there was a 24 month interruption in deliveries, the benefits would be:

Alternative	Year Improvement in Place	Break Even Year	BCR	IRR	Total Net Benefit	Average Annual Benefits	Average Annual Net Benefits
jack to 215	2019	2033	2.9	10.5%	$ 3,048,922,371	$ 240,224,926	$ 157,430,470
new at 215	2022	2039	2.0	8.2%	$ 2,543,066,818	$ 265,856,055	$ 133,456,198
bored tunnel	2024	2043	1.8	7.5%	$ 2,296,578,330	$ 281,960,464	$ 133,161,306
immersed tunnel	2024	2053	1.3	5.9%	$ 1,228,607,601	$ 281,960,464	$ 78,016,860

Notes on Rail Transit as a Partial Substitute for All Water Routes

The Bayonne Bridge Air Draft Study uses as its base case the assumption that rail is not a constraint for the Port of New York and New Jersey. While it is clear from interviews with players within the intermodal industry that this is the case, it also became evident over the course of the study process that, in fact, market share for rail from the west coast of the United States (USWC) is likely to decrease over the analysis period because of likely transfers of goods from mini-land bridge[1] from the USWC to all-water services.[2] There are multiple reasons for this, specifically -

1. The expansion of the Panama Canal will make it less expensive for ships to use all -water routing from Far East manufacturing centers to the USEC.[3] This enlargement will allow carriers to utilize larger ships on Far East - USEC voyages.

2. Demographic changes within the economic hinterland of New York and New Jersey defined as the 17-County Metropolitan Area, the markets within a 260-mile radius of the Port, and a 17-state region have served to make the New York metropolitan area more of a consumer population base than it was in the original 1999 analysis as a result of population growth attributable to migrants coming from outside of the 1999 delineations of the Port's economic hinterland.[4]

---

[1] This is known as *mini-land bridge* which is an intermodal movement in which the shipment is moved from a foreign country to the U.S. by water and then moved across the U.S. by railroad to a destination that is a port city, or vice versa for exports from a U.S. port city. *Land bridge* refers to the movement of containers by ship-rail-ship on Japan-to-Europe moves. In these cases, ships move containers to from the Far East to USWC ports, rails move containers to an east coast port where those containers are loaded onto another ship which deliver them to Europe. *Micro-land bridge* refers to an intermodal movement in which the shipment is moved from a foreign country to the U.S. by water and then moved across the U.S. by railroad to an interior, non-port city, or vice versa for exports from a non-port city.

[2] Indeed, market share for rail from the USEC may increase as some goods may arrive at USEC ports by water then move closer to their inland destinations by westbound micro-land bridge.

[3] The economies of scale captured by using larger ships will decrease transportation costs of all-water routes. The Panama Canal Authority will charge the profit maximizing rent for use of this resource, which may, in fact be close to what the rail carriers charge or it could be significantly less, in which case rail carriers would have to keep the price of service between the USWC and eastern destinations such that the change in mode and extra lifts required to move from ship to rail remain favorable in light of the decreased cost of trans-Panama movements.

[4] The 31-County metropolitan area was one of the delineations of catchment area used in the 1999 Study. At that time, it was determined that approximately 70% of containerized cargo moving through the Port was destined for or originated in the 31-County metropolitan area. This area consists of 31 counties, includes 14 counties in southern New York State (five in New York City, two in Long Island, and seven in the Mid-Hudson region); 14 counties in northern New Jersey; and three counties in southwestern Connecticut. This was the most narrow of the four definitions of PONYNJ hinterland used in that document. The HNS also considered the 260-mile radius from the Port used by the New York Shipping Association (for purposes of its “Unit Assessment” charged to containerized cargo) from which approximately 82% of the containerized cargo that moved through the Port was destined for or originated at the time of that writing and the 17-state region extending from New York to Missouri and Maryland to Maine that could be serviced by the Port of New York for less cost and within a reasonable time disadvantage than from the Ports of Los Angeles and Long Beach. The 17 states are New York, New Jersey, Massachusetts, Rhode Island, New Hampshire, Vermont, Connecticut, Maine, Pennsylvania, Delaware, Maryland, Ohio, Michigan, Indiana, Illinois, Iowa, and Missouri. While referred to solely as the "17 states" as a demarcation, Washington, D.C. is generally included in this calculation. This differs slightly from the 17 state definition used by the Port Authority in other materials in which it adds Virginia, but excludes Iowa and Missouri and considers Washington, D.C. a

3. The availability of on- or near-dock rail facilities will affect the PONYNJ in two ways. The most obvious is the recognition by the shipping community that PANYNJ's $600 million investment in rail infrastructure is in fact facilitating the movement of containers out of the PONYNJ by rail. This $600 million program rail will produce 1.1 M in lift capacity port-wide by 2010 and will grow to 1.4 M lifts by 2013 (including a new Global ICTF and expanded PNCT rail facility). There should also be an additional +300K lift capacity, port-wide, by 2030 with the final expansion of the Corbin Street Yard and full build out of ExpressRail Staten Island. Of less obvious benefit, but of particular importance, is the fact that the Ports of Los Angeles (LA) and Long Beach (LB) are limiting land-side expansion in response to community complaints and environmental issues. Permitting for facility expansion at the Ports of LA and LB is arduous and slow and is anecdotally reported to have essentially stopped. Limited on-dock and near-dock capacity adds to the cost of moving goods through the USWC. Added on-dock near-dock capacity at the PONYNJ should make it more attractive to move some of the goods through the PONYNJ that might otherwise have traveled by land bridge from the USWC. Indeed, in some situations cargo that presently comes to, say St. Louis via LA/LB might come via the Panama Canal and the PONYNJ via rail once the Canal is expanded.

4. The two rail carriers serving the Ports of LA/LB are currently undertaking major line haul improvements;[5] however, line haul capacity is likely to be a problem in the Pacific Northwest. Since many of the goods destined for the New York market come by rail via the Ports of Seattle and Tacoma, limitations in line haul capacity from the Pacific Northwest are likely to make the movement of some goods through the PONYNJ more attractive.

5. At-grade rail crossings in Chicago present a large problem for the land bridge system. Currently, rail hubs in Chicago are tied up by the existence of at-grade rail crossings, which ensnare both rail and road traffic. While rail is generally favored at these junctions, trains still have to move at very slow speeds and at some points are forced to stop for switching.[6] The railroads are waiting for improvements to the highway system, which are to be publicly funded but which may be slow to occur even in spite of the recent infusion of American Recovery and Reinvestment Act funding. Chicago rail traffic affects both goods coming from the east and goods coming from the west, but because the land bridge transit is more highly utilized coming from west to east, the Chicago tie-up may make all water routes through the Port of New York and New Jersey to inland destinations more attractive to shippers.

6. While reported to be a major problem by mainstream media, it is empirically unclear what effect the increase in the volume of coal moved by rail is having on the movement of containers by rail. In the United States, the vast majority of coal moves from Wyoming to power plants in the Midwest. Since 2000, there has been $2-3 billion invested in track in Nebraska, Iowa, and

---

"state." The remaining 31 of the lower 48 states were considered secondary economic hinterlands for which the Port of New York and New Jersey has a minor share of international trade but over which it actively competes with other ports for market share.

[5] The Burlington Northern Santa Fe (BNSF) is increasing capacity from 70-80 to 100 trains per day (each train has approximately 250 cars). The Union Pacific (UP) will be adding 50 trains to their main line per day in 2010 and 2011.

[6] "Freight Train Network Suffers Lack of Modernization." PBS NewsHour, 21 April 2009.

Illinois for added line capacity for coal. Still, coal and containers are in direct competition for engines. While rail engines have a short lead time from the point when they are ordered to the time they come on-line and this potential shortage of trains is likely to be overcome in the long term, demand from the coal industry may help to drive up the price of movement by rail.

In spite of these factors that seem theoretically likely to shift the mode balance of TEU carriage from mini-land bridge rail to ship on Far East-USEC routes, this report assumes that the USWC-USEC land bridge remains an integral part of the domestic transportation network. This is done purposefully so as to retain a bias, if any might exist, against project justification throughout the benefits calculations. The sensitivity analysis presented with this document considers the effects of more containers arriving at the Port of New York from Asia by all water services.

Summary of Vessel Simulations

The full report on the navigational simulations was not available at the time of publication of this report but will be available from the Army Corps at a later date.

Port Cargo and Truck Diversion Analysis

Over long distances, the cost of moving goods by ship is less expensive than moving those goods by rail, which is less expensive than moving those goods by truck, or, generally:

$$C_{\text{movement by ship}} < C_{\text{movement by rail}} < C_{\text{movement by truck}}$$

This assumes, of course, that all three modes - ship, truck, and rail - are available to the shipper for getting a good from its origin to its destination. In reality, there are practical limitations imposed by geography to this inequality. For example, where there is no water, a good cannot be moved by ship and where there are no rail lines, a good could not be moved via rail. On the USEC, because of the limitations of the rail system and the fact that the distance from USEC ports to warehouses or intermediate destinations is not far enough to warrant the extra handling associated with the rail system, the most likely substitute for ship movement is movement by truck.[1]

This analysis quantifies the effects of substitution of ship for truck routing into and out of the PONYNJ hinterland in three discrete ways.

1. It calculates the demarcation between the destinations at which the shipper would prefer to ship through the PONYNJ as against through the Port of Norfolk (ORF), the most likely competitor Port under specific conditions. It also shows the line of destinations where the shipper would be indifferent between the PONYNJ and ORF.
2. It calculates the extra truck miles and the costs of those extra truck miles that would occur on a per FEU[2] basis for containers headed to specific destinations.

The HNS used different hinterlands for different analytical purposes as appropriate to the questions to be answered by that effort. Because the data being analyzed for the purposes of this appendix is based on mileage, this appendix uses three distances in its analysis. The first is the 260-mile radius from the Port used by the New York Shipping Association from which approximately 80 to 82% of the containerized cargo that moved through the Port was destined for or originated from at the time of that writing. The 260-mile catchment area is based on the observation that for a rail transfer to be a cost effective mode shift (*i.e.*, considering the extra lift required going from ship to rail to truck v. ship to truck), the distance covered by the less expensive per mile mode must be sufficiently long for the extra handling expense to be covered.[3] This is also the distance at which the International Longshoremen's Association assessment on loaded containers changes. Within 260 miles of the Port, the ILA assessment on a container moved by truck is $110; after 260 miles, the assessment is $21 per container. For all rail moves,

[1] Over some longer distances, a barge may be an appropriate substitute; however, those cases are very limited.
[2] While generally waterborne containers are discussed in terms of TEU's, trucking is based on the FEU basis. For this reason, this section uses FEU's as its base of calculation.
[3] If the extra handling is treated as a fixed cost, then $\frac{FC}{(P - AVC)} = 260$, where FC is the fixed cost for extra handling and P is the per ton-mile charge by rail.

the assessment is $10/container. It also considers an intermediate distance of 400 miles. At distances greater than 400 miles, freight is often carried by rail. The 400-mile radius is the point at which rail becomes cost competitive with truck from the PONYNJ. The gap between the 260 and 400-mile radii makes up the bulk of the PONYNJ's discretionary market. The third zone of analysis is the 17-state region extending from New York to Missouri and Maryland to Maine that could be served by the Port of New York for less cost and within a reasonable time disadvantage than from the Ports of Los Angeles and Long Beach.[4]

Truck mileage for the journeys considered in this Appendix are generated using PC Miler software. PC Miler is trucking industry mapping software that generates point-to-point routes for truck trips. In these calculations, PC Miler used distances and driving routes that a driver would normally take to minimize time and cost. The model addresses the tradeoff between taking the most direct path and staying on major, high quality highways by giving interstate highways a higher priority than toll roads, which, in turn, are given a higher priority than secondary highways.

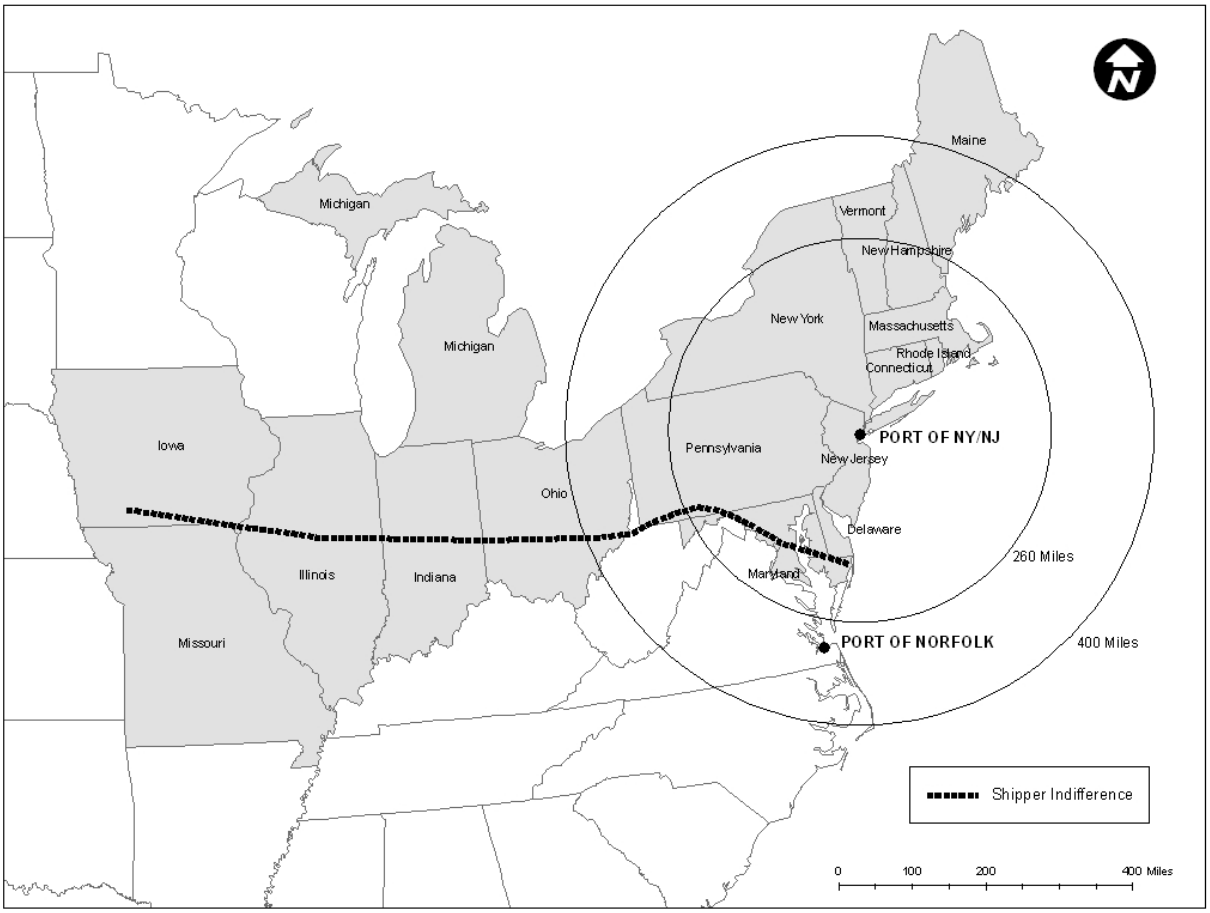
1. In this calculation, a container of 2 TEU's or 1 FEU has to go from Busan to somewhere in the mid-Atlantic. Because the PONYNJ is air draft limited, the largest ship that can call can carry 6,500 TEU's. In this case, we assume the average ship calling Norfolk (ORF) is 10,000 TEU's. According to carrier schedules, the difference in travel time on the water between Busan and ORF and versus Busan and PONYNJ and ORF is one day at sea and one day in port. From the vessel operating costs extrapolated from IWR data and used in the base report, the per TEU cost on a 10,000 TEU vessel is $279.17 while the per TEU cost on a 7,000 TEU vessel is $305.85. This difference, $26.65, is multiplied by 2 to get per FEU cost = $53.30 per FEU. The calculation assumes that the fees are similar leaving each facility, and that the customer does not care about when the container is delivered, provided that it is within a certain relatively low number of days.

While the shipper saves $53.30 on that FEU from Busan just going to the dock by going through Norfolk, the container needs to get from the Port to its destination. If the container has to go by truck to its destination, and trucking costs $1.73/mile,[5] that $53.30 saved by having the container dropped in ORF is lost to added trucking expense incurred if the distance from the Port of ORF to destination is more than 30.8 miles further from Norfolk than it is from the PONYNJ. The shipper will prefer to have the container moved through the PONYNJ in cases in which the distance from ORF is greater than 30.8 miles than it is from the PONJNJ. The shipper is indifferent in cases when [distance_{orf}* rate] -$53.30 = distance_{PONYNJ}*rate, provided that all other expenses are the same.

[4] The 17 states are New York, New Jersey, Massachusetts, Rhode Island, New Hampshire, Vermont, Connecticut, Maine, Pennsylvania, Delaware, Maryland, Ohio, Michigan, Indiana, Illinois, Iowa, and Missouri. While referred to solely as the "17 states" as a demarcation, Washington, D.C. is generally included in this calculation. This differs slightly from the 17 state definition used by the Port Authority in other materials in which it adds Virginia, but excludes Iowa and Missouri and considers Washington, D.C. a "state."

[5] American Transportation Research Institute, December 2008. The costs included in this are fuel-oil, lease or purchase payments, repair and maintenance, fuel taxes, truck insurance premiums, tires, licensing and overweight-oversize permits, tolls, driver pay, driver benefits, and driver bonus payments.

The figure below shows the Eastern United States and the line at which the shipper is indifferent to whether his goods are shipped through the PONYNJ and ORF. At points on this line, the transportation cost from BUSAN (ship plus truck) of shipping through PONYNJ and ORF were the same, given the conditions presented above. North of the line, it will cost less to go through the PONYNJ. South of the line, it will cost less to ship through ORF. The line is not straight because routes are not "as the crow flies" but rather must follow established freight roads. For example, there are places in southwestern Pennsylvania (Blue Ridge Summit), which are closer to ORF than to the PONYNJ. Similarly, Dover Air Force Base in Delaware is only 31.8 miles closer to the PONYNJ than it is to ORF, by roadway.



2. The table below shows that the added truck cost of moving those TEU's through another facility, assuming that the cost to transit the facility is the same in both cases, is high enough that it easily overcomes any cost savings relating to economies of scale from larger vessels that might be able to call a competing port. To the extent cargo is destined for points above the indifference line, there is not likely to be a significantly large diversion to Norfolk or other facilities.

	Road Miles From				
	PONYNJ	ORF	Extra truck miles from ORF	Additional truck cost from ORF	Additional transportation cost per FEU from ORF
Newark, NJ	6.10[6]	348.6	342.5	$593.53	$540.23
Cranbury, NJ	34.5	314.3	279.8	$484.05	$430.75
Dover, DE	155.1	189.6	34.5	$59.69	$6.35
Boston, MA	230.5	579.9	349.4	$604.5	$551.16
Pittsburgh, PA	361.8	428.1	66.3	$114.70	$61.40
Columbus, OH	526.5	567.0	40.5	$70.07	$16.77

[6] This figure is from the PONYNJ to zip code 07102.

Regulatory Considerations for Bridge Alteration

Regulatory considerations that may apply to Bayonne Bridge alteration and construction of the potential alternatives include, but are not limited to the following:

National Environmental Policy Act of 1969, *P.L. 91-190 and 42 U.S.C. §4321 et seq.* - The National Environmental Policy Act, commonly referred to as NEPA, requires the Federal Government to undertake an assessment of effects of proposed actions prior to making decisions. Federal involvement in Bayonne Bridge alteration and construction of any of the proposed alternative will require NEPA documentation that evaluates the environmental, social, economic impacts of reasonable alternative actions. More information on NEPA may be found at www.nepa.gov .

Coastal Zone Management Act, *P. L. 92-583, 16 U.S.C. 1451-1456* -
The Coastal Zone Management Act, CZMA, is administered by the National Oceanic and Atmospheric Administration's Office of Ocean and Coastal Resource Management. The objectives of CZMA are to manage the Nation's coastal resources by balancing economic development with environmental conservation in the coastal zone. Bayonne Bridge alteration and construction of any of the proposed alternatives will need to be assessed for coastal zone impacts. More information on the CZMA is found at http://coastalmanagement.noaa.gov/czm/czm_act.html

Clean Air Act, *P.L. 101-549, 42 U.S.C. 85* -
The Clean Air Act is the law that defines EPA's responsibilities for protecting and improving the Nation's air quality and the stratospheric ozone layer. Impacts to air quality that may result from Bayonne Bridge alteration or construction of any of the proposed alternatives will require examination under the Clean Air Act. More information on the Clean Air Act may be found at http://www.epa.gov/air/caa/ .

Clean Water Act*, P.L. 92-500, 33 U.S.C. 1251-1387* -
The Clean Water Act employs a variety of regulatory and non-regulatory tools to sharply reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water." Any action relating to alteration or construction of a proposed alternative for the Bayonne Bridge may be subject to evaluation for Clean Water Act compliance. More information on the Clean Water Act may be found at http://www.epa.gov/watertrain/cwa/

National Historic Preservation Act of 1966, *as amended, P.L. 89-665; 16 U.S.C. 470 et seq.* -
The National Historic Preservation Act, NHPA, establishes preservation as a national policy and directs the Federal government to provide leadership in preserving, restoring and maintaining the historic and cultural environment of the Nation. Preservation is defined as the protection, rehabilitation, restoration, and reconstruction of districts, sites,

buildings, structures, and objects significant in American history, architecture, archeology, or engineering. Section 106 of the NHPA requires a Federal Agency to take into account the effect of any undertaking on any district, site, building, structure or object that is included in or eligible for inclusion in the National Register of Historic Places. 36 CFR Part 800: Protection of Historic Properties, are the regulations governing the Section 106 Review Process, including the coordination between a Federal Agency, the appropriate State Historic Preservation Office and the Advisory Council of Historic Places, when necessary. Alteration of the Bayonne Bridge will require NHPA review. More information is found at http://www.nps.gov/archeology/tools/laws/NHPA.htm .

Executive Order 11593, *Protection and Enhancement of the Cultural Environment* -
This Executive Order (E.O.) requires Federal agencies to administer cultural properties under their control and direct their policies, plans, and programs in such a way that federally owned sites, structures, and objects of historical, architectural, or archeological significance were preserved, restored, and maintained. Moreover, the E.O. directed agencies to reconsider any plans to transfer, sell, demolish, or substantially alter any property determined to be eligible for the National Register and to afford the Council an opportunity to comment on any such proposal. Finally, the E.O. required agencies to record any listed property that may be substantially altered or demolished as a result of Federal action or assistance and to take necessary measures to provide for maintenance of and future planning for historic properties. Federal elements of modification of the existing Bayonne Bridge will require compliance with E.O. 11593. More information may be found at http://www.achp.gov/book/sectionVI.html .

Fish and Wildlife Coordination Act, *P.L. 85-624; 16 U.S.C. 661 et seq.* -
The Act of March 10, 1934 as amended, authorizes the Secretaries of Agriculture and Commerce to provide assistance to and cooperate with Federal and State agencies to protect, rear, stock, and increase the supply of game and fur-bearing animals, as well as to study the effects of domestic sewage, trade wastes, and other polluting substances on wildlife. Under the Act, Federal agencies involved in water resource are to consult with the U.S. Fish and Wildlife Service and with the agency exercising administration over wildlife resources of the particular state wherein the proposed project is to be constructed or action taken. Action regarding the major alteration of the existing structure or construction of a proposed alternative may require this coordination. More information may be found at http://www.fws.gov/laws/lawsdigest/fwcoord.html .

Endangered Species Act, *P.L. 93-205; 16 U.S.C. 1531 et seq.* -
The purposes of the Endangered Species Act, ESA, are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved and to provide a program for the conservation of such endangered species and threatened species and establishes a policy that all Federal departments and agencies seek to conserve endangered species and threatened species and utilize their authorities in furtherance of the purposes of the Act. Federal involvement in Bayonne Bridge alteration and construction of any of the proposed alternative will require ESA compliance. More information on the ESA may be found at
http://www.fws.gov/laws/lawsdigest/ESACT.html .

Executive Order 11990, *Protection of Wetlands; 42 F.R. 26961* -
Executive Order 11990 requires Federal agencies, in planning their actions, to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided. Federal elements of modification of the existing Bayonne Bridge will require compliance with Executive Order 11990. More information on wetlands protection may be found at http://www.epa.gov/wetlands/regs/eo11990.html .

Estuary Protection Act, *P.L. 90-454; 16 U.S.C. 1221 et seq.* -
This Act authorizes the Secretary of Interior, in cooperation with the States, Secretary of the Army and other Federal agencies, to conduct an inventory and study of the Nation's estuaries, to facilitate estuary protection, conservation and restoration in a manner that maintains the balance between conserving the natural resources and natural beauty of the Nation and the need to develop these estuaries for further growth and development of the Nation. The Act requires Federal agencies, in planning for the use or development of water and related land resources, to give consideration to estuaries and their natural resources. All plans and projects submitted to Congress shall include a discussion by the Secretary of Interior of such estuaries and resources, and the potential impact of the proposed project on them, as well as his recommendations thereon. Bayonne Bridge alteration and construction of proposed alternatives may be subject to this Act. More information on the Estuary Protection Act may be found at http://www.fws.gov/laws/lawsdigest/ESTUARY.HTML .

Magnuson-Stevens Fishery Conservation and Management Act *with Essential Fish Habitat Amendment, 16 U.S.C. 1801 et seq.* -
The Magnuson-Stevens Fishery Conservation and Management Act (MSA) and its Essential Fish Habitat (EFH) Amendment is the primary law governing marine fisheries management in United States federal waters. The purpose of this Act is to conserve and manage the fishery resources found off the coasts of the U.S. Federal action relating to alteration to the Bayonne Bridge and construction of proposed alternatives will require assessment of compliance with MSA and EFH policy. Text of the Act may be found at http://www.nmfs.noaa.gov/sfa/magact/ .

Executive Order 12898, *Environmental Justice; 59 CFR 7629, 62 CFR 18377, 60 CFR 33896* -
Executive Order (E.O.) 12898 for Environmental Justice applies to all Federal projects and programs. Its purpose is to ensure that Federal activities do not have a disproportionately high and adverse affect on a minority or low-income populations. Each Federal agency uses its own regulations to comply with environmental justice legislation. Federal elements of alteration to the Bayonne Bridge and construction of proposed alternatives will require compliance with E.O. 12898. The text of the E.O. is here:
http://el.erdc.usace.army.mil/emrrp/emris/emrishelp5/executive_order_12898_legal_matters.htm

Section 4(f)of the Dept of Transportation Act of 1966; *P.L 89-670, 80 Stat. 931, 49 U.S.C. 1653(f) -*
The Department of Transportation Act (DOT Act) of 1966 included this provision which stipulated that the Federal Highway Administration (FHWA) and other DOT agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historical sites unless the following conditions apply, first - there is no feasible and prudent alternative to the use of land, and second - the action includes all possible planning to minimize harm to the property resulting from use. More information may be found at http://www.environment.fhwa.dot.gov/4f/index.asp

Executive Order 11988, Floodplain Management*; 42 F.R. 26951 amended by E.O. 12148 -*
The purpose of Executive Order (E.O.) 11988 is to avoid the long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and to restore and preserve the natural and beneficial values served by floodplains. The text of this E.O. may be found at http://www.archives.gov/federal-register/codification/executive-order/11988.html

Noise Control Act of 1972*; P.L. 92-574, 86 Stat. 1234, 42 U.S.C. 4901 et seq. -*
This Act initiated a Federal program of regulating noise pollution with the intent of protecting human health and minimizing annoyance of noise to the general public. Federal involvement in Bayonne Bridge modification or construction of any proposed alternative would be subject to Federal statutes on noise control. More information on Federal noise regulation may be found at http://www.ehso.com/ehshome/regslaws40gnoise.php

APPENDIX G

National Security Implications

The text presented below was provided on 5 May 2009 by the Army's Surface Deployment Distribution Command Transportation Engineering Agency in response to a Port Authority and Corps request for assessment of the potential national security implications of Bayonne Bridge alteration and replacement.

Problem

The Surface Deployment Distribution Command Transportation Engineering Agency (SDDCTEA) was contacted by the United States Coast Guard (USCG) on behalf of the Port Authority of New York and New Jersey to participate in a feasibility study concerning the Bayonne Bridge. Currently the air draft under the Bayonne Bridge is 151 ft at mean high water and is the main limiting factor for access to the Port Newark and Port Elizabeth Terminals.

Specifically, SDDCTEA was asked to evaluate the national security implications of several future construction options on the table related to the Bayonne Bridge. These options include leaving the bridge unchanged, removing the bridge and replacing with a tunnel or bridge and raising the bridge.

Background/Analysis

To gain a better understanding of the issue we spoke with the ACOE in the NY/NJ region. Based upon that conversation, it appears as though this study is a result of the ongoing improvements to the Panama Canal and its three locks. When these improvements are completed (approximately 2014/2015) the canal will be capable of allowing "Next Generation" container vessels also known as "Post Panamax" to pass through. These improvements to the Panama Canal will likely result in an increase in the number of port calls along the east coast by these commercial vessels. Obviously the Port of NY/NJ will likely be a desired destination for these ships. The anticipated problem is that the Air Draft of these Post Panamax ships may prevent them from sailing under the Bayonne Bridge in its current configuration.

As part of our analysis, TEA set out to study the existing MSC fleet. Approximately 5% (6 of 118) of the current MSC fleet have air drafts (ballast or loaded greater than 151 feet) that prevent them from passing under the Bayonne Bridge as it is today. SDDC Pamphlet 700-4 was used for this analysis.

TEA also reviewed meeting minutes that are on file from the 2003 visit to the Port of NY/NJ. According to these minutes, it has been approximately 10 years since the last significant deployment out of the port. Most deployments in this region over this time frame have come out of the Port of Philadelphia.

Conclusion

APPENDIX G

Based upon the data collected, it appears as though the effect on the Department of Defense's (DOD) ability to deploy military forces will be minimal regardless of what is done with the Bayonne Bridge. There will, however, be some factors that should be looked at based upon each of the options presented:

Option A – Do nothing and leave the Bayonne Bridge as is.

- If the Bayonne Bridge remains unchanged then there would be minimal to no affect to DOD deployment activities from NYNJ.

Option B – Raise the Bayonne Bridge.

- Raising the bridge would allow more ships (including MSC's bigger ones) access to PPO facilities. This could present a few drawbacks.

    1. Access to the port facilities would need to be maintained during construction.
    2. Allowing bigger commercial ships to the port could reduce the availability to DOD of those same facilities.

Option C – Remove the Bayonne Bridge and replace it with a tunnel.

- Replacing the Bayonne Bridge with a tunnel would not alter DOD's ability to deploy from the Port of NYNJ assuming:

    1. Minimum draft limits are maintained post construction.
    2. Access to the port facilities would need to be maintained during construction.

    It should be noted that allowing bigger commercial ships to the port could reduce the availability to DOD of those same facilities.

Acronyms

AAGR	Average Annual Growth Rate
BCR	Benefit-to-Cost Ratio
CPIP	Comprehensive Port Improvement Plan
CZMA	Coastal Zone Management Act
DOD	Department of Defense
ERDC	Energy Research and Development Center (US Army Corps of Engineers)
FEU	Forty-foot Equivalent Unit
GPS	Global Positioning System
HDP	50 ft. Harbor Deepening Project
HNS	New York and New Jersey Harbor Navigation Study
IDC	Interest During Construction
IMO	International Maritime Organization
IRR	Internal Rate of Return
IWR	Institute for Water Resources (US Army Corps of Engineers)
KTMH	Keel-to-Mast Height
MHW	Mean High Water
MISLE	Marine Information for Safety and Law Enforcement
MLW	Mean Low Water
NED	National Economic Development
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act
NPV	Net Present Value
O&M	Operations and Maintenance Costs

ORF	Port of Norfolk
PANYNJ	The Port Authority of New York and New Jersey
PONYNJ	Port of New York and New Jersey
RED	Regional Economic Development
SDDCTEA	Surface Deployment Distribution Command Transportation Engineering Agency
TEU	Twenty-foot Equivalent Unit
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USEC	United States East Coast
USWC	United States West Coast
VOCs	Vessel Operating Costs
VTS	Vessel Tracking System (US Coast Guard)
WRDA	Water Resources Development Act

Exhibit G - Present and Prospective Commercial Navigation and Cargo

Savannah River Crossing

International Maritime Organization Number (IMO); Gross Resister Tonnage (GRT); Twenty Foot Equivalent Unit (TEU); Length Overall (LOA)

FINAL STUDY REPORT

DRAFT

Savannah River Crossing Feasibility Study

PI No. 0017183

ARCADIS

September 2022

GDOT
Georgia Department of Transportation

FINAL STUDY REPORT

SAVANNAH RIVER CROSSING FEASIBILITY STUDY

Chandria Brown, PE
GDOT Project Manager

Kristen Kasmire, PE, SE
Study Team Project Manager

Julie Price, AICP
Study Team Deputy Project Manager

Prepared for:
Georgia Department of Transportation
Office of Program Delivery
600 West Peachtree Street
Atlanta, Georgia 30308

Prepared by:
Arcadis U.S., Inc.
2839 Paces Ferry Road #900
Atlanta, Georgia 30339
Tel 770 431 8666
Fax 770 435 2666

Our Ref.:
30119591

Date:
September 2022

This report is a working document that will be included in the Practical Alternative Review process as part of the larger NEPA process.

This document is intended only for the use of the individual or entity for which it was prepared and may contain information that is privileged, confidential and exempt from disclosure under applicable law. Any dissemination, distribution or copying of this document is strictly prohibited.

DRAFT

CONTENTS

1 Introduction 10
1.1 Purpose 10
1.2 Challenges 12
1.3 Study Goals and Objectives 13
1.4 Final Study Report Outline 14
1.4.1 Global and National Market Outlook 14
1.4.2 Existing Conditions and Future Needs Assessment 15
1.4.3 Alternatives Development 15
1.4.4 Alternatives Evaluation and Screening 15
2 Global and National Market Outlook 16
2.1 Ship Sizes 17
2.1.1 Economies of Scale 20
2.1.2 Ship Cascading 22
2.2 World Trade Patterns 22
2.2.1 Panama and Suez Canals 23
2.2.1.1 Suez Canal 24
2.2.1.2 Panama Canal 24
2.2.2 Changes in Source Production 24
2.2.3 Other Considerations 25
2.2.3.1 Decarbonization and Desulfurization 25
2.2.3.2 Climate Change 26
2.3 National Trends 27
2.3.1 Largest U.S. Ports Based on Volume 27
2.3.2 West vs. East Coast 28
2.3.3 Jones Act 29
3 Existing and Future Conditions 30
3.1 Data Collection 30
3.2 Physical Conditions 30
3.2.1 Bridge Assessment 30
3.2.1.1 Existing Conditions of the Talmadge Memorial Bridge 31
3.2.1.1.1 Bridge Connections 32

DRAFT

3.2.1.1.2 Back River Bridge 32
3.2.1.1.3 Geotechnical Conditions 32
3.2.1.2 Future Requirements for a New Savannah River Crossing 33
3.2.1.2.1 Connectivity Considerations 33
3.2.1.2.2 Bridge Alternative Requirements 33
3.2.1.2.3 Tunnel Alternative Profile 34
3.2.2 Roadway Network Assessment 35
3.2.2.1 Functional Classification 35
3.2.2.2 Road Features: Number of Lanes 36
3.2.2.3 Restrictions of Commercial Vehicle Use in the City of Savannah 37
3.2.3 River Assessment 38
3.2.3.1 Existing Conditions of the Savannah River 38
3.2.3.2 Future Assessment of the Savannah River's Navigability 38
3.2.4 Existing Topography 39
3.2.5 Physical Needs Summary 39
3.3 Economic Conditions 39
3.3.1 Economic Impact of the Port 40
3.3.1.1 Current 40
3.3.1.2 Future 40
3.3.2 TEU Volumes 41
3.3.2.1 Current 41
3.3.2.2 Future 41
3.3.3 Ship Use 42
3.3.3.1 Current 42
3.3.3.2 Future 42
3.3.4 Projects 42
3.3.4.1 Ongoing 42
3.3.4.2 Planned 43
3.3.5 Economic Needs Summary 44
3.4 Environmental Conditions 45
3.4.1 Environmental Existing Conditions 45
3.4.1.1 Natural Resources 45

DRAFT

3.4.1.1.1 Protected Species 45
3.4.1.1.2 Streams and Wetlands 47
3.4.1.2 Flood Plains 48
3.4.1.3 Underground Storage Tank/Hazardous Waste Sites 50
3.4.1.4 Community/Public Facilities 51
3.4.1.5 Greenspace/Parks/Conservation Land & Community Assessment 52
3.4.1.6 Cultural Resources 52
3.4.1.7 Environmental Justice 53
3.4.2 Future Environmental Considerations 55
3.4.2.1 Potential Permits and Approvals 55
3.4.2.2 NEPA Environmental Review 56
3.4.2.3 Parallel Review Processes 58
3.4.3 Environmental Needs Summary 59
3.5 Traffic Conditions 59
3.5.1 Existing Traffic Assessment 60
3.5.1.1 Traffic Volumes 60
3.5.1.1.1 Daily Total Traffic Volume 60
3.5.1.1.2 CORE MPO Travel Demand Model Volume 61
3.5.1.1.3 Truck Volume 62
3.5.1.1.4 Travel Speeds 65
3.5.1.1.5 Level of Service (LOS) 65
3.5.1.2 Crash Analysis 66
3.5.1.2.1 Study Area Total Crashes 66
3.5.1.2.2 Crashes at Talmadge Memorial Bridge 68
3.5.1.3 Commuter Origin-Destination (OD) Analysis 69
3.5.1.4 Freight Flow 70
3.5.1.5 Rail System Data and Analysis 74
3.5.2 Future Travel Conditions 77
3.5.2.1 CORE MPO Travel Demand Model Future Forecast 77
3.5.2.2 VISUM Model Analysis 79
3.5.2.2.1 Traffic Counts Collection 79
3.5.2.2.2 VISUM Model Development and Alternative Analysis 82

DRAFT

3.5.3 Traffic Needs Summary 85
3.6 Needs verification 86
4 Alternatives Development 87
4.1 Collaboration 88
4.2 Fact Sheets for Alternative Categories 89
4.3 Fact sheets for specific alternatives 103
5 Alternatives Screening 110
5.1 Three-Tiered Screening 110
5.2 Tier 1 Fatal Flaw Analysis 111
5.3 Tier 2 Feasibility, Practical Operation, and Construction 111
5.4 Tier 3 Detailed Evaluation 112
5.5 Evaluation Matrix 113
6 Next Steps 114

FIGURES

Figure 1. Talmadge Memorial Bridge and Port Terminals 10
Figure 2. Timeline for Study and Subsequent Activities 11
Figure 3. Savannah River Crossing Feasibility Study Area 11
Figure 4. Maximum Clearance for Existing Talmadge Memorial Bridge 13
Figure 5. International Container Volume in TEU, 2000-2019 17
Figure 6. Evolution of Containership Dimensions (All Dimensions in Meters. 1 m = Approx. 3.28 ft) 19
Figure 7. Order Book Shares Based on Ship Sizes, 2015-2020 20
Figure 8. Economies of Scale in Container Shipping (US$/TEU) 21
Figure 9. Relation Between Ship Costs and Handling Costs Per TEU 22
Figure 10. Changes in Volumes of Traded Goods, 2015-2019 23
Figure 11. Changes in U.S. Import Origin, 2018-2019 25
Figure 12. Largest U.S. Ports, measured in Laden TEUs (Excluding Empties) 27
Figure 13. East Coast Takes on Larger Share of Shipping Volume 29
Figure 14. Data Sets 30
Figure 15. Current Vertical Envelope of the Talmadge Memorial Bridge 32
Figure 16. Proposed Tunnel Profile 34

DRAFT

Figure 17. Potential Design for Tunnel Option 34
Figure 18. Road Functional Classification 36
Figure 19. Number of Through Lanes in Study Area 37
Figure 20. Building Permit Locations 44
Figure 21. Wetlands and Water Bodies within Environmental Screening Area 48
Figure 22. Flood Hazard Areas within Environmental Screening Area 49
Figure 23. Hazardous Waste Sites within Environmental Screening Boundary 50
Figure 24. Gas Stations and Underground Storage Tanks within Environmental Screening Boundary 51
Figure 25. Parks within Environmental Screening Boundary 52
Figure 26. Historic Features within Environmental Screening Boundary 53
Figure 27. 2019 Annual Average Daily Traffic (AADT) Volume – TADA 61
Figure 28. 2015 Daily Total Traffic Volume – CORE MPO Travel Demand Model 62
Figure 29. 2019 Annual Average Daily Truck Traffic Volume 63
Figure 30. 2015 Daily Level of Service – CORE MPO Travel Demand Model 66
Figure 31. 2015-2019 Crashes by Severity in the Study Area 67
Figure 32. 2015-2019 Commercial Vehicle Crashes by Severity in the Study Area 67
Figure 33. Top 10 Workplace and Residence Origin-Destination (OD) Flow 70
Figure 34. Total Freight Flows by Tons from Savannah Area in 2017 71
Figure 35. Total Freight Flows by Values (M$) from Savannah Area in 2017 72
Figure 36. Railroad Ownership 75
Figure 37. Total Rail Flows by Tons from Savannah Area in 2017 76
Figure 38. 2045 E+C Daily Total Traffic Volume - CORE MPO Travel Demand Model 77
Figure 39. 2045 E+C Daily Truck Volume – CORE MPO Travel Demand Model 78
Figure 40. 2045 E+C Daily Level of Service – CORE MPO Travel Demand Model 79
Figure 41. TMC and ADT Locations for Traffic Counts Collection 80
Figure 42. Flow Chart of the VISUM Model Development and Alternative Evaluation 83
Figure 43. Alternatives Evaluation Approach 111
Figure 44. Evaluation Matrix 113

DRAFT

TABLES

Table 1. Study Area Tier for each Study Topic 12
Table 2. Overview of West and East Coast 28
Table 3. Clearance Comparisons of Bayonne Bridge vs. Talmadge Memorial Bridge 33
Table 4. Design Criteria for Bridge and Tunnel alternatives 35
Table 5. Summary of Physical Needs 39
Table 6. Predicted Versus Actual TEUs Handled at the Port of Savannah 41
Table 7. Summary of Economic Needs 45
Table 8. State and Federally Protected Species 46
Table 9. Community and Public Facilities within Environmental Screening Boundary 51
Table 10. Anticipated Permits and Approvals 56
Table 11. NEPA Environmental Review Process for an EA and EIS 58
Table 12. Summary of Environmental Needs 59
Table 13. GDOT TADA Truck Percentages at Selected Count Locations in Study Area 64
Table 14. Speed Limits along Selected Arterials 65
Table 15. 2015-2019 Crashes on Talmadge Memorial and Little Back River Bridges by Manner of Collision 68
Table 16. 2015-2019 Crashes on Talmadge Memorial and Little Back River Bridges by Most Harmful Event 68
Table 17. Top 10 Counties Commuting into Chatham County, Georgia 69
Table 18. Top 10 Counties Commuting out of Chatham County, Georgia 69
Table 19. Top 20 Destinations of Truck Freight Flows by Tons that Originated from Savannah Area 73
Table 20. Top 20 Destinations of Truck Freight Flows by Values that Originated from Savannah Area 74
Table 21. Total Traffic Volume Annual Growth Rates of Selected Roads 77
Table 22. ADT Locations 81
Table 23. TMC Locations 82
Table 24. Peak Hour Vehicle Hours of Delay (VHD) in VISUM Modeling Area across Alternatives 84
Table 25. Peak Hour Vehicle Hours of Delay by Corridor across Alternatives 84
Table 26. Peak Hour Level of Service by Corridor across alternatives 85
Table 27. Summary of Traffic Needs 85
Table 28. Physical, Economic, Environmental, and Evaluation criteria for Traffic Needs 86
Table 29. Build Alternatives Considered 88

DRAFT

APPENDICES

Appendix A: Leadership Presentations

Appendix B: Bridge Demolition Report

Appendix C: Tier 2 Alternative Reports

Appendix D: Tier 3 Alternative Reports

Appendix E: VISUM LOS Maps

Appendix F: Geotechnical Investigation Report

Appendix G: Cost Estimate Backup for Tunnel

Appendix H: Cost Estimate Backup for New Bridge

Appendix I: GDOT Webpage Materials (Webpage content, FAQs, Fact Sheet)

Appendix J: Environmental Justice Maps

Appendix K: Final Letter-Height Requirement Form GPA to GDOT

Appendix L: Risk Registers

Appendix M: Economic Needs Tech Memo

Appendix N: Traffic Ramp Configuration Scenarios

Appendix O: Data Collection List

DRAFT

ACRONYMS AND ABBREVIATIONS

ACS	American Community Survey
CEQ	Council on Environmental Quality
CFS	Commodity Flow Survey
CORE MPO	Coastal Region Metropolitan Planning Organization
CTPP	Census Transportation Planning Products
E+C	Existing and Committed
EJ	Environmental Justice
EPA	Environmental Protection Agency
FAF	Freight Analysis Framework
FIRM	Flood Insurance Rate Map
FRA	Federal Railroad Administration
GDOT	Georgia Department of Transportation
GPA	Georgia Ports Authority
GSTDM	Georgia Statewide Travel Demand Model
GVW	Gross vehicle weight
LATS	Lowcountry Area Transportation Study
LOS	Level of Service
LRTP	Long Range Transportation Plan
MHW	Mean High Water
MTP	Metropolitan Transportation Plan
NEPA	National Environmental Policy Act
NPMRDS	National Performance Management Research Data Set
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
OD	Origin and destination
SCDOT	South Carolina Department of Transportation
SHEP	Savannah Harbor Expansion Project
SIA	Structural Inventory and Assessment
TADA	Traffic Analysis & Data Application
TEU	Twenty-foot equivalent unit
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey

DRAFT

1 INTRODUCTION

As the fastest-growing container port in the nation, the Port of Savannah is expected to continue record-setting gains in the coming years amid favorable local, national, and international trends. The Port's growth has generated significant economic benefits to the Savannah region, Georgia, and South Carolina, and major investments in the Port are underway. The Savannah Harbor Expansion Project (SHEP) completed in March 2022, has deepened the shipping channel to 47 feet, accommodating ships that have much larger twenty-foot equivalent unit (TEU) capacities.

Even with the harbor deepening, the clearance limitations of the Talmadge Memorial Bridge effectively restrict an ever-larger fleet of ships seeking to access the Port. This is significant because larger ships (up to 23,000 TEUs and beyond) are becoming increasingly common on the world's oceans given their economy-of-scale benefits of fuel efficiency and lower overall operating costs.

The Talmadge Memorial Bridge is located southeast of the Port's Ocean and Garden City terminals, as shown in Figure 1. In addition to serving as a veritable gatekeeper for larger ships calling on the Port, the bridge is a critical vehicle thoroughfare from Savannah to Hutchinson Island and into South Carolina along US 17.



Figure 1. Talmadge Memorial Bridge and Port Terminals

The bridge, Port, and surrounding areas constitute the study area as part of the Savannah River Crossing Feasibility Study. The study, undertaken in partnership between the Georgia Department of Transportation (GDOT) and Georgia Ports Authority (GPA), considers factors that directly and indirectly affect the study area and a potential new river crossing. This study will rely on data and analysis from a variety of sources to provide a more holistic understanding of the area's conditions, needs, and opportunities.

1.1 Purpose

The purpose of this study is to investigate and develop improvement alternatives that will address the clearance limitations on the Savannah River and support the continued safe, efficient vehicular access between Savannah and Hutchinson Island as well as South Carolina. This comprehensive planning feasibility study, coupled with conceptual engineering tasks, builds on GDOT's Talmadge Memorial Bridge Air Draft Analysis, completed in late 2019.

DRAFT

The current study includes transportation planning to support identifying and developing improvement alternatives via detailed feasibility analyses. A thorough cost and benefit analysis of each alternative will support the overall evaluation that ultimately leads to recommended feasible alternatives. The Study Team will then perform detailed engineering and environmental activities that can further advance project development tasks, decisions, and delivery milestones. Figure 2 illustrates the anticipated timeline for the study and subsequent activities.



Figure 2. Timeline for Study and Subsequent Activities

This study is focusing on the Port of Savannah, Talmadge Memorial Bridge, and surrounding areas, including Savannah and parts of Chatham County and South Carolina. These constitute the study area, as shown in Figure 3.

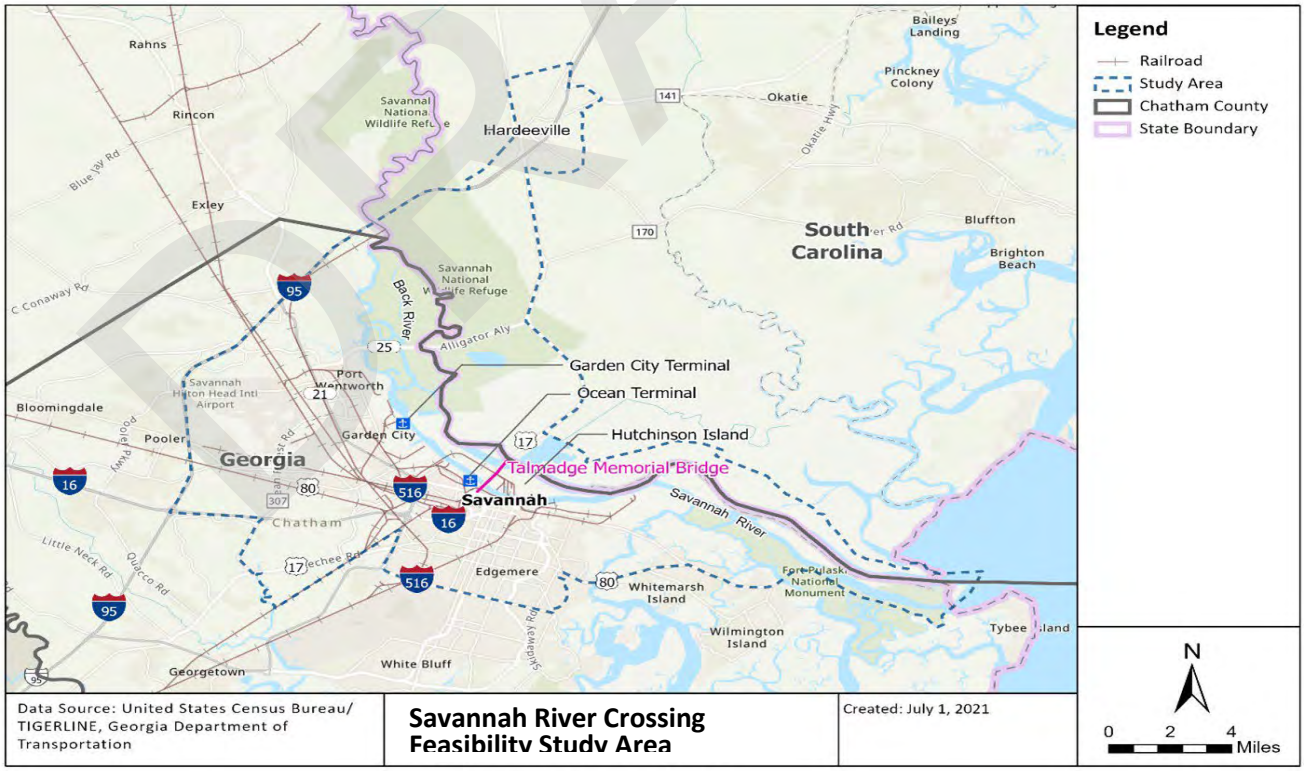


Figure 3. Savannah River Crossing Feasibility Study Area

DRAFT

Many of the factors that directly and indirectly affect the study area need to be examined more broadly. For instance, the Port of Savannah's prominence as an international shipping hub means that changes within the study area could have compounding effects beyond the immediate area. As such, the areas of focus for each of the four study topics will vary based on those considerations. To that end, the Study Team developed additional study area tiers, which include Chatham County and the rest Georgia as well as areas in adjacent states to the north and west. Table 1 indicates the study area tier for each of the study topics.

Table 1. Study Area Tier for each Study Topic

Study Topics	Study Area	Chatham County	Broader
Physical	✓		
Economic	✓	✓	✓
Environmental	✓		
Traffic	✓	✓	✓

1.2 Challenges

The Talmadge Memorial Bridge provides 185 feet of bridge clearance, or the distance from the mean high water elevation to the underside of the bridge. The bridge's current clearance poses two challenges:

1. **Accessibility.** The existing bridge does not provide enough clearance for a generation of ever-larger ships (up to 23,000 twenty-foot equivalent units, or TEUs). These ships are increasingly common on the world's oceans given their economy-of-scale benefits of fuel efficiency and lower overall operating costs. TEUs describe the capacity of container ships.
2. **Operational efficiency.** The bridge's clearance is sufficient, despite operational limitations, for ships with capacities of 14,000 to 17,000 TEUs, which currently call on the Port of Savannah. The passage of such ships beneath the bridge to access the Port of Savannah depends on a delicate balance between the bridge's clearance, ship loads, and tidal fluctuations. A larger bridge clearance would create larger windows of time for these ships to arrive and depart, allowing more flexibility in operations.

Figure 4 illustrates the Talmadge Memorial Bridge's clearance for ships with capacities of 16,000 TEUs and 23,000 TEUs to show the opportunities and limitations, respectively, of the current bridge dimensions. The navigational opening, which is generally understood as the area under which a ship can safely pass, is 185 feet high by 500 feet wide. For safe passage, pilots prefer to have a 3-foot clearance between their ships and the bridge.

DRAFT

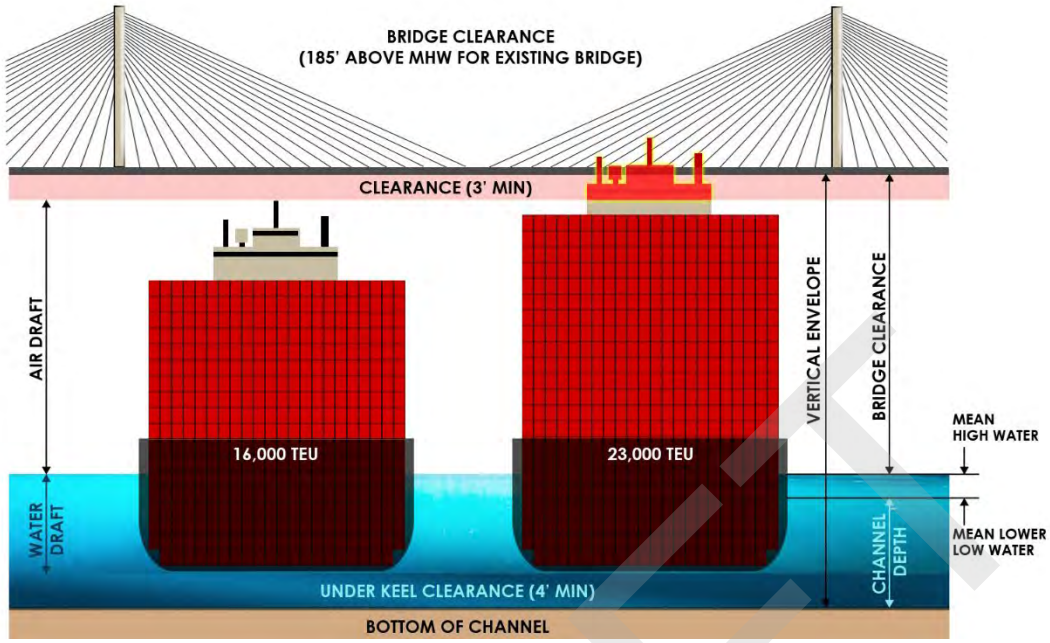


Figure 4. Maximum Clearance for Existing Talmadge Memorial Bridge

In May 2021, the CMA CGM Marco Polo arrived on the U.S. East Coast, including a stop in Savannah. With a capacity of more than 16,000 TEUs, the Marco Polo is the largest container ship to call on the East Coast. It is one of many large container ships being deployed to meet trade flow demands, and such ships make up an increasingly larger share of port calls.[1] As indicated, larger ships bring economies of scale; at the same time, they create challenges such as longer load and discharge times.

Ships such as the Marco Polo can arrive in Savannah only with a reduced load and under ideal tide conditions – in this case, during low tide on May 26 – a result of clearance limitations of the bridge. These limitations could potentially stifle the Port's future growth. Other East Coast ports, including the Port of New York/New Jersey and the Port of Virginia, have addressed their clearance limitations to accommodate larger ships. The Bayonne Bridge (approaching the Port of New York/New Jersey) now has a clearance of 215 feet, and the Port of Virginia in Norfolk has no clearance limitation because of a tunnel that carries vehicles under the river channel**.** Savannah's clearance limitations may make the Port less competitive and therefore limit economic opportunities for the Port, region, and state.

1.3 Study Goals and Objectives

The goals and objectives for the study focus on the core components of economic sustainability, minimization of impacts to the surrounding area, and efficiency of cost and construction. The goals and objectives were developed at the beginning of the study and refined as the study progressed. The goals and objectives are as follows:

[1] https://www.joc.com/maritime-news/container-lines/cma-cgm/largest-ship-call-east-coast-arrive-next-week-cma-cgm_20210514.html



Support the long-term economic efficiency and sustainability of the GPA and Georgia's economy

- Provide a navigation clearance to support Ultra Large Container Vessels (ULCV)
- Provide freight accessibility to the existing port infrastructure
- Provide accessibility and connectivity to both sides of the Savannah River
- Deliver the project within a reasonable timeframe with minimal disruptions to current port operations



Meet design standards

- Provide for a safe passage of both ground transportation and vessels
- Minimize vehicular delay
- Leverage innovative technology to promote safety and mobility



Minimize impacts on the built and natural environment

- Avoid, minimize, or mitigate impacts on community, historic, and visual resources
- Minimize effects on environmentally sensitive areas, natural habitats, and water resources
- Maximize alignment with existing plans



Minimize impacts to cost and construction

- Minimize construction impacts to the traveling public
- Deliver the project at a financially feasible cost
- Leverage partnerships for successful infrastructure development and maintenance

1.4 Final Study Report Outline

The Final Study Report incorporates all study analysis, findings and recommendations that occurred over the course of 2021 and respective updates in 2022. It includes five sections: global and national market outlook, existing conditions and future needs assessment, alternatives development, alternative evaluation and screening and next steps.

1.4.1 Global and National Market Outlook

The global market outlook relied on shipping data, academic and professional journals, and news articles to examine the economic conditions of the Port of Savannah. Carriers are actively ordering larger ships to leverage their economy-of-scale benefits. Larger volumes of cargo along the same routes allow handling costs to be spread out over more units, driving down net costs and increasing net gains for these carriers. These trends indicate that demand for these larger ships will continue to increase. At the same time, shifting global production patterns suggest that routes to Savannah from major production hubs are becoming more popular. Indeed, recent trends show production shifting away from China and moving to Southeast Asian countries such as Vietnam, fueled by the international trade war between the U.S. and China, with COVID-19 only exacerbating these tensions. The fastest routes from origin to a destination on the East Coast is through the Suez Canal, which can support larger ships than the Panama Canal. Still, the 2016 expansion of the Panama Canal has led to larger ships calling on the East Coast more frequently. These patterns indicate that the Port of Savannah may see more frequent activity on global shipping routes.

DRAFT

1.4.2 Existing Conditions and Future Needs Assessment

The Study Team has identified four key areas of analysis that will help contextualize the existing Savannah River crossing:

- **The Physical Conditions section** is primarily concerned with the existing Talmadge Memorial Bridge and Port of Savannah facilities as both independent facilities and as part of Savannah's larger mobility network. The Physical Conditions section also looks at the state of the Savannah River and how it factors into the current and future conditions for proposed alternatives.
- **The Economic Conditions section** discusses factors that directly and indirectly affect the primary study area. There is a particular emphasis on the shipping industry, which is one of the most important areas of economic activity for Savannah and is most directly impacted by the conditions of the Port of Savannah. The Economic Conditions section is informed by the data, research, and findings of the Economics Needs Assessment.
- **The Environmental Conditions section** examines the natural and built environments. This section helps contextualize the environmental and human impacts of the proposed alternatives. Primary topics of interest include natural, cultural, and community resources as well as Environmental Justice (EJ) populations.
- **The Traffic Conditions section** analyzes a variety of mobility conditions and needs for vehicular and rail traffic. This outlines the mobility needs of the study area for private and commercial traffic. The existing mobility networks help identify potential opportunities for improving connectivity and establishing certain parameters for potential future traffic flow scenarios.

1.4.3 Alternatives Development

The Study Team identified and studied 26 potential alternatives to improve Port accessibility. Alternative categories are as follows:

- Tunnel
- New Bridge: Same Location
- New Bridge: Truman Parkway Extension
- Remove Bridge and Re-Route US 17 Traffic
- Modify Existing Bridge
- Downriver Port Facilities

Through future stakeholder engagement and/or the alternative analysis effort, other alternatives may be added to the screening analysis. A No-Build option will be considered as part of the National Environmental Policy Act (NEPA) documentation, but it is not included in this evaluation as the purpose is to identify feasible build alternatives. This section will include basic fact sheets for all alternatives categories.

1.4.4 Alternatives Evaluation and Screening

The initial 27 alternatives were evaluated using a three-tiered screening approach. The development of the screening approach began by identifying goals and objectives that form the framework of the evaluation. The goals and objectives were developed based on case studies, best practices, and subject matter expert knowledge in collaboration with and concurrence from GDOT and GPA. Within the framework of these

DRAFT

goals and objectives, screening criteria were created to also align with federal and state requirements to ensure compliance with NEPA in future study efforts.

Using the goals and objectives, the Study Team developed the three-tiered screening approach to ultimately identify feasible alternatives that will best meet the needs of the local area, region, and state. This tiered screening approach provides for elimination of alternatives, in which any alternative not meeting the criteria in a tier does not advance for further evaluation.

The first tier of screening evaluates each alternative against fatal flaw criteria to ensure the alternative under consideration meets the goals and objectives of the study. The Tier 2 screening evaluates the feasibility and practicality of each alternative to construct and operate. The Tier 1 and 2 screenings resulted in three alternatives to move forward into the Tier 3 Detailed Screening.

- Tunnel – Upstream of Existing Bridge with access to Hutchinson Island
- New Bridge (Same Location) – 230' Bridge Clearance Upstream/Downstream of Existing Bridge
- Modify Existing Bridge – to provide 230' clearance

The Tier 3 detailed evaluation of the final three alternatives resulted in one alternative being eliminated. The Modify Existing Bridge alternative was determined not feasible based on multiple criteria. Two feasible alternatives advance to in the next steps to conceptual engineering and development: Tunnel and New Bridge.

2 GLOBAL AND NATIONAL MARKET OUTLOOK

Large container ships are the most common way to move goods around the globe, with the shipping industry responsible for more than 80 percent of world trade. Understanding the global shipping landscape is necessary to contextualize Savannah's role in the industry and how external forces may change that role. Shipping container volumes have increased significantly, from approximately 225 million TEU in 2000 to approximately 800 million TEU in 2019, as shown in Figure 5.[2]

DRAFT

[2] https://data.worldbank.org/indicator/IS.SHP.GOOD.TU?end=2019&start=2000&view=chart



Figure 5. International Container Volume in TEU, 2000-2019

During this time, carriers made significant short- and medium-term investments in much larger ships, many of which already exceed the Port of Savannah's capacity. At the same time, North American importers have shifted sources of production, leading to more efficient routes to reach U.S. markets. These decisions have prompted ports such as Savannah's to add capacity to its terminals, among other expansion measures.

Accommodating larger ships would make Savannah a more attractive port and increase economic activity across the logistics chain. However, it would also likely create additional demand on land transportation services, increasing port costs and expanding inland support operations to keep up with rising shipping volumes while maintaining service speed and quality.

2.1 Ship Sizes

Increasing ship sizes directly shape Savannah's current and potential development plans. The Georgia Ports Authority recently started construction to straighten a bend at Berth 1 of Garden City Terminal, and it ordered eight taller ship-to-shore cranes – all meant to expand the Port's ability to serve larger ships.[3] In addition, the Savannah Harbor Expansion Project (SHEP) dredged a total of 32 miles of the inner and outer harbor of the Savannah River, allowing larger ships to safely navigate these channels.

Addressing the clearance limitations of the Talmadge Memorial Bridge will only boost the Port's commercial attractiveness to larger ships. This trend is evident in the observed change at the Port of New York/New Jersey since improvement of the clearance under the Bayonne Bridge. In 2017, prior to the improved

[3] https://gaports.com/press-releases/savannah-serves-largest-vessel-ever-the-16000-teu-marco-polo/

clearance, approximately 0.9 percent of the ships calling the Port of New York/New Jersey were 13,000+ TEUs; in 2019 (to date), that number has increased to 22.7 percent.[4]

Ships have scaled up rapidly over the past decade, and larger ships make up a growing proportion of ship fleets worldwide. As of March 2021, of the approximately 24 million TEUs in service, more 3.4 million TEUs are from ships greater than 18,000 TEUs. These Ultra-Large Container Ships (ULCS) and Megamax-24 ships are just over 14% of the shipping capacity.[5] There is the potential of introducing an even larger generation of Gigamax ships with up to 28,000 TEU capacity, the next step up from the 25,000 TEU capacity ships already being commissioned.[6]

Figure 6 shows the evolution of containership sizes and dimensions. Ship dimensions are derived from multiplying the overall length of the ship by its width, or beam, and draft, or vertical distance from the bottom of the keel to the waterline.

DRAFT

[4] www.joc.com/port-news/us-ports/port-new-york-and-new-jersey/ny-nj-port-handling-larger-ships-bigger-payloads_20190514.html
[5] Alphaliner. (2021). Monthly Monitor March 2021. *Alphaliner.*
[6] Alphaliner. (2021). Alphaliner Weekly Newsletter 2021-22. *Alphaliner.*

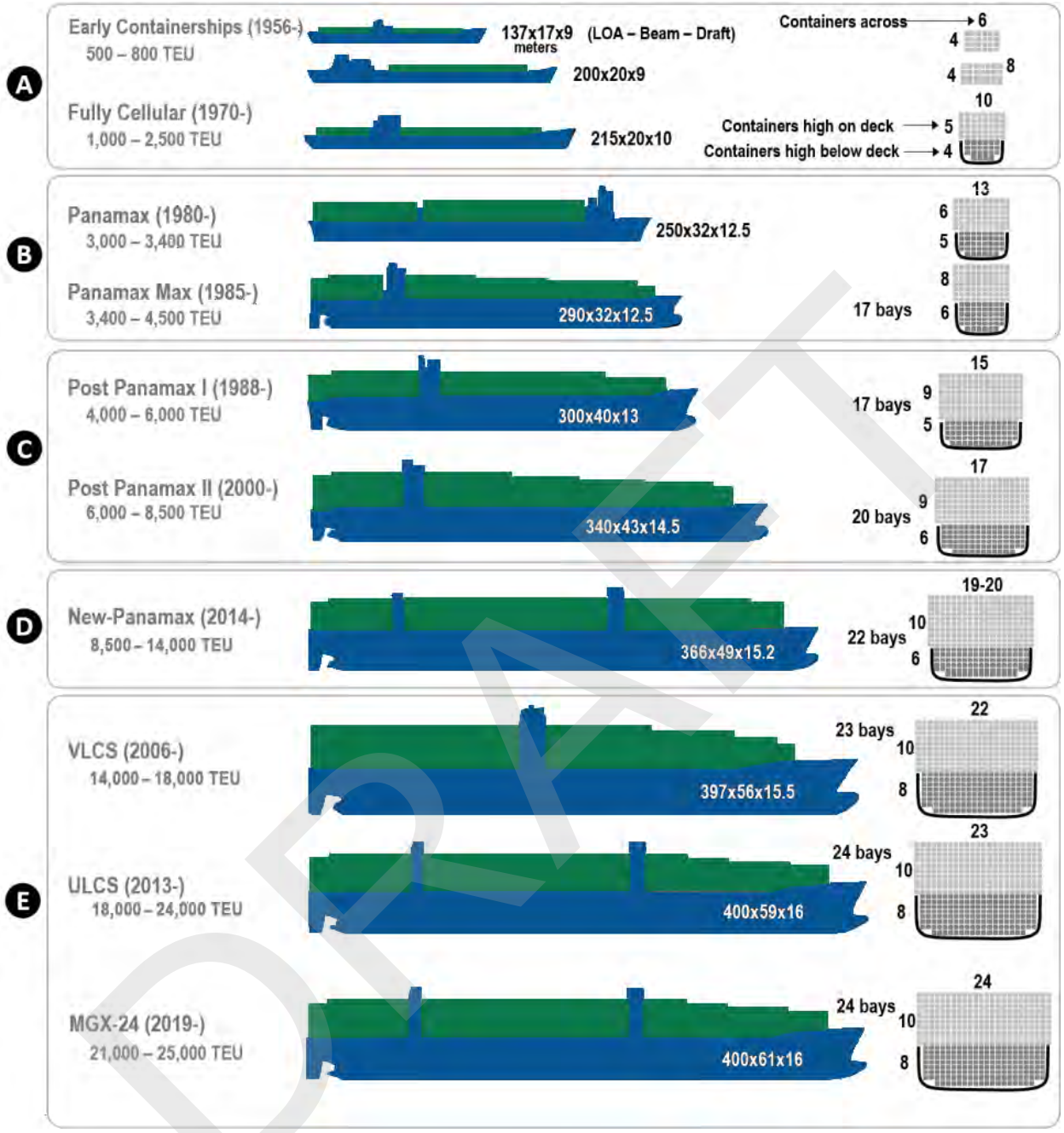


Figure 6. Evolution of Containership Dimensions (All Dimensions in Meters. 1 m = Approx. 3.28 ft)

DRAFT

From 2015-2020, ocean carriers have placed ship orders that indicate a long-term investment in newer, larger ships.[7] As shown in Figure 7, ULCS, or ships over 18,000 TEUs, make up an increasing share of the annual order book – more than 50% of ship orders every year but one since 2015. The second largest category of orders is for New-Panamax ships, which range from 8,500 to 14,000 TEUs. Beyond the current supply, larger ships are likely to continue to be a regular, if not increasingly prominent, feature of modern shipping fleets.

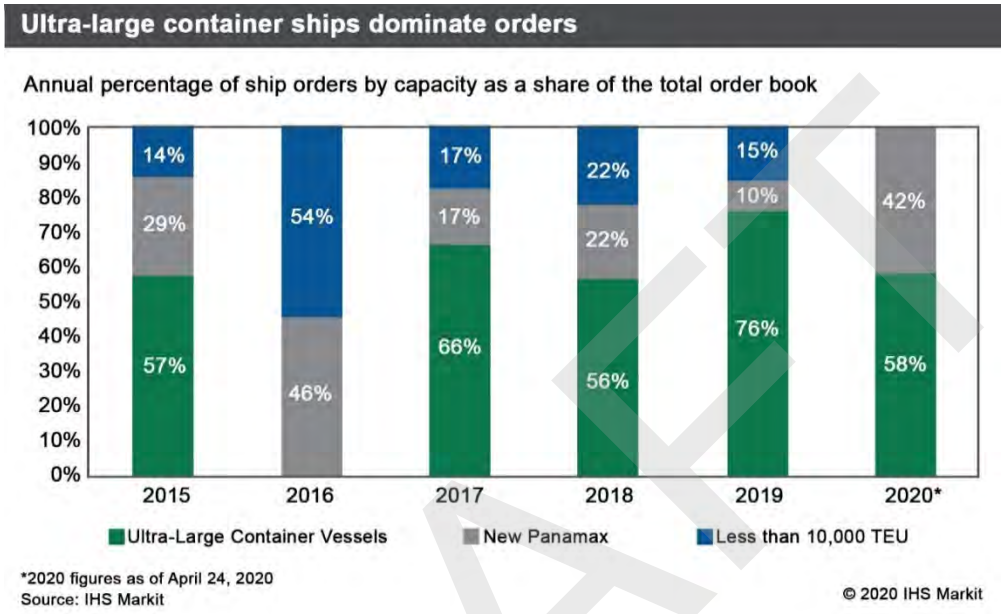


Figure 7. Order Book Shares Based on Ship Sizes, 2015-2020

2.1.1 Economies of Scale

As indicated, larger ships bring economies of scale, with total transportation costs spread over more containers, ultimately reducing the average cost per container, as shown in Figure 8. Additionally, reduced fuel needs because of lower-per-container consumption saves money and works toward emissions reduction targets from the International Maritime Organization (see section 2.2.3.1). Also worth noting are possible future savings from infrastructure investments in clearance improvements. For instance, even the largest ships, those exceeding 24,000 TEUs, could feasibly stay within the parameters of the existing clearances at the Suez Canal or Port of New York/New Jersey, possibly negating the need for additional investments for some time. Container shipping companies also realize economies of scale by leveraging larger ships to capture market share and forging alliances with other companies to maximize capacities.[8]

[7] https://www.joc.com/maritime-news/hapag-lloyd-adds-six-mega-ships-growing-orderbook_20210622.html
[8] Alphaliner. (2021). Alphaliner Weekly Newsletter 2021-22. *Alphaliner.*

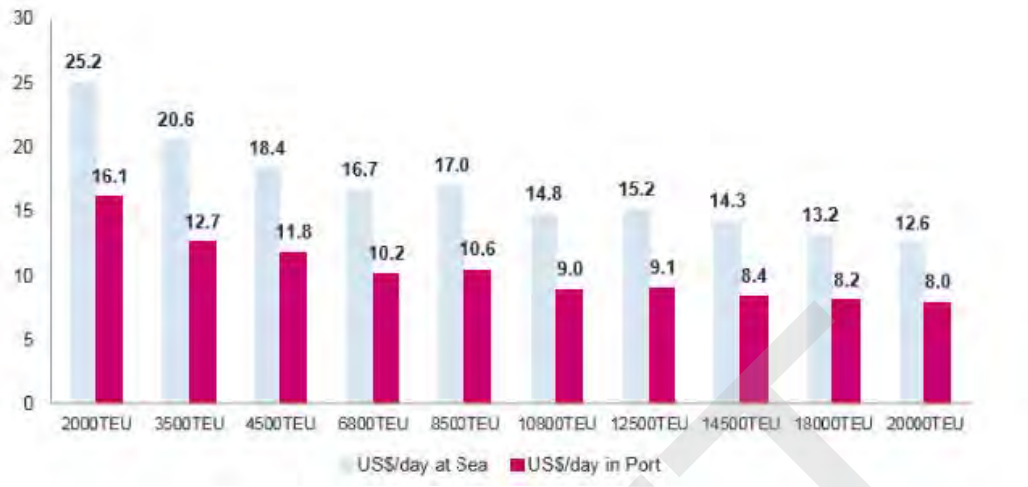


Figure 8. Economies of Scale in Container Shipping (US$/TEU)

It should be noted that this simplified approach to economies of scale neglects a few key risks and considerations for both carriers and terminals. Theoretically, an optimal TEU capacity exists, beyond which handling costs increase, contributing to an increase in the total costs across the supply chain. This relationship is shown in Figure 9.

Reduced shipping costs are offset by shipping limitations and additional handling costs. Economies of scale are maximized when a ship operates near capacity, which is only likely to happen on head haul trades, which are the routes from origin to destination with the highest container volume during peak periods. Carriers are limited in their routes for larger ships, which are best suited for routes with only a few calls at main ports and long-distance trips. These are often the only routes that have the capacity and infrastructure to support such large ships.

Additionally, larger ships usually require longer load and discharge times, necessitating capable crews at ports or marginally faster sailing speeds to be able to keep up with existing service schedules.[9] These disparities increase as ship size increases.

[9] Alphaliner. (2021). Alphaliner Weekly Newsletter 2021-22. *Alphaliner.*

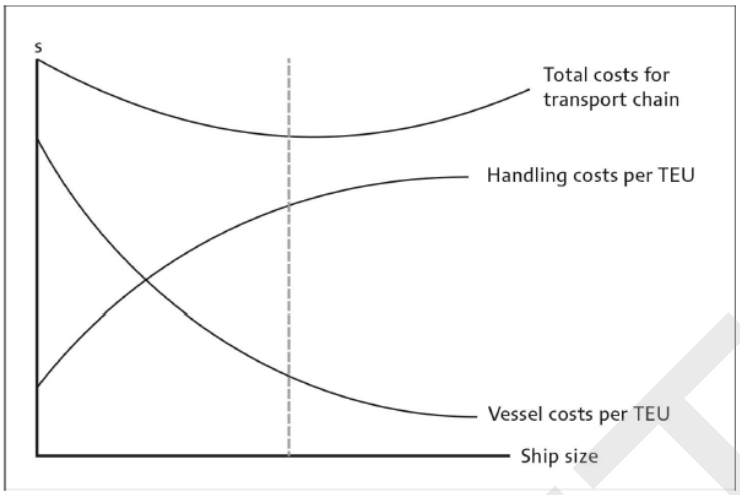


Figure 9. Relation Between Ship Costs and Handling Costs Per TEU

2.1.2 Ship Cascading

Cascading occurs when newer, often much larger ships enter the fleet rotation. Newer ships, many of which exceed 18,000 TEUs, are deployed on the East Asia-to-Europe trade route, which has the highest volumes. Ships that are currently on these routes are then moved to the second most active route, or the East Asia-to-U.S. East Coast route. As the current generation of ever-increasing Very Large Container Ships (VLCS) continues to be ordered and delivered, it is expected they will serve the East Asia-to-Europe route, and the existing 18,000 TEU ships will be cascaded/redeployed to serve the East Asia-to-U.S. East Coast route.

Ship cascading effectively increases shipping capacity across shipping lines. From March 2020 to March 2021, there was a 2.5% year-over-year increase in total liner capacity.[10] This fleet growth, combined with ship capacity increases, is essential to help match global growth trends. Given the current market upcycle, this period of increased orders will strengthen the supply/demand balance for carriers.

The size of ships is a critical consideration for service routing and frequency, often dictating which routes are feasible and most profitable. However, other factors such as source production, market destination, and political agreements can dramatically shift trade route patterns, directly influencing to what extent ship cascading occurs.

2.2 World Trade Patterns

As production and consumption trends shift, trade patterns will also need to change to meet supply and demand. These routing decisions are usually based on finding the shortest, most direct route from origin to destination. As noted, more than 80% of international trade in goods from production to consumption moves by sea, and much of this traffic is concentrated on a few key routes. The Asia to Europe is the major global trade route, which is where the largest container ships are primarily deployed, followed by Asia to North America and then North America to Europe. These routes often rely on larger ships, but there are limitations on the Asia to North America routes, particularly the accessibility and capacity of U.S. East Coast ports to support larger ships.

[10] Alphaliner. (2021). Monthly Monitor March 2021.

DRAFT

Over time, the volume and value of goods traded along these routes have changed. Notably, trade between the United States and China has decreased dramatically due to U.S.-China trade tensions as well as North American manufacturers' decision to shift their sources of production to Southeast Asia and India. Shifts in trade routes from 2015 to 2019 are documented in Figure 10[11] below.

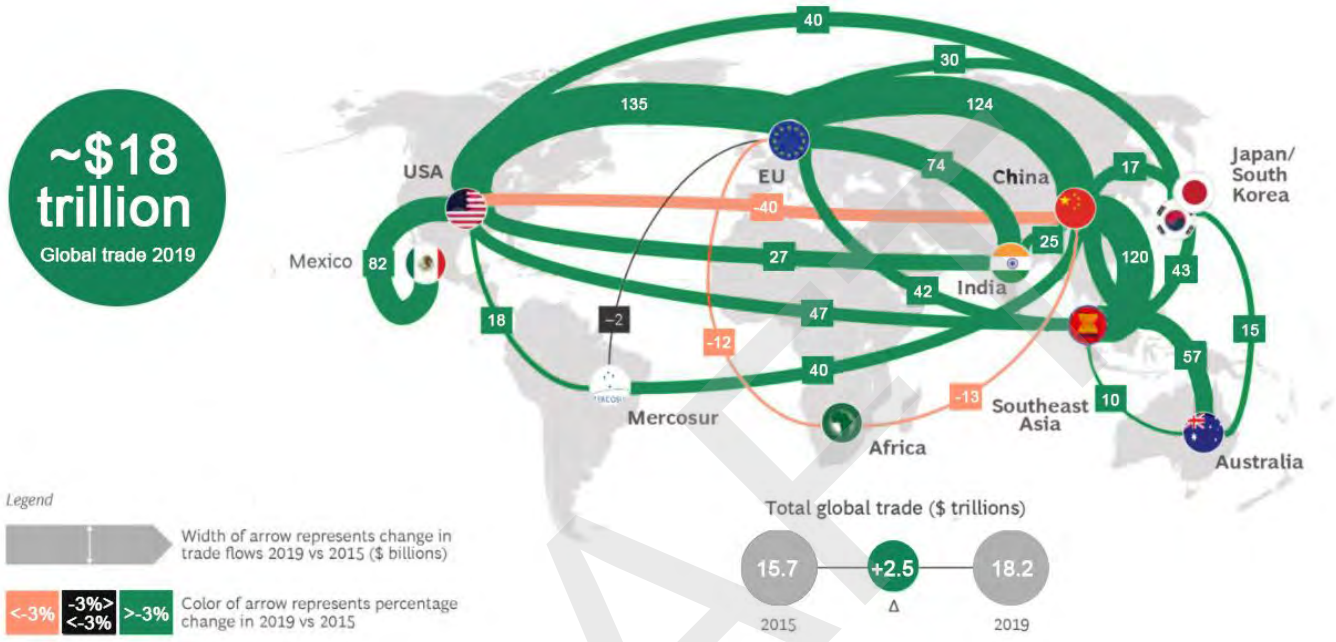


Figure 10. Changes in Volumes of Traded Goods, 2015-2019

2.2.1 Panama and Suez Canals

Trade flows are also dictated by the capacities of the Suez and Panama canals, which are pinch points in the network between Europe, Asia, and North America. The canals' increasing capacities have allowed larger ships and therefore larger volumes of cargo to flow through these routes. However, the canals still have limitations, which is why the Europe-to-U.S. East Coast and Asia-to-U.S. West Coast routes are more attractive for customers as they offer direct service without having to go through either canal.

Routing between the Suez or Panama Canal is a calculated decision based on manufacturing source and market destination. In Asia, there is an invisible line that exists somewhere between Hong Kong and Vietnam. South of that line, the mileage to New York is shorter via the Suez Canal. North of the line, the Panama route provides the shortest distance.[12] Manufacturing is moving farther south, making routes via the Suez Canal more efficient than those through the Panama Canal. The nearly unrestricted capacity of the Suez Canal means that larger ships can arrive more directly to the U.S. East Coast.[13]

[11] https://www.bcg.com/publications/2020/redrawing-the-map-of-global-trade
[12] https://www.joc.com/maritime-news/canal-competition-us-east-coast-cargo-heats_20190620.html
[13] https://www.freightwaves.com/news/what-panama-canal-toll-plan-means-to-shipping-rail-and-trucking

2.2.1.1 Suez Canal

The Suez Canal is one of the most important thoroughfares for shipping, especially between Europe and Asia. Currently, the Al Salam Bridge, or Mubarak Peace Bridge, which spans the canal, has the highest clearance of any other bridge in the world built on a flat land. The bridge's clearance is 230 feet, and its water draft is 66 feet. These dimensions mean that ships of up to 24,000 TEUs can pass through the waterway.[14]

2.2.1.2 Panama Canal

Following its expansion in 2016, the Panama Canal is now able to support ships up to 14,000 TEUs, which is large enough for most Neo-Panamax ships. The expansion, combined with raising the Bayonne Bridge at the Port of New York and New Jersey in 2019, has opened up the U.S. East Coast dramatically to larger ships. The share of larger ships calling on the East Coast increased from just 3 percent in 2017, when the Bayonne Bridge was elevated, to 11 percent in 2019.[15] Still, the Panama Canal cannot support some of the world's largest container ships, so the routes, and thus the ports of call, for these ships are still limited.

2.2.2 Changes in Source Production

Asia, and specifically China, has been a major source for manufacturing intermediate products for decades. Despite growth over time, trends indicate that many manufacturers and importers are looking to other countries such as Vietnam and Mexico to source their goods. Between 2018 and 2020, U.S. imports from Vietnam increased in value by 27% per year. U.S. imports from China dropped significantly by 10% each year during the same period.[16] Changes in U.S. imports origins between 2018 to 2019 are detailed in Figure 11. The search for other production sources came because of the U.S.-China trade war and, due to COVID-19, the potential desire to shorten supply chains and make economic activity increasingly regional versus global.[17] Shifting and more diversified sources of production may affect routing, frequency and volume of deliveries, and the size of necessary ships.

DRAFT

[14] https://www.maritime-executive.com/article/world-s-largest-container-ship-transits-suez-canal
[15] Increasing vessel sizes a red flag for US ports (joc.com)
[16] https://www.mhlnews.com/warehousing/article/21163278/ports-deal-with-growing-pains
[17] https://www.joc.com/maritime-news/container-lines/covid-19-readjusts-%E2%80%98sweet-spot%E2%80%99-container-ships-sizes_20200427.html

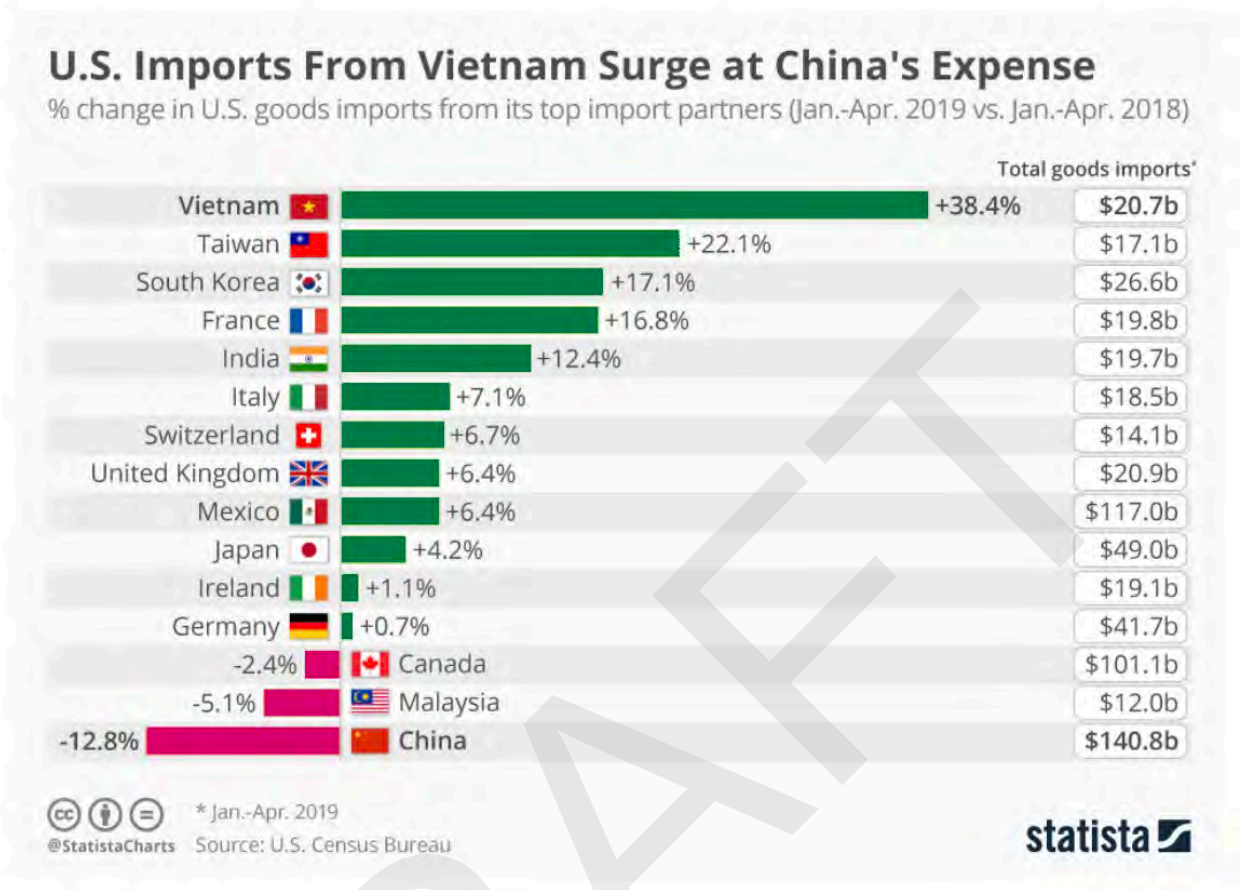


Figure 11. Changes in U.S. Import Origin, 2018-2019[18]

2.2.3 Other Considerations

2.2.3.1 Decarbonization and Desulfurization

In 2018, the International Maritime Organization (IMO) set a goal to reduce greenhouse gas emissions by 50% by 2050 as compared to 2008 levels. In addition to developing carbon-neutral ships, the IMO is weighing a carbon levy to encourage carriers to order more efficient ships.[19] Limiting carbon dioxide (CO2) emissions, coupled with IMO policy limits on sulphur content of fuel, forces ship manufacturers, flag states, carriers, and even ports to invest in equipment and technology to meet these requirements.[20] Flag states are countries under which a ship is registered and whose jurisdiction and laws the ship must follow. Because differing flag states have different environmental standards, international standards encourage consistency but may require more or less action depending on the flag state. In addition to upfront capital costs, carriers may also need to pay higher prices for very low sulphur fuel oil (VLSFO) blends, which are far more costly than traditional heavy fuel oils. Some carriers have turned to liquified natural gas (LNG) as an option. In the first quarter of 2021, there were 16 orders for LNG-fueled container ships totaling 238,872 TEUs.[21] The

[18] https://techpinions.com/tech-manufacturing-moving-out-of-china-at-rapid-rate/56664
[19] https://unctad.org/news/decarbonizing-maritime-transport-estimating-fleet-renewal-trends-based-ship-scrapping-patterns
[20] https://www.imo.org/en/MediaCentre/HotTopics/Pages/Sulphur-2020.aspx
[21] Orders for LNG-Fueled containervessels.pdf

DRAFT

cumulative result is overall higher operating costs for carriers, which may seek shorter, more direct routes to avoid some of these expenses.[22]

2.2.3.2 Climate Change

Climate change has direct implications on the Port of Savannah's infrastructure as extreme weather can reduce the Port's operational efficiency and increase accident risk while compromising inland transportation services, including key rail lines and roadways. Ports are particularly vulnerable to the effects of climate change because of their location along open coasts or in otherwise low-lying areas. Warmer water means there will be more extreme weather events such as hurricanes, which can cause major infrastructure damage and expenses. Rising sea levels contribute to more tidal or "sunny day" flooding, an increasingly common occurrence in which temporary flooding is caused by high-tide flows. These tidal floods can block roadways and rail lines, creating additional dangers and delays.[23]

Savannah has already experienced some effects of climate change such as increased high-tide flooding of US 80 near Fort Pulaski. The Fourth National Climate Assessment in 2018 noted that coastal cities in the Southeast such as Savannah are at particular risk of increasing flood frequencies. Globally, average sea levels are expected to rise by at least several inches over the next 15 years, and coastal infrastructure will be exposed to the effects of relative sea level rise (SLR).[24] These conditions will only become more pronounced as the Earth continues to warm.[25]

DRAFT

[22] Mohamed, H. A., Arof, A. M. (2020) impact of sulfur cap 2020 regulation on the shipping industry.
[23] https://unctad.org/news/climate-change-impacts-seaports-growing-threat-sustainable-trade-and-development
[24] https://www.savannahnow.com/news/20181209/climate-report-offers-look-at-local-effects-happening-now
[25] https://www.savannahnow.com/news/20181209/climate-report-offers-look-at-local-effects-happening-now

2.3 National Trends

Savannah is a major U.S. port and is influenced by a number of national trends. The major national divide is between the West Coast and East Coast ports. Choosing which coast to ship to is often a decision made by carriers, who factor in logistics such as land transportation options. Beyond direct port activities, national trade balances and the economic benefits of TEU growth can have important and widespread benefits for the national economy, meaning that local decisions by top ports such as Savannah can have compounding impacts across the country.

2.3.1 Largest U.S. Ports Based on Volume

Figure 12 summarizes the 10 largest container ports in the United States based on combined import and export volume data for laden containers. Empty containers are not included in this overview. Savannah has been consistently ranked as one of the largest container ports in the U.S., and it is the fastest growing in the nation with an average annual growth of more than 6% over the past decade. Table 2 is a microcosm of that trend, showing Savannah's increasing TEU totals year over year from 2017 to 2020, with a market share of 10% for 2020. From an export perspective, Savannah has the second highest TEU volume and a market share of 11.2%.

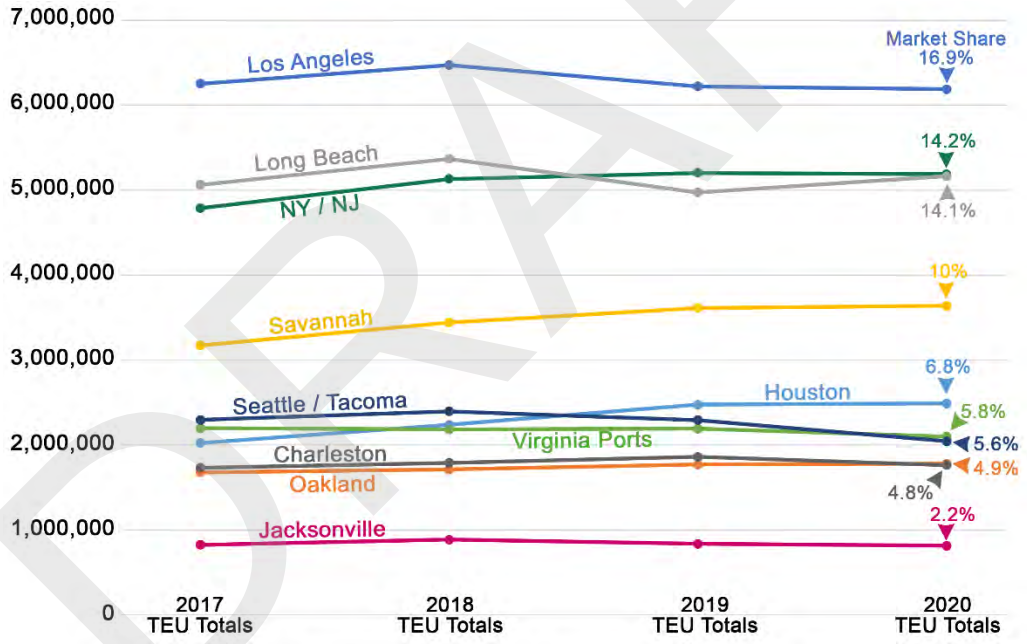


Figure 12. Largest U.S. Ports, measured in Laden TEUs (Excluding Empties)

DRAFT

2.3.2 West vs. East Coast

The West Coast has historically experienced greater trade volumes than the East Coast, as summarized in Table 2. This is due in large part to the close proximity and direct access of the West Coast to Asia, the manufacturing hub of the world.

Table 2. Overview of West and East Coast[26]

Asia to U.S. West Coast						
	2014	2015	2016	2017	2018	2019
Ship Count	314	312	280	250	258	253
Total Deployed TEUs	2,208,536	2,339,185	2,212,439	2,008,466	2,111,700	2,199,634
Avg. Ship Size	7,034	7,497	7,902	8,034	8,185	8,694
Weekly Deployed TEUs	289,125	276,964	265,712	276,758	287,105	272,039
Weekly Allocated TEUs	229,502	226,453	208,213	218,303	224,857	215,951
Number of Services	42	39	36	37	37	34

Asia to U.S. East Coast						
	2014	2015	2016	2017	2018	2019
Ship Count	236	284	218	212	196	209
Total Deployed TEUs	1,355,396	1,650,167	1,541,101	1,668,009	1,698,473	1,821,344
Avg. Ship Size	5,743	5,810	7,069	7,868	8,666	8,715
Weekly Deployed TEUs	117,975	140,666	134,710	147,304	154,399	163,366
Weekly Allocated TEUs	99,649	119,112	114,997	125,986	136,536	143,765
Number of Services	21	25	20	19	18	19

In recent years, freight has been shifting away from the West Coast to the East Coast, as shown in Figure 13. This was made possible by U.S. East Coast ports' investments in capacity to handle larger ships as well as the 2016 expansion of the Panama Canal, which has allowed larger ships to call directly on the East Coast. This means that while carriers may experience slightly longer ocean voyages compared with stopping at ports on the West Coast, these carriers avoid the long, expensive overland trip across the country to meet most markets, which are located on the East Coast. Furthermore, access to major inland cities such as Chicago, St. Louis, and Nashville may also benefit from longer maritime trips but much shorter land trips from the East Coast.

[26] https://www.us.jll.com/en/views/snapshots/industrial-east-cost-ports-continuing-to-see-shipping-growth-4-23-19

DRAFT

These advantages are likely to compound as the East Coast continues to accept larger ships and further invests in inland support infrastructure such as rail and roadways.[27] Other factors for the increasing East Coast share of trade include rising costs of shipping from East Asia/China to the West Coast, which has tripled since 2019.[28] Much of these rising costs are part of persistent supply chain delays because of COVID-19 and the Suez Canal blockage. Shippers are desperate to get their goods to market, even if that means paying inflated prices or taking longer routes. These strains and cost pressures are anticipated to continue into 2022 and beyond.[29] Additionally, the U.S.-China trade war and shifting sources of production make other routes more attractive. [30]

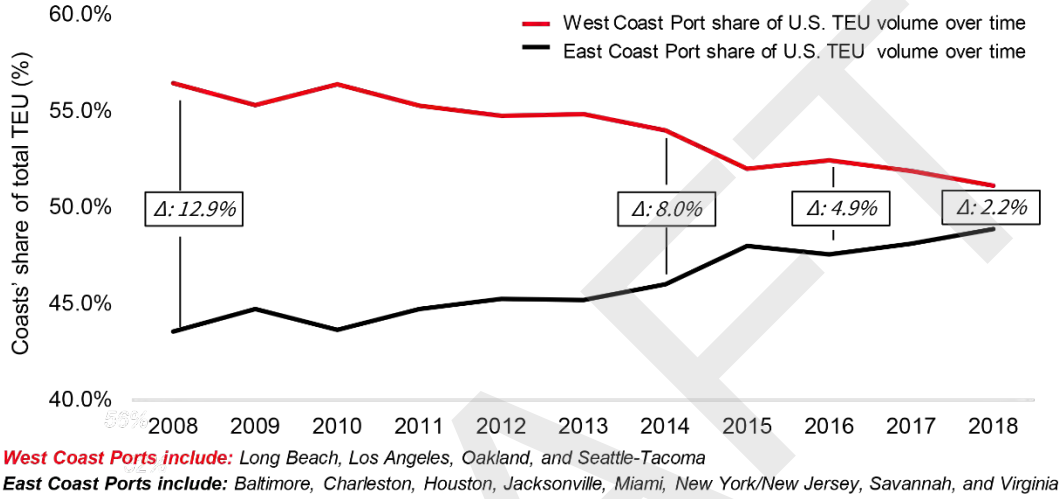


Figure 13. East Coast Takes on Larger Share of Shipping Volume[31]

2.3.3 Jones Act

The Jones Act, formally known as Section 27 of the Merchant Marine Act of 1920, specifies that trade between U.S. ports must use U.S. built and flagged ships with U.S. citizen crews. Ships that do not meet these requirements face strict guidelines limiting their interactions with U.S. ports.[32] The Jones Act most directly affects domestic trade, but there are important implications for international trade and the ports that handle international ships. The strict ship and crew requirements of the Jones Act limit the ports of call for international carriers. The majority of mainline carriers, which make up a large portion of U.S. port activity, operate non-U.S. ships, meaning they are not allowed to load a container in one port and discharge at another port along the U.S. coastline. Carriers must be strategic about the ports they call on, looking for relatively large volumes of both discharge and loading. This creates competition among U.S. ports, which must have both port capacity to accept larger ships with larger volumes of discharge as well as robust export networks to load new containers. Consequently, ports that can accept larger ships and meet the inland support needs for larger volumes of cargo will attract more international carriers.

[27] https://porteconomicsmanagement.org/pemp/contents/part9/port-of-savannah-logistics-cluster/transit-times-shanghai-north-american-routing-options/
[28] https://www.npr.org/sections/money/2021/06/15/1006381735/how-chaos-in-the-shipping-industry-is-choking-the-economy#:~:text=Pop%20Culture-,How%20'Chaos'%20In%20The%20Shipping%20Industry%20Is%20Choking%20The%20Economy,is%20struggling%20to%20keep%20up.
[29] https://www.wsj.com/articles/container-ship-prices-skyrocket-as-rush-to-move-goods-picks-up-11625482800
[30] Desormeaux, H. (2019). Choosing the Right U.S. Coast from Asia. *BlueWater Reporting*.
[31] https://www.us.jll.com/en/views/snapshots/industrial-east-cost-ports-continuing-to-see-shipping-growth-4-23-19
[32] https://fas.org/sgp/crs/misc/R45725.pdf

3 EXISTING AND FUTURE CONDITIONS

3.1 Data Collection

The data sets collected for the comprehensive assessment of existing and future conditions and potential alternatives include transportation and traffic-related data, information specific to the existing Talmadge Memorial Bridge and Savannah River channel, Port of Savannah-related activities and economic data, and environmental resources data. Environmental resources data encompasses natural, cultural, and community resources as well as environmental justice populations. Previous studies and projects as well as relevant articles will also be included for reference. These data sets are illustrated in Figure 14. and described in the following sections. A summary table of all data is found in Appendix O.



Figure 14. Data Sets

3.2 Physical Conditions

The Physical Conditions section looks at the Talmadge Memorial Bridge and Savannah River within the study area. The current conditions are mainly defined by the state of the existing bridge, Back River Bridge, and Savannah River. The future requirements are related to the potential structural parameters needed to support the proposed alternatives. The proposed needs look ahead at the growing needs of the Port of Savannah and connectivity within and beyond the study area.

3.2.1 Bridge Assessment

The bridge assessment is based on a variety of technical documents that speak to the structural condition of the Talmadge Memorial Bridge and surrounding infrastructure. It's important to note that the Back River Bridge, connecting Hutchinson Island with South Carolina, although not the focus of the Savannah River Crossing Feasibility Study, could be impacted by a potential new Savannah River crossing. The future requirements section is based on the goals and vision for the region and how best to support them through future investments.

DRAFT

3.2.1.1 Existing Conditions of the Talmadge Memorial Bridge

The Talmadge Memorial Bridge is an iconic feature of the Savannah skyline. Built in 1991, the bridge spans 1.9 miles and connects US 17 across the Savannah River from Downtown Savannah to Hutchinson Island, which then connects to South Carolina via the Back River Bridge. The Talmadge Memorial bridge is a twin-pylon, cable-stayed bridge that is primarily concrete. It carries two lanes in each direction with a 10-foot shoulder on the outside and a barrier in the middle. There are no sidewalks or other infrastructure for cyclists or pedestrians. Based on a 2020 inspection by GDOT, the bridge deck, superstructure, and substructure are in Satisfactory Condition. This means the bridge is sound with structural elements showing minor deterioration.

The dimensions of the Talmadge Memorial Bridge limit the size of ships that can pass under it. The bridge has 185 feet of bridge clearance, or the distance from the mean high water elevation to the underside of the bridge. The navigational opening, which is generally understood as the area under which a ship can safely pass, is 185 feet high by 500 feet wide. Figure 15 illustrates the current vertical envelope for ships with capacities of 16,000 TEUs and 24,000 TEUs to show the opportunities and limitations, respectively, of the current bridge dimensions. Based on its analysis and findings, the Study Team will recommend improvement alternatives to the existing river crossing that achieves the following:

1. **Allows access for larger ships up to 23,000 twenty-foot equivalent units (TEUs):** Given its bridge clearance limitations, the Talmadge Memorial Bridge effectively restricts the size of ships that can safely navigate beneath the bridge to access the Port of Savannah.
2. **Improves the operational efficiency for ships between 12,000 and 17,000 TEUs that currently call on the Port:** As of May 2021, the largest ship to call on the Port was the CMA CGM Marco Polo at more than 16,000 TEUs. The passage of such ships depends on a delicate balance between the bridge's clearance, ship loads, and tidal fluctuations. A larger bridge clearance would create larger windows of time for these ships to arrive and depart, allowing more flexibility in operations.

In Summer 2022, the Georgia DOT initiated a bridge maintenance project to replace some of the existing cables. As part of that project, GDOT will investigate the possibility of providing an interim, incremental improvement to the vertical clearance under the Talmadge Memorial Bridge. This interim project will investigate modifying the cables to elevate the existing bridge. The height that the bridge can be raised is unknown at this time but is expected to be no more than 10 feet. This interim project will not meet the long-term vertical clearance requirements as outlined in this study.

DRAFT

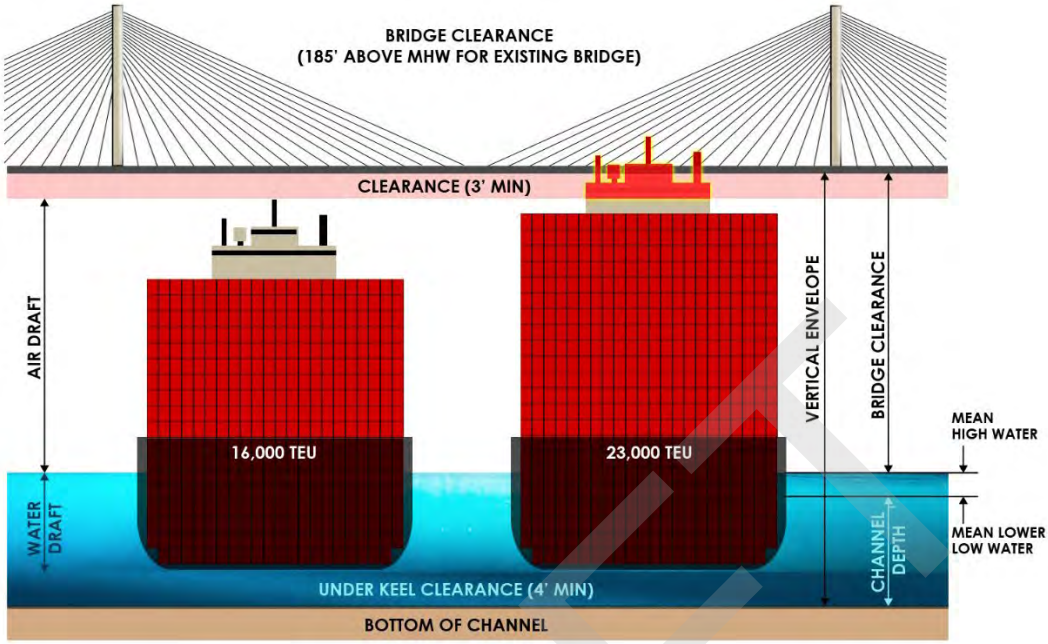


Figure 15. Current Vertical Envelope of the Talmadge Memorial Bridge

3.2.1.1.1 Bridge Connections

The Talmadge Memorial Bridge is a critical connection point from Downtown Savannah to Hutchinson Island. From Savannah, the bridge can be accessed via interchanges at Louisville Road and West Oglethorpe Avenue. There is another interchange on Hutchinson Island at the Savannah Harbor Parkway. There are no current plans to change these access points, and the proposed alternatives would likely maintain these connections except for the one at Oglethorpe Avenue.

3.2.1.1.2 Back River Bridge

The Back River Bridge, also known as the Little Back River Bridge, is the continuation of US 17 from Hutchinson Island to South Carolina. Built in 2015, it is 3,290 feet long and made of concrete. The bridge carries two lanes of traffic, one in each direction, with shoulders on each side. Like the Talmadge Memorial Bridge, the Back River Bridge has no sidewalks or bike accommodations. A 2020 inspection by GDOT indicates that the bridge is in Good Condition, and the superstructure and substructure are in Very Good Condition. GDOT and the South Carolina Department of Transportation (SCDOT) are working in partnership to develop two additional lanes on a new parallel Back River Bridge at the SR 404 Spur/US 17. Design started in early 2021. The project aims to improve safety and traffic flow following increased economic growth in the area.

3.2.1.1.3 Geotechnical Conditions

The Study Team conducted a review of the historical boring data and performed two new borings near the project site to assess the suitability of the soil and rock for the alternatives under development. The findings did not preclude any of the alternatives. The full report outlining the findings and preliminary recommendations can be found in Appendix F.

DRAFT

3.2.1.2 Future Requirements for a New Savannah River Crossing

A new Savannah River crossing should improve the economic viability of the Port of Savannah without compromising regional connectivity. The physical requirements of a new Savannah River crossing could vary depending on the final recommended alternative for implementation.

3.2.1.2.1 Connectivity Considerations

The Port of Savannah consists of two modern deepwater terminals: Ocean Terminal and Garden City Terminal, located upstream from the existing Talmadge Memorial Bridge. The current bridge, by way of US 17, is a critical vehicle thoroughfare, connecting Downtown Savannah, Hutchinson Island, and South Carolina (via the Back River Bridge). Currently, the Talmadge Memorial Bridge is the only direct connection for these three destinations, making the bridge an essential mobility asset in the regional transportation network. The connection to Hutchinson Island is especially important given its ongoing development – including plans for a massive mixed-use complex that would contain a significant number of retail and residential properties – as well as a planned Port expansion on the island. Any alternative to remove the Savannah River crossing at its current connection point would involve a long detour to Hutchinson Island. Given these considerations, a new Savannah River crossing must provide adequate access to Downtown Savannah, Hutchinson Island, and South Carolina.

3.2.1.2.2 Bridge Alternative Requirements

Any proposed alternatives that maintain a bridge component must include certain design and construction considerations to meet the conditions, needs, and goals for a new Savannah River crossing. One important consideration is access to the Port of Savannah. As the Port seeks to maintain, if not improve, its global competitiveness, development of other ports must be considered. The two most relevant global reference points are the Bayonne Bridge at the Port of New York/New Jersey and the Mubarak Peace Bridge, which spans the Suez Canal. With vertical clearances of 215 feet and 230 feet, respectively, these bridges set international parameters for globally competitive port infrastructure. A clearance less than the Bayonne Bridge's will be a limiting factor to ever-increasing ship sizes. A clearance greater than 230 feet may offer more flexibility in capacity than what Savannah could reasonably expect. Differing channel depths and variable tide patterns are also worth noting, as a 215-foot clearance in Savannah is not equivalent in terms of ship accessibility to the 215-foot clearance at the Bayonne Bridge, as shown in Table 3. To meet the clearance equivalencies, the actual bridge clearance may need a slight adjustment.

Table 3. Clearance Comparisons of Bayonne Bridge vs. Talmadge Memorial Bridge

Dimension	Bayonne Bridge (Port of NY/NJ)	Existing Talmadge Memorial Bridge	New Savannah River crossing
Navigation Channel	Kill van Kull Strait	Savannah River	Savannah River
Bridge Clearance (high tide)	215 ft	185 ft	230 ft
Tidal Fluctuation	~5 ft	~7 ft	~7 ft
Channel Depth (low tide)	51 ft	47 ft	47 ft
Total Vertical Envelope	**271 ft**	**239 ft**	**284 ft**

DRAFT

3.2.1.2.3 Tunnel Alternative Profile

Another option is to remove the clearance limitations of the existing bridge with a tunnel option. Figure 16 shows the initial profile view of the tunnel alternative, with portal locations and existing cross streets for reference. Current conceptual layouts expect to tie into the Back River Bridge vertically and horizontally.

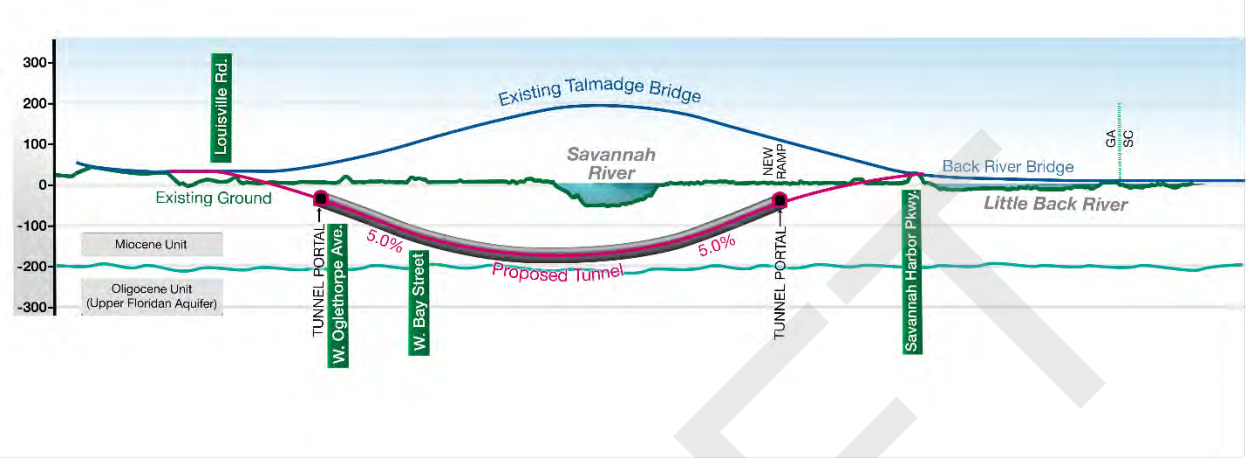


Figure 16. Proposed Tunnel Profile

Figure 17 shows one potential cross section for a tunnel option. It is currently designed to sit 50 feet below the bottom of the channel with two separate tunnels, each carrying two lanes of traffic plus a wide shoulder. The two tunnels will be periodically connected to allow for emergency access and egress. This cross section is one design iteration for a tunnel option, and continued refinement of needs, objectives, and parameters may alter final design specifications.

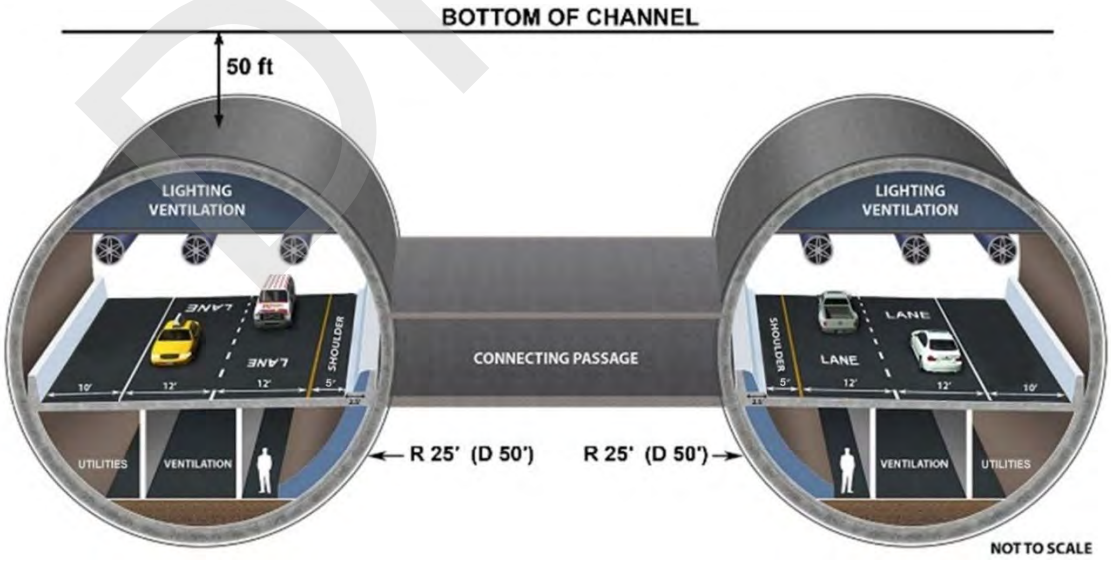


Figure 17. Potential Design for Tunnel Option

DRAFT

Another requirement for a tunnel alternative is the possibility of future deepening of the channel to 55 feet plus 2 feet over dredge. The current final depth after the SHEP is 47 feet plus 2 feet.

3.2.2 Roadway Network Assessment

The roadway network assessment is based on a variety of data sources that examine existing conditions of the roadway infrastructure within the study area. This section will review the functional classification status of each surrounding road and identify roadway features such as the number of through lanes. Future conditions should maintain the classification and number of lanes described below. Table 4 lists the design criteria for the bridge and tunnel alternatives.

Table 4. Design Criteria for Bridge and Tunnel alternatives

	Bridge	Tunnel
Design speed main line	50 mph	50 mph
Design Speed Ramps	35 mph	35 mph
Design Speed Loop Ramps	30 mph	30 mph
Lanes	4 lanes	4 lanes
Max Grade	5.5%	5.0%
Max Super Elevation Rate main line	6%	6%
Max Super Elevation Rate Ramps	10%	10%
Inside Shoulder Mainline	10’	10’
Outside Shoulder Mainline	12’	12’
Inside Shoulder Ramps	4’	4’
Outside Shoulder Ramps	10’	10’
Tunnel Diameter	N/A	50’
Minimum Tunnel Cover	N/A	50’
Bridge Clearance	230’	N/A

3.2.2.1 Functional Classification

Functional classification (FC) is the system by which streets and highways are grouped into classes or systems according to the character of traffic service that they are intended to provide. FC is important because it establishes the functional role of a roadway in serving local trips versus longer distance travel and the volume of traffic to be accommodated. It also influences roadway design characteristics as it relates to the degree of access to adjacent land and the development patterns/growth patterns along a corridor. The current FC for US 17 on the Talmadge Memorial Bridge is a principal arterial. Figure 18 highlights the functional classification of other roadways within the study area.

DRAFT

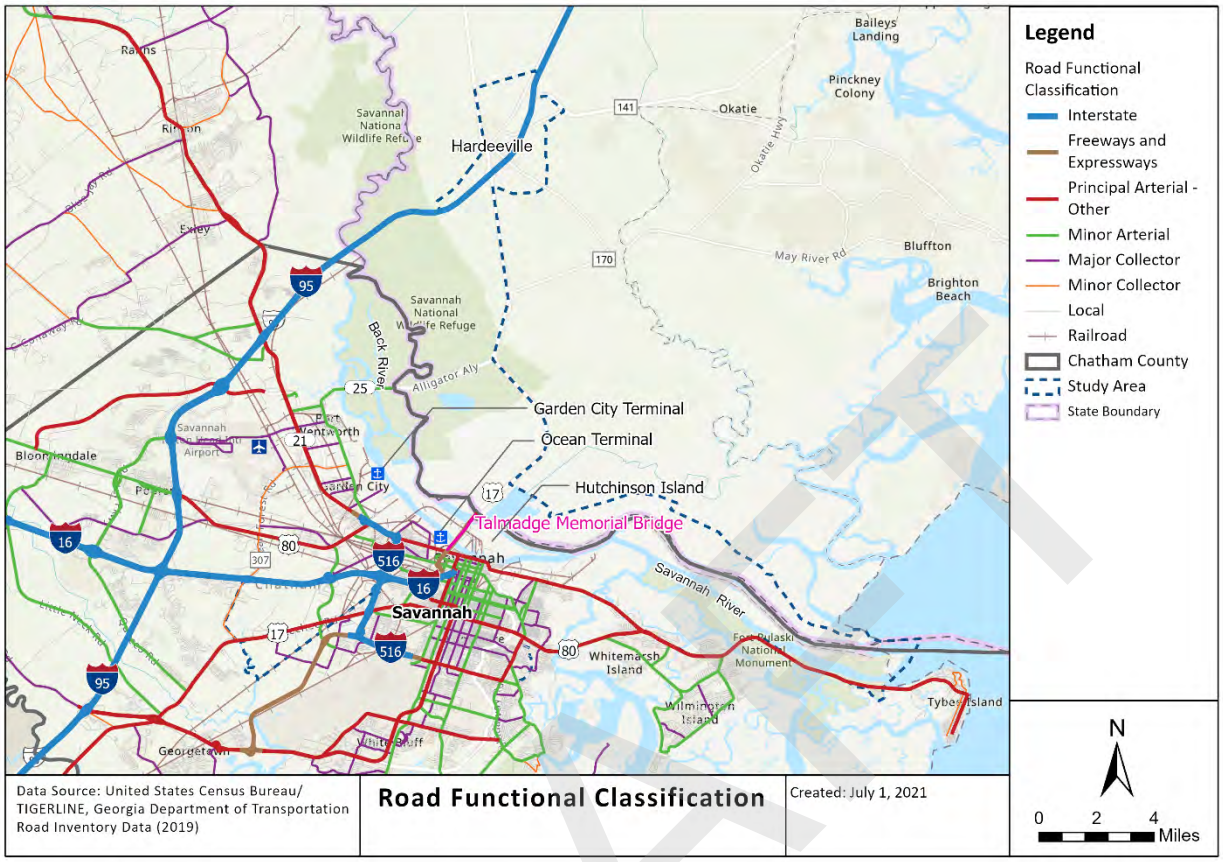


Figure 18. Road Functional Classification

3.2.2.2 Road Features: Number of Lanes

Roadway features are the characteristics that can be attached to a roadway. Figure 19 shows the number of through lanes for roadways throughout the study area. Future roadway conditions should maintain the number of through lanes, if possible, to limit traffic flow disruption.

DRAFT

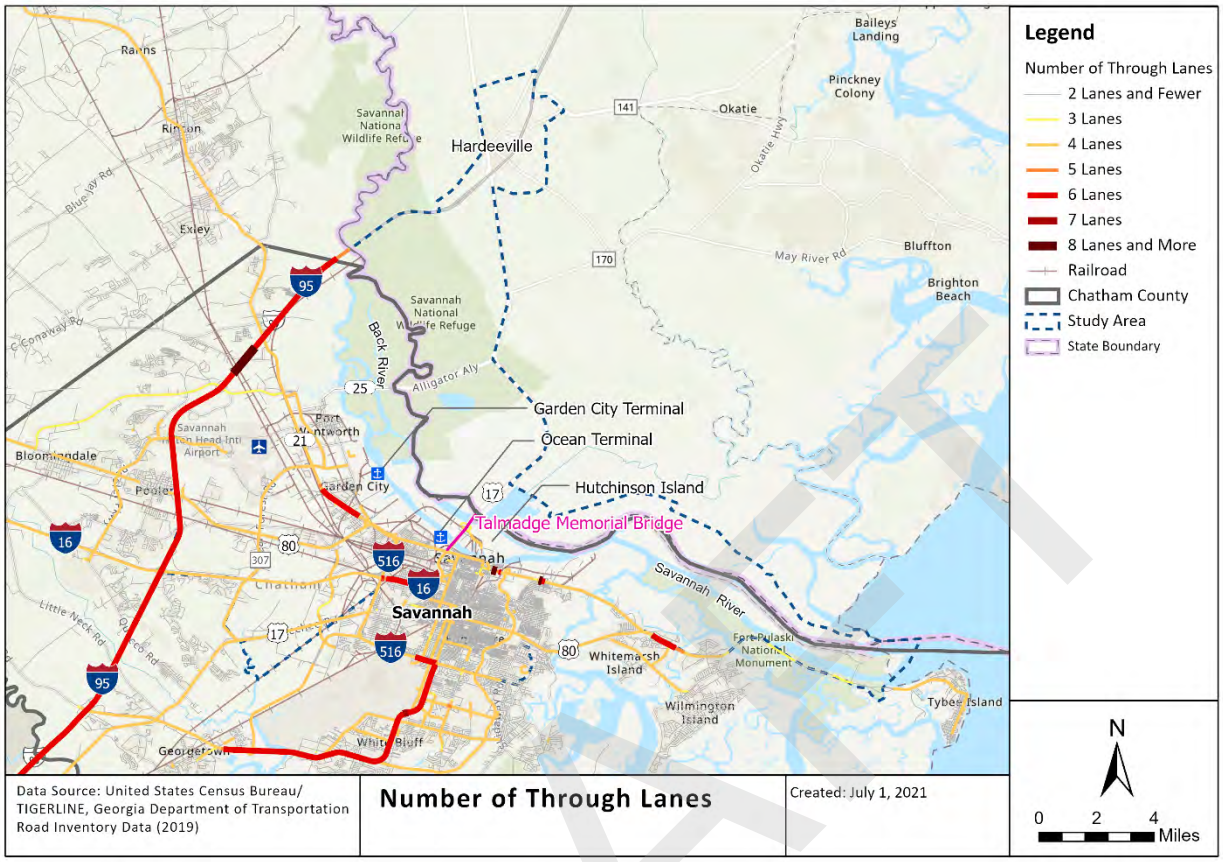


Figure 19. Number of Through Lanes in Study Area

3.2.2.3 Restrictions of Commercial Vehicle Use in the City of Savannah

The City of Savannah has enacted regulations on large commercial vehicles utilizing certain streets within the downtown area. This area is largely comprised of the Savannah Historic District, which contains more than 20 city squares of museums, mansions, monuments, and more. The regulations are intended to preserve the architecturally significant infrastructure, protect the historic tree canopy, reduce hazardous traffic conditions, and promote the general health, safety, and welfare of Savannah's residents and visitors. According to Savannah's Code of Ordinances, it is unlawful for a driver of any truck, wagon, or other commercial vehicle that exceeds 10,000 pounds of gross vehicle weight (GVW) to use certain streets[33], including Augusta Avenue from Graham Street to East Lathrop Avenue as well as Bull Street between Broughton and Gaston streets.

[33] The full list of streets is listed in Section 215, Appendix I - Traffic Regulations in the Code of Ordinances, Savannah, Georgia. http://online.encodeplus.com/regs/savannah-ga/doc-viewer.aspx?secid=3789&keywords=commercial%27s%2Ccommercials%2Ccommercials%27%2Ccommercial%2Cvehicle%27s%2Cvehicles%2Cvehicles%27%2Cvehicle#tocid-001.004.011.019

3.2.3 River Assessment

The Savannah River is a critical asset for Savannah and provides benefits far beyond the immediate study area. In particular, the river is a major economic thoroughfare for the region, connecting the Southeast to the Atlantic Ocean and the rest of the world.

3.2.3.1 Existing Conditions of the Savannah River

The Savannah River itself naturally shapes the opportunities for future development. Currently, the Savannah River at the location of the Talmadge Memorial Bridge is approximately 900 feet bank-to-bank with a 500-foot navigation channel and an 1,800-foot turning basin upstream near Garden Terminal. This turning basin is a one-way canal, prohibiting larger ships from passing one another and likely resulting in additional wait times for ships.

As indicated, the SHEP, a U.S. Army Corps of Engineers (USACE) project, deepened the Savannah Harbor shipping canal to 47 feet with a 2-foot over dredge. The SHEP dredged a 32-mile stretch, extending the channel 8 miles farther into the Atlantic Ocean and continuing inland past the Port of Savannah and Garden City Terminal. For the inner harbor, the SHEP has improved navigability and expanded the Kings Island Turning Basin[34]. The project was completed in Q1 of 2022.

The Floridan aquifer system, the primary source of drinking water for almost 10 million people, spans an area of about 100,000 square miles in the southeastern United States and runs under the Savannah River.[35] The location of the aquifer system should be considered when examining improvement alternatives.

The Port of Savannah is a tidal port, meaning the water levels of the Savannah River (and therefore the bridge clearance) are subject to changing tides. If a port's tidal window is missed and restrictions are placed for shallow water navigation, it could delay a ship's itinerary up to 12 hours as it waits for the next tide to enter or depart from a port. This delay could also ripple through the ship's long-term schedule, affecting its other ports of call.

3.2.3.2 Future Assessment of the Savannah River's Navigability

At a certain point, the water draft of the Savannah River may also become a limiting factor to the size of ships that can traverse the river to access the Port. The SHEP channel deepening, while important, will merely make Savannah harbor and the associated shipping channel on par with the depths of competing ports. To maintain the Port of Savannah's competitive edge as ships continue to grow and other ports also invest in their infrastructure, potential plans could further deepen the channel to 55 feet with a 2-foot over dredge. Although these plans are speculative, they are important to consider as alternatives such as a tunnel will need to be designed to not limit future channel deepening efforts.

Beyond ensuring adequate channel depth, wider ships also require larger turning spaces. Although the current channel width does not pose any obstacles given the relative limitations of the air and water drafts, any channel investments to further accommodate larger ships may need to consider the channel width as another dimension.

[34] https://www.sas.usace.army.mil/Missions/Civil-Works/Savannah-Harbor-Expansion/
[35] https://pubs.usgs.gov/ha/ha730/ch_g/G-text6.html

DRAFT

3.2.4 Existing Topography

The Study Team obtained aerial imagery and lidar of the study area. This three-dimensional survey aided the team in understanding the project area and preparing visualizations of the alternatives. This data will be very important in future preliminary design of the preferred alternative.

3.2.5 Physical Needs Summary

The Port of Savannah continues to experience record-setting increases in container volume, and it provides broad economic benefits to Savannah and the surrounding region. However, the Talmadge Memorial Bridge's existing clearance limitations may hinder this development by reducing the Port's competitiveness, particularly as an ever-larger fleet of ships seeks to navigate the Savannah River to access the Port. The Talmadge Memorial Bridge, by way of US 17, is also a critical vehicle thoroughfare, connecting Downtown Savannah, Hutchinson Island, and South Carolina. This already-critical route may prove even more significant as development and Port expansion are planned on Hutchinson Island.

Addressing the existing Savannah River crossing with one of several potential alternatives should improve the economic viability of the Port without compromising regional connectivity. Other considerations include the Back River Bridge and the navigability of the Savannah River. Like the Talmadge Memorial Bridge, the Back River Bridge is a structurally sound bridge that is an important connector. Major changes to the existing Savannah River crossing such as a new location will need to factor in the implications to the Back River Bridge. Similarly, the physical and environmental constraints of the Savannah River may set additional development parameters that will need to be accounted for in each proposed alternative.

Table 5. Summary of Physical Needs

Physical Needs
Address the existing **clearance** of the Talmadge Memorial Bridge, which limits the size of ships that can safely navigate the Savannah River to access the Port
Maintain a Savannah River crossing to connect Downtown Savannah, Hutchinson Island, and South Carolina via US 17
Align the design of a new river crossing to the planned expansion of the Back River Bridge where possible
Meet the needs of travelers within and around the study area identified by the functional classification and characteristics of the roadway system

3.3 Economic Conditions

This section summarizes the Economic Needs Assessment. The main purpose of the Economic Needs Assessment is to identify the need and economic justification for an alternative to the existing Savannah River crossing. Two additional goals of the Economic Needs Assessment are to define the Port's future market outlook and provide a baseline for the alternatives analysis.

The actions of the Port of Savannah influence and are influenced by much larger trends in the shipping industry. To fully capture these dynamics, the Economic Needs Assessment looks at the economic context of the Port of Savannah from international, national, regional, and local perspectives. However, for the purpose of this more localized Existing and Future Conditions and Needs Assessment, the Study Team

DRAFT

included only sections that detail activities in Savannah. Economic conditions inform the market outlook, and the outlook leads to a range of growth scenarios in the economic modeling and cost-benefit analysis for the proposed alternatives for the Savannah River crossing.

There are several key economic needs for a new Savannah River crossing as it relates to the Port of Savannah. The Port is a major economic engine for the study area and beyond. Along with the Port of Brunswick, the Port of Savannah supports more than 560,000 jobs throughout the state each year and contributes $33 billion in income, $140 billion in revenue, and $3.8 billion in state and local taxes to Georgia's economy.[36] Investments in the Port yield positive returns that provide benefits across the state, and the Port continues to experience growing TEU volumes and ship sizes. Savannah's employment forecast is expected to increase by 3.6 percent (more than double the state and four times more than the gain projected for the nation). This is in part due to recent and proposed infrastructure projects at the Port, resulting in much higher container traffic.[37]

The Port's growth and subsequent positive impacts are on track to continue, notwithstanding the bridge's existing clearance limitations. A new Savannah River crossing should avoid constraining future growth of Port activities, be sensitive to other plans and projects in the area and have an alignment that complements other developments to the extent possible.

3.3.1 Economic Impact of the Port

In addition to its direct effects of employment and investment, the Port of Savannah is a logistics hub for the East Coast, stimulating economic activity within and beyond the study area.

3.3.1.1 Current

The Port of Savannah is the fourth largest container port in the U.S. and the second largest on the East Coast.[38] The direct and indirect effects of the Port's economic activity have important implications within the immediate study area as well as compounding effects on Georgia's robust logistics and shipping industry. Activity from Georgia's deepwater ports, which is mainly the Port of Savannah, made up 11% of Georgia's total sales, 8% of Georgia's total GDP, and 10% of Georgia's total employment in FY2019. Each of these areas has positive economic multipliers, indicating that an investment in the Port of Savannah will yield positive rates of return in each area and benefit Georgians across the state.[39]

3.3.1.2 Future

The Port of Savannah is the fastest-growing container port in the U.S, and it continues to meet and exceed projected TEU volumes, as discussed in more detail below. Given the rate of investment and growth in capacity, the Port is on track to continue these trends and play an integral role for economic activity not just within the study area, but also Georgia, South Carolina, and beyond.

[36] Economic Impact FY2021 (dcatalog.com)
[37] Selig Center Publications (uga.edu)
[38] https://container-news.com/top-10-the-busiest-container-ports-in-the-united-states/
[39] Humphreys, J. M (2020). The Economic Impact of Georgia's Deepwater Ports on Georgia's Economy in FY 2019. *Selig Center for Economic Growth, The University of Georgia.*

DRAFT

3.3.2 TEU Volumes

3.3.2.1 Current

In FY2021, the Port moved 5.3 million TEUs, a 15% growth from 2020 volumes.[40] This growth far exceeded the Port volumes anticipated in the U.S. Army Corps of Engineers' 2012 SHEP projections, and it came despite complications and slowdowns from COVID-19. Since 2017, Savannah has consistently surpassed the projected volumes, as shown in Table 6.

Table 6. Predicted Versus Actual TEUs Handled at the Port of Savannah

Year	Predicted TEUs (SHEP Estimate)	Actual TEUs
2030	6.5 million	-
2025	5.0 million	-
2021	4.3 million	5.3 million
2020	4.1 million	4.6 million
2019	4.0 million	4.5 million
2018	3.8 million	4.2 million
2017	3.7 million	3.9 million
2016	3.6 million	3.6 million
2015	3.5 million	3.5 million

3.3.2.2 Future

The Port of Savannah is on track to far exceed the SHEP TEU volume projections, a result of industry trends, infrastructure investments in the Port's capacity, and accelerated growth in Georgia and the rest of the Southeast. Historically, West Coast ports provided the most direct access to Asian production hubs, offered more capacity to support larger ships, and delivered better land connectivity and support services to move products to market more quickly. However, the expansion of the Panama Canal in 2016, coupled with East Coast port investments in infrastructure to support larger ships, has shifted carrier demand away from the West Coast to the East Coast.

Also helping fuel the Port's increasing volumes is the Southeast's economic and population growth over the past few decades. Georgia's economy is the second largest in the South (behind Florida), with a gross domestic product (GDP) increasing from $430.7 billion in 2010 to roughly $533.6 billion in 2020, or almost 24%.[8] In addition, Georgia has consistently ranked the Top State for Business by the publication Area Development based on the state's logistics infrastructure, favorable tax incentives, access to capital and project funding, and competitive labor environment, among other benefits.[9]

Taken together, these factors contribute to an increasing number of larger ships calling on the Port of Savannah. In preparation, GPA has invested in expanding the Port's capacity. In a recent press release, GPA approved an increase in the Garden City Terminal's annual berth capacity by an estimated 1 million

[40] https://gaports.com/press-releases/port-of-savannah-moves-5m-teus/
[8] https://www.forbes.com/sites/andrewdepietro/2021/08/04/2021-us-states-by-gdp-and-which-states-have-experienced-the-biggest-growth/?sh=3d2f3d29846c
[9] https://gaports.com/press-releases/gpa-makes-major-infrastructure-investment/
[10] https://gaports.com/press-releases/gpa-makes-major-infrastructure-investment/
[11] www.joc.com/port-news/us-ports/port-new-york-and-new-jersey/ny-nj-port-handling-larger-ships-bigger-payloads_20190514.html

DRAFT

TEUs, bringing it to 6 million TEUs in total capacity by June 2023.[10] GPA will also expand other Port of Savannah facilities and open a new terminal on Hutchinson Island to increase total annual capacity to 11 million TEUs by 2030. These capacity investments, combined with increasing demand, suggest that Savannah will continue to exceed current TEU volume projections.

3.3.3 Ship Use

3.3.3.1 Current

The Port of Savannah has seen increasingly larger ships over time. In May 2021, the CMA CGM Marco Polo called on the Port. At more than 16,000 TEUs, it is the largest ship to call on the East Coast. Larger ships are making up an increasingly greater proportion of ship fleets – fuelled mostly by carriers seeking to maximize economies of scale. Many of these ships are more than 20,000 TEUs and already far exceed the parameters to safely navigate the Savannah River to access the Port. Ships like the Marco Polo were able to call on the Port within a small window under ideal tidal conditions – in this case, during low tide on May 26 – and a ship load of 6,000 containers.[41] Like other ports, Savannah has invested in port infrastructure to accommodate larger ships.

3.3.3.2 Future

There is little to suggest any slowdown in the move toward larger ships. Despite rising handling and support costs, larger ships still maintain the benefits of fuel efficiency and lower overall operating costs; consequently, carriers are actively investing in larger ships with their orders for future fleets. As a result, ports that can accommodate these larger ships will likely see increased activity, and those unable to support them will be less competitive. This trend is evident in the observed change at the Port of New York/New Jersey since the improvement of the clearance under the Bayonne Bridge. In 2017, prior to elevating the roadway to improve the bridge clearance, approximately 0.9% of the ships calling on the Port of New York/New Jersey were greater than 13,000 TEUs; as of 2019, that number had increased to 22.7%.[12]

3.3.4 Projects

The Port of Savannah has several ongoing and planned projects, so any recommended alternative to the existing Savannah River crossing should be carefully coordinated to avoid conflicts and maximize benefits.

3.3.4.1 Ongoing

A number of ongoing projects and investments directly benefit the Port while others support the shipping industry more broadly. GPA has begun renovations on the Ocean Terminal, and it is in the beginning stages of reconstructing and realigning Berth 1 of the Garden City Terminal. Also, as discussed in previous sections, the SHEP was completed in early 2022. The project cost was estimated at $973 million, but projected net annual benefits top $282 million. For every $1 investment in the SHEP, the nation can expect a $7.30 return.[13] Lastly, GPA has invested $218 million as part of the Mason Mega Rail Project. Opened

[12] https://www.usharbors.com/harbor/georgia/savannah-ga/tides/?tide=2021-06#monthly-tide-chart
[13] https://www.savannahnow.com/business/20190930/deepening-begins-for-inner-savannah-harbor

DRAFT

November 12, 2021, the 18 additional rail tracks increase Savannah's intermodal capacity by more than 30%, allowing them to move freight more quickly.[42]

3.3.4.2 Planned

In addition to the immediate Port projects, there are proposed developments underway within the study area and surrounding communities, most notably the construction of the Savannah Container Terminal on Hutchinson Island. The new facility will be nearly 200 acres with a capacity of 2.5 million TEUs when completed.[14] Another long-term potential development that could impact the study area is the Jasper Ocean Terminal (JOT). The JOT project is designed as a $5 billion seaport that would begin operation after the Charleston and Savannah ports reach capacity. This project is expected to be a major economic driver for the Southeast – having the capacity to transfer 8 million 20-foot cargo containers a year. Plans call for the terminal to be an evenly split joint venture between the GPA and South Carolina Ports Authority. Construction is not anticipated to start until at least 2035.[15]

Other plans directly related to the study area and surrounding communities include the Coastal Region Metropolitan Planning Organization (CORE MPO) Metropolitan Transportation Plan (MTP) (2019), CORE MPO Freight Study-Freight Transportation Plan Phase II (2015), CORE MPO Congestion Management Process (2017), CORE MPO SR 307 Corridor Study (Underway), CORE MPO SR 21 Corridor Study (Underway), Chatham County-Savannah Comprehensive Plan (2016), City of Garden City Comprehensive Plan (2016), City of Port Wentworth Comprehensive Plan (2016), and GDOT Bike-Walk Coastal (2020). Given Savannah's critical role in the transportation, shipping, and logistics industries, broader state and federal plans are also relevant. Such plans include GDOT's Freight and Logistics Plan for Rail (2018) and GDOT's State Rail Plan (2021).

The Study Team also received information from the City of Savannah regarding other developments in the study area, shown in Figure 20.

DRAFT

[42] https://www.railwayage.com/intermodal/georgia-ports-mega-rail-project-marks-milestone/
[14] https://gaports.com/press-releases/gpa-unveils-major-expansions/
[15] https://www.constructionequipmentguide.com/georgia-wants-time-to-analyze-5b-jasper-ocean-terminal-deal-with-south-carolina/53636

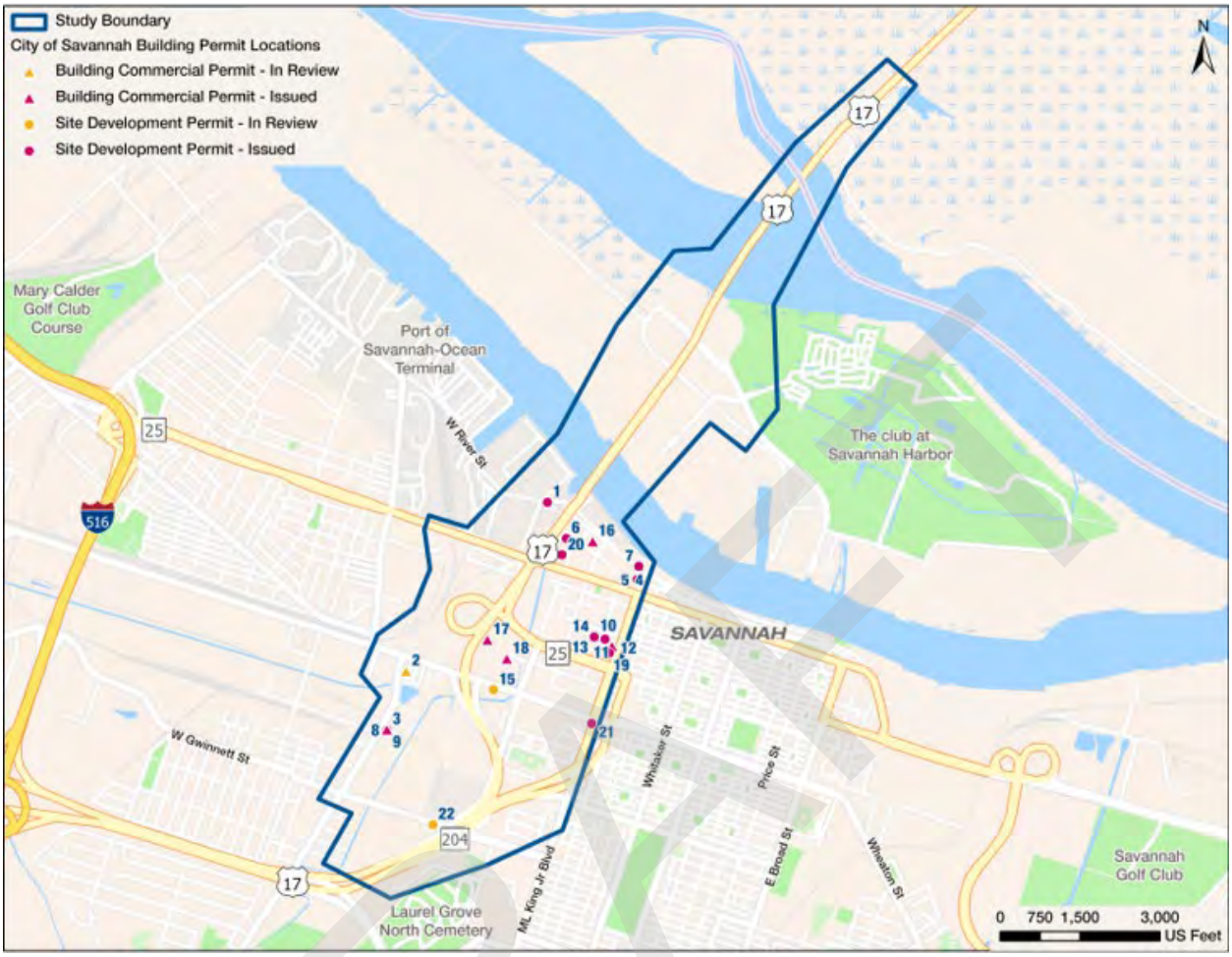


Figure 20. Building Permit Locations

Lastly, developments in South Carolina and for US 17 are important to consider, as the existing Savannah River crossing and Port of Savannah directly impact and are impacted by the activity in South Carolina. South Carolina plans include the 2040 Lowcountry Area Transportation Study (LATS) Long Range Transportation Plan (LRTP) (2015), South Carolina Statewide Freight Plan (2018), and Jasper County (S.C.) Comprehensive Master Plan (2018).

3.3.5 Economic Needs Summary

There are a several key economic needs for a possible new Savannah River crossing as it relates to the Port of Savannah. The Port is a major economic driver for the study area and beyond. Investments in the Port yield positive returns that provide benefits across the state, and the Port continues to experience growing TEU volumes and ship sizes. That growth and subsequent positive impacts are on track to continue, notwithstanding the bridge's existing clearance limitations. In addition to investments at the Port, there are other ongoing and planned projects in the area. A new Savannah River crossing should avoid constraining future growth of Port activities, be sensitive to other plans and projects in the area and have an alignment that complements other developments to the extent possible.

Table 7. Summary of Economic Needs

Economic Needs
Maintain the continued growth for the Port of Savannah to remain a main economic driver for Chatham County, state of Georgia, and East Coast
Avoid constraining future growth of Port activity
Align with other plans and developments in the area

3.4 Environmental Conditions

This section examines the environment surrounding the Talmadge Memorial Bridge and Savannah River within the study area. A desktop screening was conducted to identify existing conditions and potential environmental and community resources of concern. Field verification will be conducted at a later stage, as needed. The desktop screening included the review of county, state, and regional agency databases to document the presence of natural, cultural and social resources, possibility of community impacts, and disadvantaged communities (Environmental Justice populations) under Title VI of the Civil Rights Act of 1964.

As described in the following section, the study area contains numerous environmental resources which will require extensive state and federal agency coordination. Identification of environmental resources allows the design development of a project to avoid and/or minimize potential project-related impacts. Coordination with state and federal resource agencies has not been initiated but would be required in compliance with the National Environmental Policy Act (NEPA) of 1969 and related Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR Parts 1500-1508).

3.4.1 Environmental Existing Conditions

3.4.1.1 Natural Resources

For this analysis, the screening boundary consists of the study area and areas just beyond, as indicated in the figures on the pages that follow. It should be noted that the typical environmental screening boundary is much smaller than the overall study area and aligns more closely with the size of the project area. As the study moves forward into the concept phase, a more delineated boundary will be identified.

3.4.1.1.1 Protected Species

Review of the U.S. Fish and Wildlife Services (USFWS) Information for Planning and Consultation (IPaC) list for Chatham County and the Georgia Department of Natural Resources (GADNR) species occurrence list for each quarter-quadrangle located within three miles of the study area indicated 24 state or federally protected species as potentially occurring within the environmental screening area (as shown in Table 8).

DRAFT

Table 8. State and Federally Protected Species

Name	Status
Fish	
Shortnose Sturgeon (Acipenser brevirostrum)	Endangered
Atlantic Sturgeon (Acipenser oxyrinchus)	Endangered
Bluebarred Pygmy Sunfish (Elassoma okatie)	State listed
Robust redhorse (Moxostoma robustum)	State listed
Mussels	
Alasmidonta arcula (Altamaha arcmussel	State listed
Mammals	
Northern Long-eared Bat (Myotis septentrionalis)	Threatened
West Indian Manatee (Trichechus manatus)	Threatened
Birds	
Eastern Black Rail (Laterallus jamaicensis)	Threatened
Piping Plover (Charadrius melodus)	Threatened
Red-cockaded Woodpecker (Picoides borealis)	Endangered
Wood Stork (Mycteria americana)	Threatened
Least Tern (Sternula antillarum)	State listed
Reptiles	
Eastern Indigo Snake (Drymarchon corais couperi)	Threatened
Gopher Tortoise (Gopherus polyphemus)	Candidate
Green Sea Turtle (Chelonia mydas)	Threatened
Kemp's Ridley Sea Turtle (Lepidochelys kempii)	Endangered
Leatherback Sea Turtle (Dermochelys coriacea)	Endangered
Loggerhead Sea Turtle (Caretta caretta)	Threatened
Amphibians	
Frosted Flatwoods Salamander (Ambystoma cingulatum)	Threatened
Insects	
Monarch Butterfly (Danaus plexippus)	Candidate
Plants	
American Chaffseed (Schwalbea americana)	Endangered
Canby's Dropwort (Oxypolis canbyi)	Endangered
Pondberry (Lindera melissifolia)	Endangered
Hooded Pitcherplant (Sarracenia minor var. minor)	State listed

Data Source: U.S. Fish and Wildlife Service (USFWS) and GNAHRGIS Date: 09/13/2022

DRAFT

Within the environmental study area, Essential Fish Habitat (EFH) was identified for 11 species.

- Brown Shrimp (Farfantepenaeus aztecus)
- Pink Shrimp (Farfantepenaeus duorarum)
- White Shrimp (Litopenaeus setiferus)
- Red Drum (Sciaenops ocellatus)
- Spanish Mackerel (Scomberomorus maculatus)
- Gag Grouper (Mycteroperca microlepis)
- Red Grouper (Epinephelus morio)
- Goliath Grouper (Epinephelus itajara)
- Gray Snapper (Lutjanus griseus)
- Cobia (Rachycentron canadum)
- Mutton Snapper (Lutjanus analis)

Additionally, the Savannah River is identified as Critical Habitat for Atlantic sturgeon. Consultation with the National Oceanic and Atmospheric Administration (NOAA) Fisheries would be required on any potential project effects to EFH or Critical Habitat.

While the desktop review resulted in the identification of the species listed in Table 8, the presence of protected species or the potential for their suitable habitats would need to be field verified. If suitable habitat is identified for any of these species, subsequent protected species-specific surveys and coordination with USFWS, NOAA Fisheries, and/or GADNR may be required as applicable.

3.4.1.1.2 Streams and Wetlands

National Wetlands Inventory (NWI) data identifies approximately 59,300 acres of wetlands and 10,834 acres of open waters within the screening boundary. The United States Geological Survey (USGS) identifies 1,700 unnamed and 31 named streams and creeks, as shown in Figure 21. The Savannah River is also considered a navigable waterway within the study area.

DRAFT

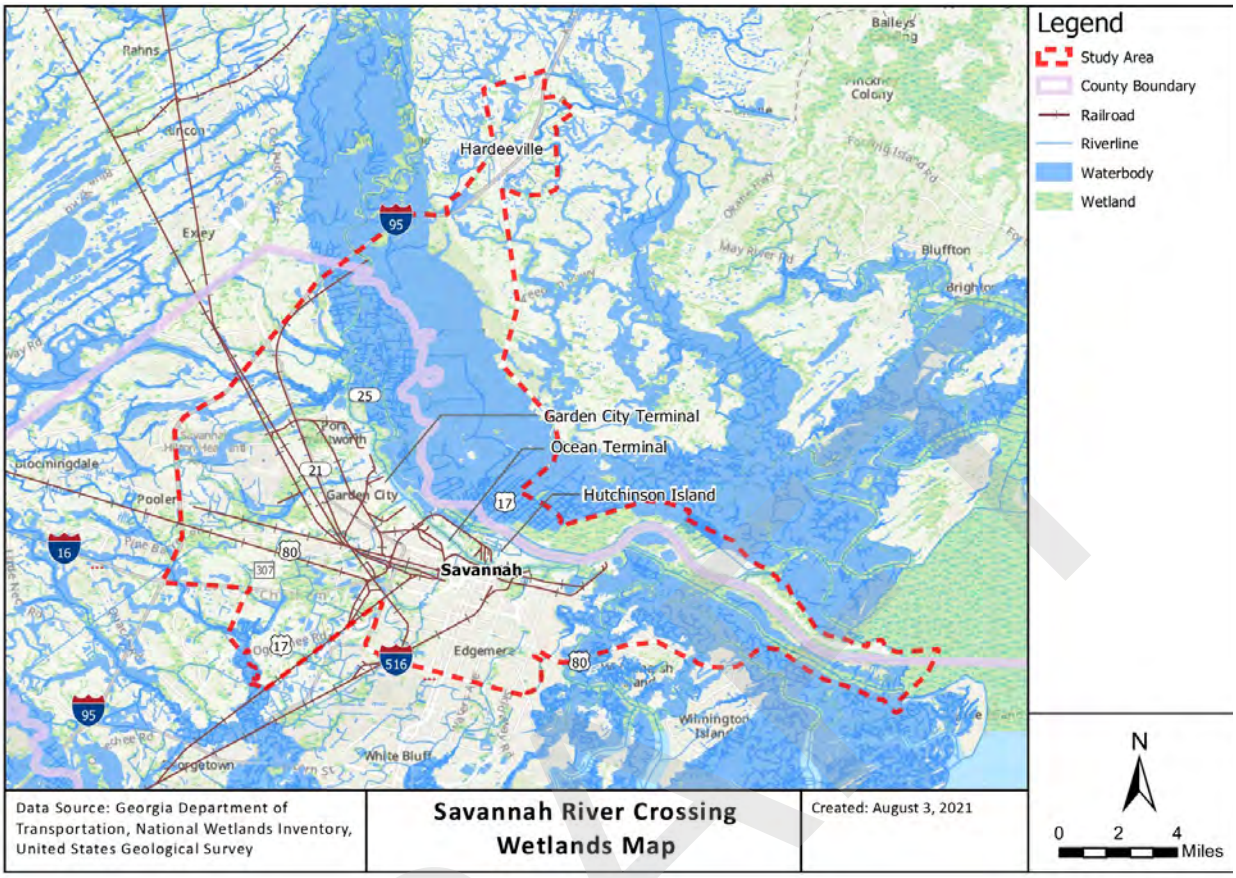


Figure 21. Wetlands and Water Bodies within Environmental Screening Area

3.4.1.2 Flood Plains

According to FEMA's Flood Insurance Rate Map (FIRM) Panels, the environmental screening area contains five regulatory floodways, as shown in Figure 22. There are Zones A and AE 100-year flood plains within the screening boundary. Zone AE flood plains are defined as areas with a 1 percent annual chance of flooding for which base flood elevations have been determined. Zone A flood plains are defined as areas with a 1 percent annual chance of flooding for which no depths or base flood elevations have been determined.

There are also Zones VE and X identified within the study area. Zone VE pertains to coastal areas with a 1 percent or greater chance of flooding and an additional hazard associated with storm waves, and Zone X are areas with minimal flood hazard.

DRAFT

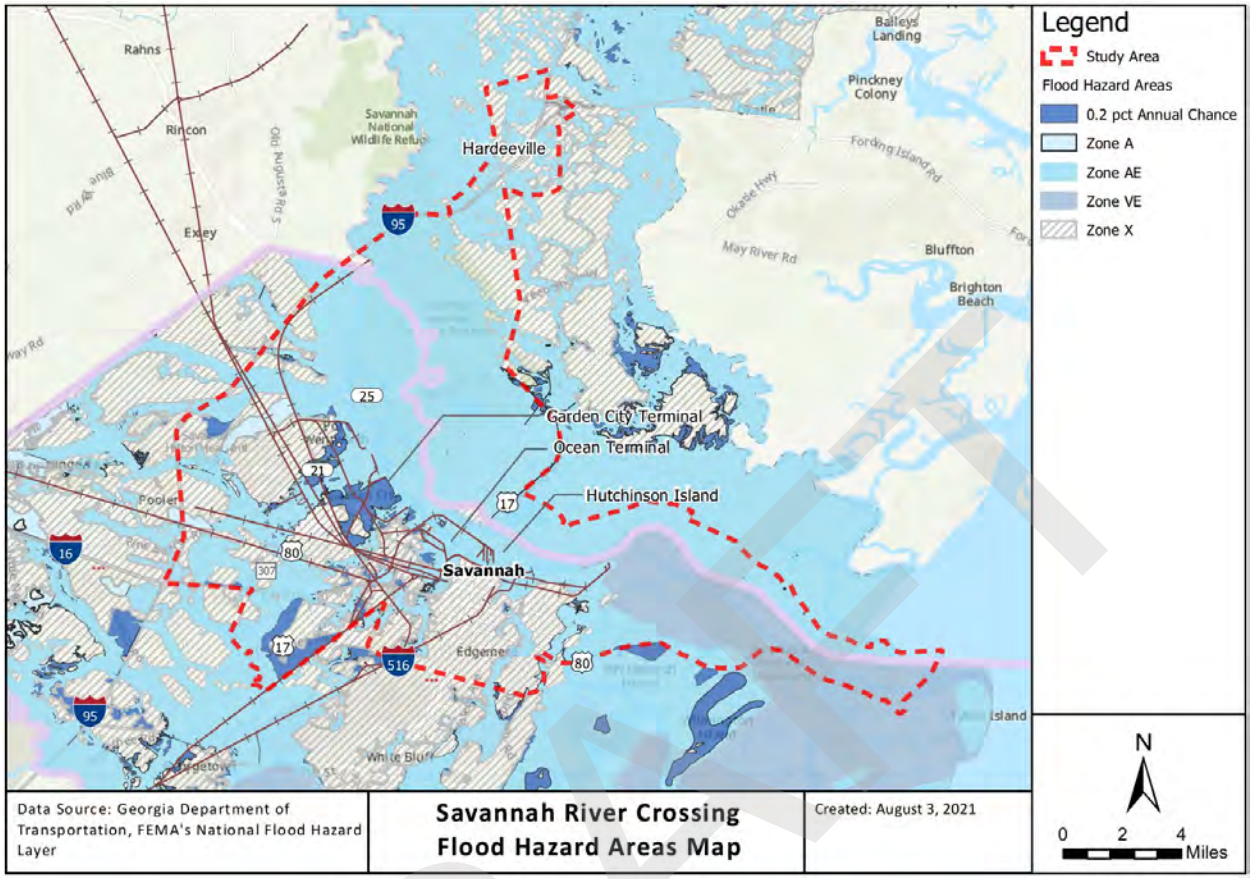


Figure 22. Flood Hazard Areas within Environmental Screening Area

DRAFT

3.4.1.3 Underground Storage Tank/Hazardous Waste Sites

An Underground Storage Tank (UST)/Hazardous Waste (HW) site investigation would be required to identify the potential for hazardous waste contamination, an operating or abandoned UST within the proposed or existing right-of-way prior to acquisition.

Eight landfills, three brownfields, and 11 potentially contaminated sites were identified within the screening boundary, as shown in Figure 23.

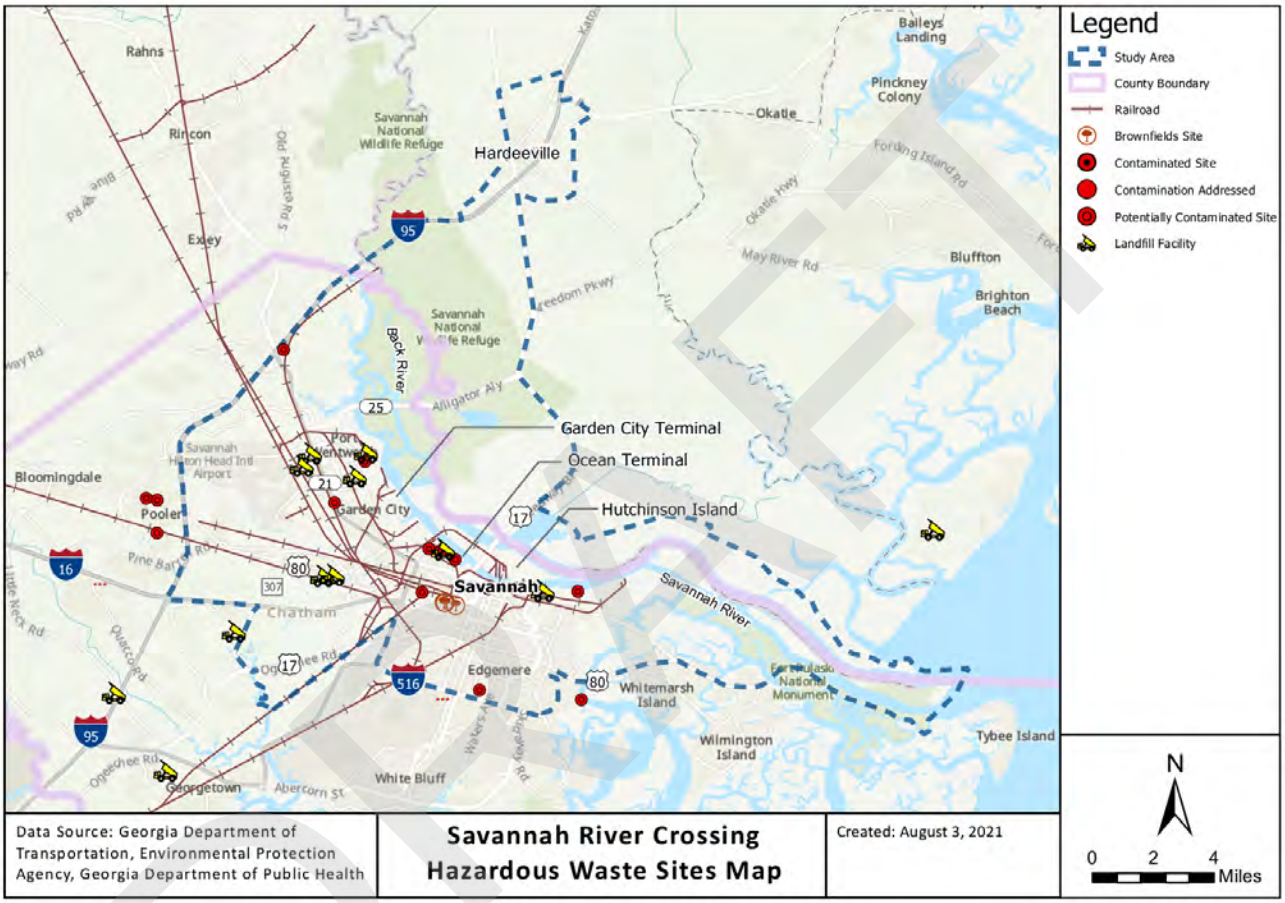


Figure 23. Hazardous Waste Sites within Environmental Screening Boundary

Thirteen gas stations and 547 underground storage tanks (USTs) were identified within the screening boundary, as shown in Figure 24.

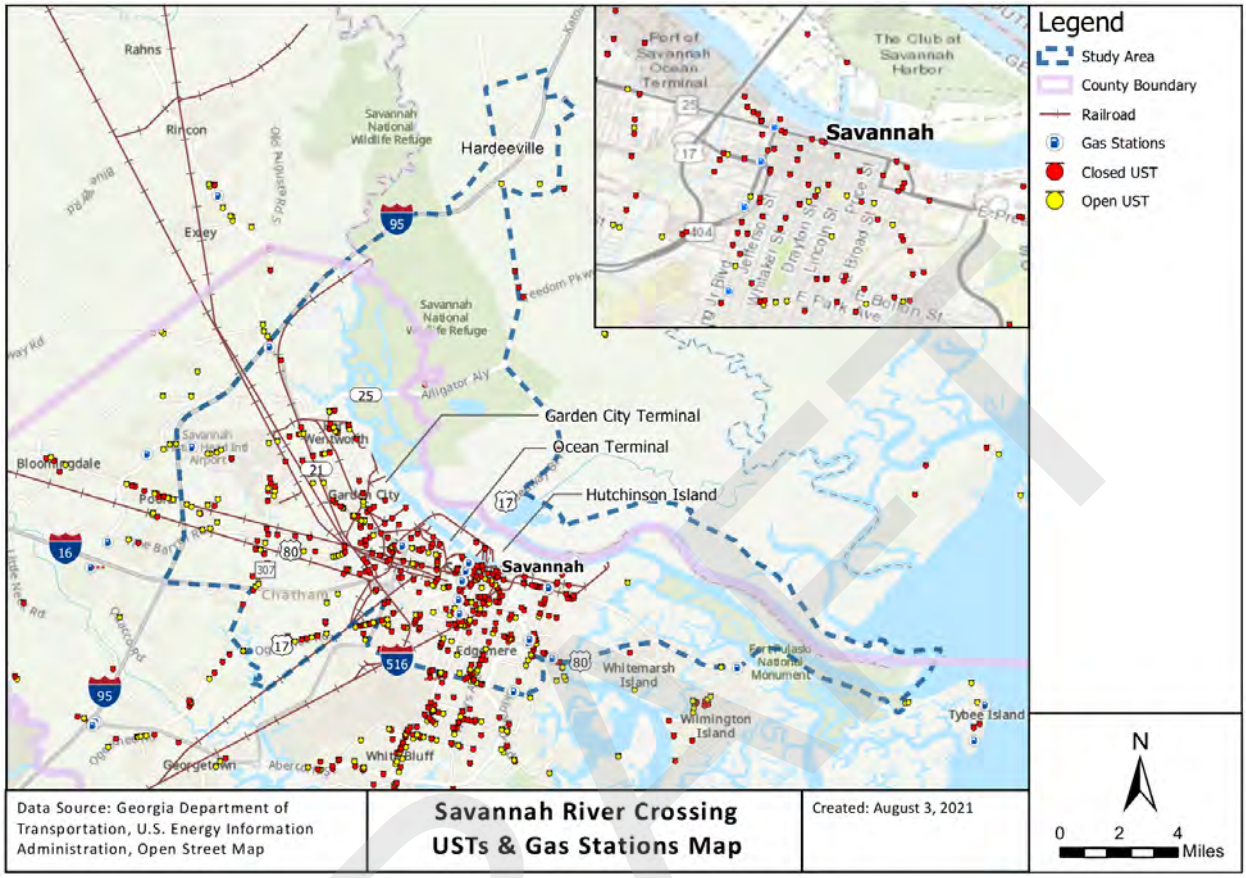


Figure 24. Gas Stations and Underground Storage Tanks within Environmental Screening Boundary

3.4.1.4 Community/Public Facilities

Table 9 shows community and public facilities located within the screening boundary.

Table 9. Community and Public Facilities within Environmental Screening Boundary

Facility Type	Number of Facilities
Schools	82
Law Enforcement Stations	50
Post Offices	10
Hospitals	4
Cemeteries	30
City Halls	6
Libraries	13
Community Centers	30
Places of Worship	359

DRAFT

3.4.1.5 Greenspace/Parks/Conservation Land & Community Assessment

The Study Team identified 124 public parks within the screening boundary, as shown in Figure 25.

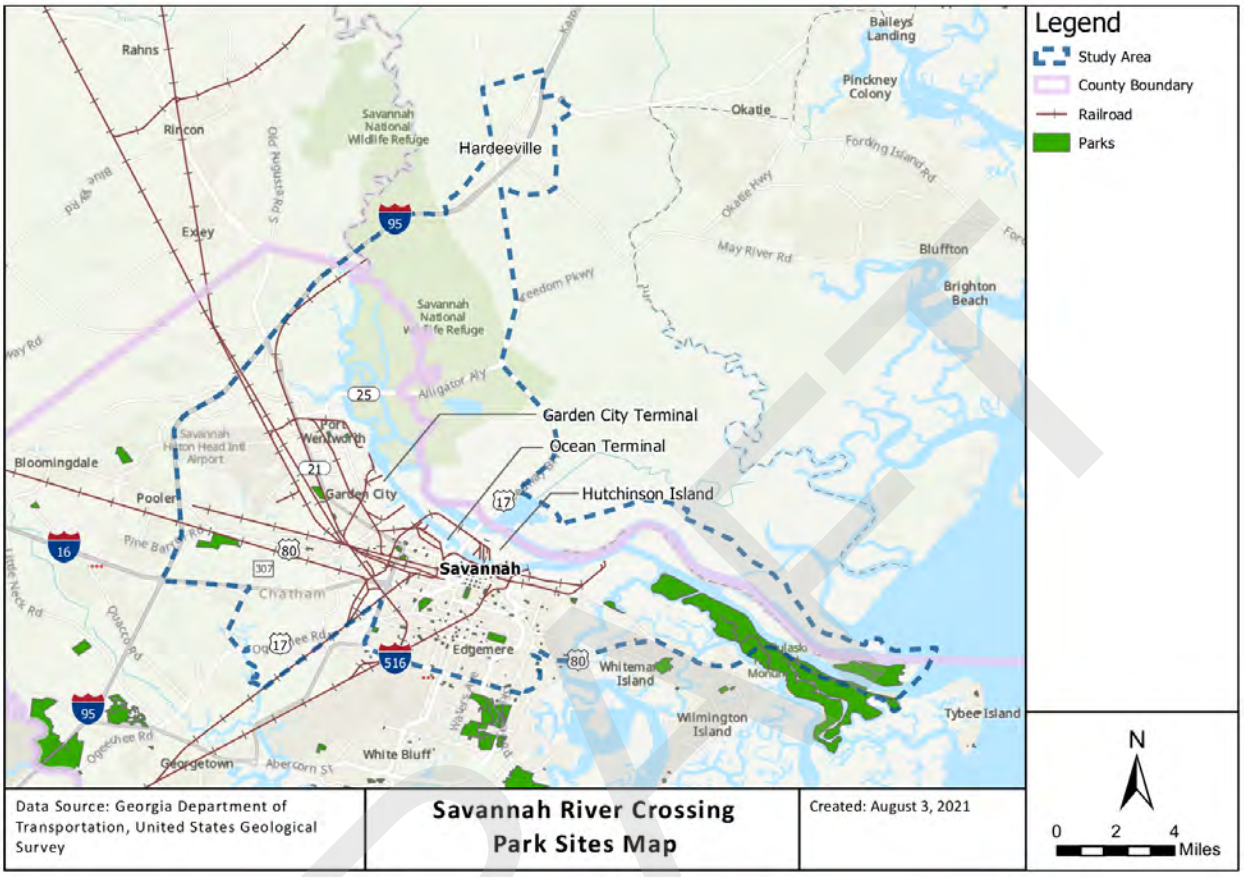


Figure 25. Parks within Environmental Screening Boundary

3.4.1.6 Cultural Resources

Savannah is a historic city with state and national significance. Several historic districts, landmarks, and individual buildings are located near the existing Talmadge Bridge. According to a GNAHRGIS search, there are many underwater archaeological sites within the Savannah River, and nine districts listed in or eligible for listing in the National Register of Historic Places (NRHP) along with numerous individually listed buildings within the screening boundary, as shown in Figure 26. Additionally, there are NRHP-eligible railroads and depots immediately within the area of the existing Talmadge Bridge.

DRAFT

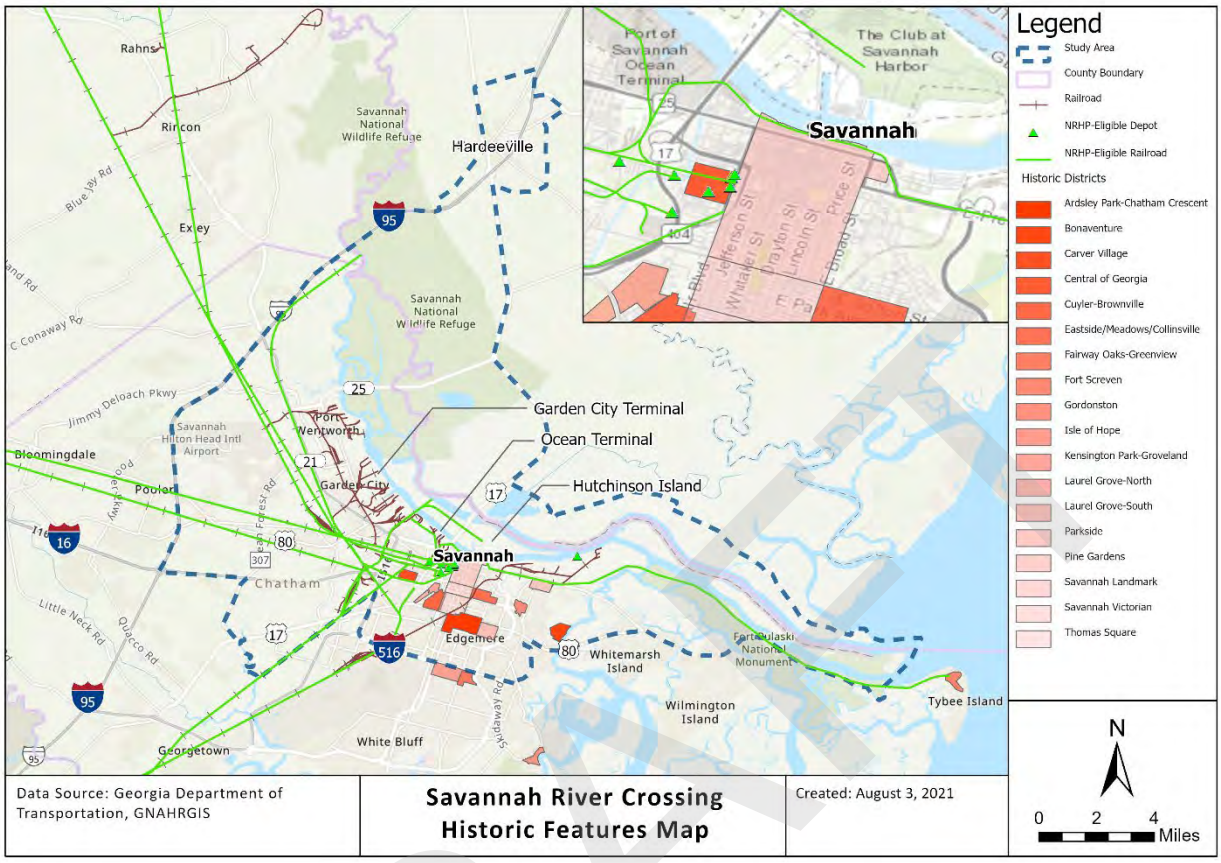


Figure 26. Historic Features within Environmental Screening Boundary

3.4.1.7 Environmental Justice

Data Sources and Methodology

The maps, included in Appendix J, are derived from the United States Census Bureau's 2019 TIGER/Line Shapefiles for Chatham (GA) and Jasper (S.C.) counties' Census tracts, and the United States Census Bureau's 2015-2019 American Community Survey (ACS) 5-Year Estimates. It is important to note that there is no data recorded for Census tract 9800 (the Port of Savannah and Hutchinson Island) and tract 106.05 (Hutchinson Island) within Chatham County, as these tracts both have populations of zero.

Population for Whom Poverty Status is Determined

This population data is derived from the Census's S1701 table titled "Poverty Status in the Past 12 Months" for Jasper and Chatham counties' tracts. The key parameter of this data is the estimated percentage of the total population below the poverty level in each Census tract.

The data shows that Chatham County's Census tracts with the highest percentage of people living below the poverty line, greater than 50% of its population, are in the City of Savannah near the Talmadge Memorial Bridge directly to its south and east. The Census tracts with the fewest number of people living below the poverty line, less than 10% of its population, are to the west, south, and east of the city and bridge. Jasper County does not have any Census tracts with less than 10% or greater than 50% of its population living below the poverty line.

DRAFT

Zero-Vehicle Access Households

The population data is derived from the Census's DP04 table titled "Selected Housing Characteristics" for Jasper and Chatham counties' tracts. The key parameter of this data is the estimated percentage of occupied housing units with no vehicles available in each Census tract.

The data shows that Chatham County's Census tracts with the highest percentage of zero-vehicle households, greater than 35% of households, are in the City of Savannah near the Talmadge Memorial Bridge to the south. The Census tracts with the fewest number of zero-vehicle households, less than 5% of households, are those farther away to the south, west, and east, and they are either outside of or farther away from the center of Savannah. The Census tracts with the fewest number of zero-vehicle households are Census tract 9503, which includes Hardeeville, S.C., and tract 9502.01, which includes Switzerland, S.C. There are no Census tracts in Jasper County with greater than 35% of its households without a vehicle.

Minority Population

The population data is derived from the Census's DP05 table titled "ACS Demographic and Housing Estimates" for Jasper and Chatham counties' tracts. The key parameter of this data is the estimated percentage of the total population that is only one race, white, in each Census tract. From this data, the estimate percentage of the total minority population was calculated.

The data shows that Chatham County's Census tracts with the highest percentage of minority residents, greater than 85% of residents, are near the Talmadge Memorial Bridge, close to the center of Savannah, to the south, west, and southeast of the bridge. The areas with the fewest number of minority residents, less than 20% of their population, include the Census tracts that are east of the bridge and Savannah in Chatham County. In Jasper County, there are no Census tracts with less than 20% of their population comprised of minority groups nor any Census tracts with greater than 85% of their population comprised of residents belonging to minority groups.

Limited English-Speaking Households

The population data is derived from the Census's S1602 table titled "Limited English-Speaking Households" for Jasper and Chatham counties' tracts. The key parameter of this data is the estimated percentage of all households that are categorized as limited English-speaking households. According to the Census, a "limited English-speaking household" is one in which no member 14 years old and over (1) speaks only English or (2) speaks a non-English language and speaks English "very well."

The data shows that Chatham County's Census tracts with the highest percentage of limited English-speaking households, greater than 4% of households, are close to the Talmadge Memorial Bridge, with two of the three tracts to the west and one to the southeast of the bridge. Tracts with no limited English-speaking households (0%) are found throughout Chatham County to the west, south, and east of the bridge. The Census tract in Jasper County with the highest percent of limited English-speaking households is Census tract 9503, which includes the City of Hardeeville and is directly north and close to the bridge. Census tract 9502.01 in Jasper has zero limited English-speaking households.

Population Aged 65 or Over

The population data is derived from the Census's S0101 table titled "Age and Sex" for Jasper and Chatham counties' tracts. The key parameter of this data is the estimated percentage of the total non-institutionalized population aged 65 years or older in each Census tract.

The data shows that Chatham County's Census tracts with the highest percentage of people aged 65 and over are southeast of the Talmadge Memorial Bridge. Specifically, these areas include Census tracts

DRAFT

110.05 and 110.06, which includes Skidaway Island. Conversely, the Census tracts west and south of the bridge have lower proportions of their populations aged 65 and over. These areas include Census tracts in Savannah, Georgetown, and Port Wentworth. In Jasper County, there are zero Census tracts with less than 10% of its population aged 65 or older and a relatively significant amount, greater than 30%, of residents aged 65 or older northwest of the bridge in Census tract 9502.01, which includes Switzerland, S.C.

Population with a Disability

The population data for this variable is derived from the Census's S1810 table titled "Disability Characteristics" for Jasper and Chatham counties' tracts. The key parameter of this data is the estimated percentage of the total civilian non-institutionalized population with a disability in each Census tract.

The data shows that Chatham County's Census tract with the highest percentage of people living with a disability is, Census tract 21, southeast of the Talmadge Memorial Bridge in the City of Savannah, with 25%-30% of its population living with a disability. The City of Savannah also contains the most Census tracts in Chatham County with the lowest percentage of residents living with a disability, less than 10%, in Census tract 101.01 directly east of the bridge; tracts 112, 113, and 29 south of the bridge; and tract 43 southwest of the bridge. Census tract 111.06, which is southwest of the bridge and outside of the City of Savannah (Whitemarsh Island), also has less than 10% of its population with a disability. Jasper County does not have any Census tracts with less than 10%, or greater than 25% of its population, with a disability.

Population Without a 4-Year Degree or Higher

The population data is derived from the Census's S1501 table titled "Educational Attainment" for Jasper and Chatham counties' tracts. The key parameter of this data is the estimated percentage of the total population that is aged 25 years or older with a 4-year degree or higher in each Census tract. From this estimated percentage, the estimated percentage of those without a 4-year degree or higher was derived.

The data mapped shows that Chatham County's Census tracts with the highest percentage of people without a 4-year degree or higher are in the Savannah area, to the west, south, and east of the Talmadge Memorial Bridge, as well as in Census tract 108.01, which includes the City of Bloomingdale, GA. The Census tracts in Chatham County that have less than 40% of their population without 4-year or higher degrees are southeast of the bridge, which include Skidaway Island and Isle of Hope areas. In Jasper County, three of the four Census tracts, including Census tract 9503, which contains the City of Hardeeville, S.C., have greater than 80% of their population without a 4-year degree or higher. The exception is Census tract 9502.01 to the northeast of the bridge, which has between 55-70% of its population without a 4-year degree or higher.

3.4.2 Future Environmental Considerations

3.4.2.1 Potential Permits and Approvals

Environmental and community resources will need to be field verified as a next step but based on the desktop screening, potential impacts to a number of resources will need to be assessed for the project. The project will also likely require several permits and approvals with respect to these resources, as summarized in Table 10.

DRAFT

Table 10. Anticipated Permits and Approvals

Responsible Agency	Permit/Approval/Protected Resource
U.S. Army Corps of Engineers (USACE)	• Clean Water Act–Section 401 permit (discharge into waters of US) • Clean Water Act–Section 404 permit (discharge of dredged or fill material into navigable waters) • Rivers and Harbors Act–Section 10 permit (construction in or over navigable waters)
U.S. Coast Guard (USCG)	• General Bridge Act/Rivers and Harbors Act–Section 9 permit (bridge above navigable waters)
U.S. Fish and Wildlife Service (USFWS)	• Endangered Species Act-Section 7 consultation (related to manatees, potentially protected bird species, and potentially protected plants)
National Oceanic and Atmospheric Administration (NOAA) Fisheries	• Endangered Species Act-Section 7 consultation (related to Atlantic sturgeon, sea turtles, and critical habitat).
U.S. Environmental Protection Agency (USEPA)	• TBD
Georgia Department of Natural Resources (GDNR) Coastal Resources Division (CRD)	• Marsh delineations • Revocable license • Coastal Zone Management Act (CZMA) coordination
GDNR Environmental Protection Division (EPD)	• Marsh buffer impacts and the surficial aquifer system
GDNR Wildlife Resources Division (WRD)	• TBD
Georgia State Historic Preservation Office (SHPO)	• National Historic Preservation Act-Section 106 consultation
GA Assembly	• Restrictive covenants

3.4.2.2 NEPA Environmental Review

Since the project currently anticipates federal funding and approvals, any viable build alternative(s) identified through the feasibility study will need to be evaluated under NEPA as a next phase of the project. The NEPA process will need to be overseen by a federal lead agency, which is typically the agency providing funding or that has a major approval action associated with the project. Based on the potential permitting requirements for the project shown in Table 10, the Study Team initially identified USCG and USACE as potential lead agencies, as well as the Federal Highway Administration (FHWA) and the Maritime Administration (MARAD) as possible funding sources. Subsequently, GDOT has indicated that federal funding may be administered by FHWA; therefore, at this time, it is anticipated that FHWA would serve as the federal lead agency for NEPA, pending their concurrence.

To facilitate an efficient NEPA environmental review process, federal agencies encourage project sponsors to conduct robust early planning processes prior to formally initiating NEPA. FHWA has established an approach called Planning and Environmental Linkages (PEL), described as “a collaborative and integrated

DRAFT

approach to transportation decision-making that 1) considers environmental, community, and economic goals early in the transportation planning process, and 2) uses the information, analysis, and products developed during planning to inform the environmental review process." Gaining agency, stakeholder, and community input early in the planning stage of a project can help build consensus on the project's need and purpose, goals and objectives, project alternatives, and potential community and environmental impacts to help streamline the future environmental review process.

While GDOT and GPA have identified goals and objectives for the study, it will be important to formalize a purpose and need statement with the federal lead agency, as that forms the basis of the overall project. Similarly, obtaining early input from the lead agency on the goals and objectives and the alternatives evaluation can help ensure that there is agreement on the range of alternatives evaluated and the identification of the alternative(s) that should undergo detailed study in the NEPA environmental review process.

In addition to the lead agency, engaging with other potential regulatory agencies early will help position the project for a successful NEPA process. This will allow GDOT to ascertain agency concerns and begin to formulate measures to address those concerns early in project development. In addition, engaging with stakeholders and the general public early in the planning process can reveal issues that may be important to these groups and facilitate a smoother environmental review process in the future.

NEPA establishes three classes of action:

- Class I- Environmental Impact Statement (EIS)—projects that are likely to have significant impacts for which a detailed EIS is prepared
- Class II- Categorical Exclusion (CE)—projects that will not result in significant impacts and minimal documentation is typically required.
- Class III- Environmental Assessment (EA)—projects where the significance of impacts is uncertain for which an EA is prepared to determine level of potential impacts

The Savannah River Crossing project would not qualify as a Class II (CE) action but could qualify as a Class I (EIS) or Class III (EA) action, pending further analysis and coordination with the eventual federal lead agency. For a class III action, an EA is prepared to provide sufficient evidence and analysis to determine whether a proposed federal agency action (i.e., a transportation project receiving federal funds) would require preparation of an EIS or would receive a Finding of No Significant Impact (FONSI), in which case no additional NEPA review would be necessary. Often the EA will identify ways in which the agency can revise the proposed project or action to minimize environmental effects. A FONSI is a document that presents the reasons why the agency has concluded that there are no significant environmental impacts projected to occur upon implementation of the action. If at any point in the process of preparing an EA it is discovered that the project would result in significant impacts, an EIS must be prepared.

For a Class I action, EISs are detailed, written statements that are required for a proposed major federal action that would significantly affect the quality of the human environment. The EIS is a full disclosure document that details the process through which a transportation project was developed, includes consideration of a range of reasonable alternatives, analyzes the potential impacts resulting from the alternatives, and demonstrates compliance with other applicable environmental laws and executive orders. The EIS has more expansive public and agency involvement and input, and it is typically an additional year

DRAFT

of effort. The Record of Decision (ROD) is the final step in the EIS process and may not be issued sooner than 30 days after the approved Final EIS is distributed nor 90 days after the Draft EIS is circulated. A comparison of the EA and EIS procedures is provided in Table 11.

Table 11. NEPA Environmental Review Process for an EA and EIS

EA	EIS
Project Initiation *(Informal)*	**Notice of Intent (NOI)** *Formal announcement of lead agency's intent to prepare an EIS and is published in the Federal Register.*
Scoping *(Optional)*	**Scoping** *(Required)* *Establishes framework of NEPA analyses and includes public review and typically a public meeting.*
Environmental Assessment *Concise assessment of potential adverse impacts and proposed mitigation measures.*	**Draft Environmental Impact Statement (DEIS)** *Detailed assessment of potential adverse impacts and proposed mitigation measures.*
Public Review *(Required)* *Minimum 30-day public comment period.* **Public Hearing** *(Optional)*	**Public Review** *(Required)* *Minimum 45-day public comment period.* **Public Hearing** *(Required)*
Findings Document *Lead agency's determination of significance of impacts. Includes responses to public and agency comments received on the EA.*	**Final Environmental Impact Statement (FEIS)** *Refined analyses based on public and agency comments and any design modifications as the Project has advanced. Includes responses to public and agency comments received on the DEIS.*
	Record of Decision (ROD) *Lead agency's determination of significance of impacts. May include responses to public and agency comments received on the FEIS.*

3.4.2.3 Parallel Review Processes

In addition to NEPA, there are several related review procedures that may apply to projects with federal actions. Federal agencies are required to evaluate potential impacts to historic and archaeological resources in compliance with Section 106 of the Historic Preservation Act, which requires public review, as needed, and consultation with SHPO, Tribes, consulting parties (i.e., parties with jurisdiction or oversight of a historic resource), as applicable. Agencies of the U.S. Department of Transportation (USDOT), such as FHWA and MARAD, are also required to comply with Section 4(f) of the USDOT Act of 1966, which affords additional protection of park and recreational lands, wildlife and waterfowl refuges, and historic sites. Section 4(f) evaluations also require public review, as needed. While Section 106 and Section 4(f) are discrete review procedures, they can be, and often are, incorporated into the NEPA environmental review process and public reviews.

DRAFT

3.4.3 Environmental Needs Summary

The study area comprises numerous sensitive environmental resources and is located in a dense urban environment with historic resources and potentially disadvantaged communities, including environmental justice populations. The potential impacts of the project will need to be evaluated as part of a future NEPA environmental review process, and potential mitigation measures will need to be developed to address any adverse impacts. As the project advances toward the environmental review stage, increased agency and public engagement will need to be initiated to gain feedback on the project's purpose and need, goals and objectives, and alternatives evaluation, as well as to better understand any regulatory or community concerns.

Table 12. Summary of Environmental Needs

Environmental Needs
Minimize impacts to environmentally sensitive resources as much as possible or mitigate impacts when unavoidable
Consider resiliency improvements to protect and preserve environmentally sensitive areas when applicable

3.5 Traffic Conditions

The traffic conditions section of this report summarizes the existing and future travel patterns within the study area and evaluates if and how different alternatives may change the future travel condition.

The existing traffic conditions in the study area were assessed to identify deficiencies relative to existing traffic capacity and operations and to establish a baseline condition against which the anticipated future conditions and potential impacts of future growth can be evaluated. The existing conditions that have been compiled and analyzed include current traffic volumes, truck volumes, travel speeds, level of service, number of crashes, commuter origin-destination (OD) flow, freight flow and rail system.

The future conditions are estimated through an existing Travel Demand Model (TDM) and a VISUM model analysis for the alternatives. The goal for future conditions is to minimize vehicular travel delays and to improve traffic safety in the study area. And the alternatives are not only to address the growing needs of the Port of Savannah but also to ensure connectivity within and beyond the study area.

The existing and future traffic condition analysis indicates that there is relatively little delay throughout the city itself, while most delay is on I-16 and I-95 and will likely worsen over time. Depending on the selected alternative, US 17 and the Talmadge Memorial Bridge could potentially be temporarily closed due to construction, and the bulk of the traffic would likely divert to West Bay Street, SR 25, SR 21, and US 80 due to their better Level of Service (LOS), with some traffic going to I-16 and I-516. The existing railyards and port terminals are located south of the Savannah River, so there would be little traffic re-routing for freight trucks accessing these facilities aside from those arriving to or departing from South Carolina.

Even with a temporary closure of the Talmadge Memorial Bridge, there would be no significant effects on transit, bike, or pedestrian activities as there are no existing transit routes, bike lanes, or sidewalks on the bridge. Also, little multimodal infrastructure exists to the north of the Savannah River, the result of a combination of a lack of development and protected national wildlife refuges in this area.

DRAFT

While there are no fatal crashes on the bridge segment of US 17 between 2015 and 2019, with around 8,000 crashes per year within the study area and a total of 106 crashes on the bridge for the same period, there is an opportunity to incorporate improved safety measures into the design of a recommended alternative.

The future travel demand model estimates good travel condition on US 17 and the Talmadge Memorial Bridge, and the alternative analysis results show little differences of impact across all the new bridge and tunnel ramp configuration scenarios, shown in Appendix N, on peak hour travel condition, as well as against the no build scenario. Therefore, at a high level, the impact on future traffic condition is not a differentiating factor for the eight ramp configuration scenarios evaluated.

3.5.1 Existing Traffic Assessment

3.5.1.1 Traffic Volumes

3.5.1.1.1 Daily Total Traffic Volume

Annual average daily traffic (AADT) represents the mean traffic volume across all days for a year at a given location, and it is a measurement to show how busy a road is. GDOT maintains the Traffic Analysis & Data Application (TADA) platform, a database of AADT volumes for all state routes and selected roadways. The most recently collected and estimated counts in the TADA are 2020, which are referenced for this study. Year 2019 counts are also used considering the impact of COVID-19 in 2020. The historical AADT between 2011 and 2019 obtained from TADA are used to calculate the annual traffic percent growth. The counts and annual percent growth rates for selected count locations within the study area are summarized in the Data Collection and Analysis Memo. Figure 27 below shows AADT volumes in 2019 and the traffic-monitoring stations within the study area.

The daily total traffic volumes on the Talmadge Memorial Bridge range from 16,700 to 19,200 in 2020 at traffic count stations 051-0169 and 051-0167, with annual growth rates between 2% and 3%. The highest volume location in the study area is at station 051-0383, on I-95 between SR 26 and I-16, with 87,400 AADT in 2019, with a 3% annual growth rate from 2011.

The traffic volumes along DeRenne Avenue and I-516 (count stations 051-0147, 051-0142, and 051-0138) decreased between 2019 and 2020. The counts at station 051-0138, I-516 West of SR 204 and Montgomery Street, and station 051-0142, SR 21/West DeRenne Avenue between Mildred Street and Montgomery Street, started to decrease in 2019. Station 051-0274, US 80/SR 26/West Victory Drive east of I-516, also experienced reduced volumes in 2019 and 2020, with a negative annual rate. Volumes at these locations were either stable or experiencing slight growth from 2011 to 2018.

Station 051-1103, Truman Parkway north of East Victory Drive near the Savannah River, shows the highest annual growth rate, 4.3%, from 2011 to 2019 among all stations. Elsewhere, the growth rates are between 1% and 3%.

DRAFT

3.5.1.1.2 CORE MPO Travel Demand Model Volume

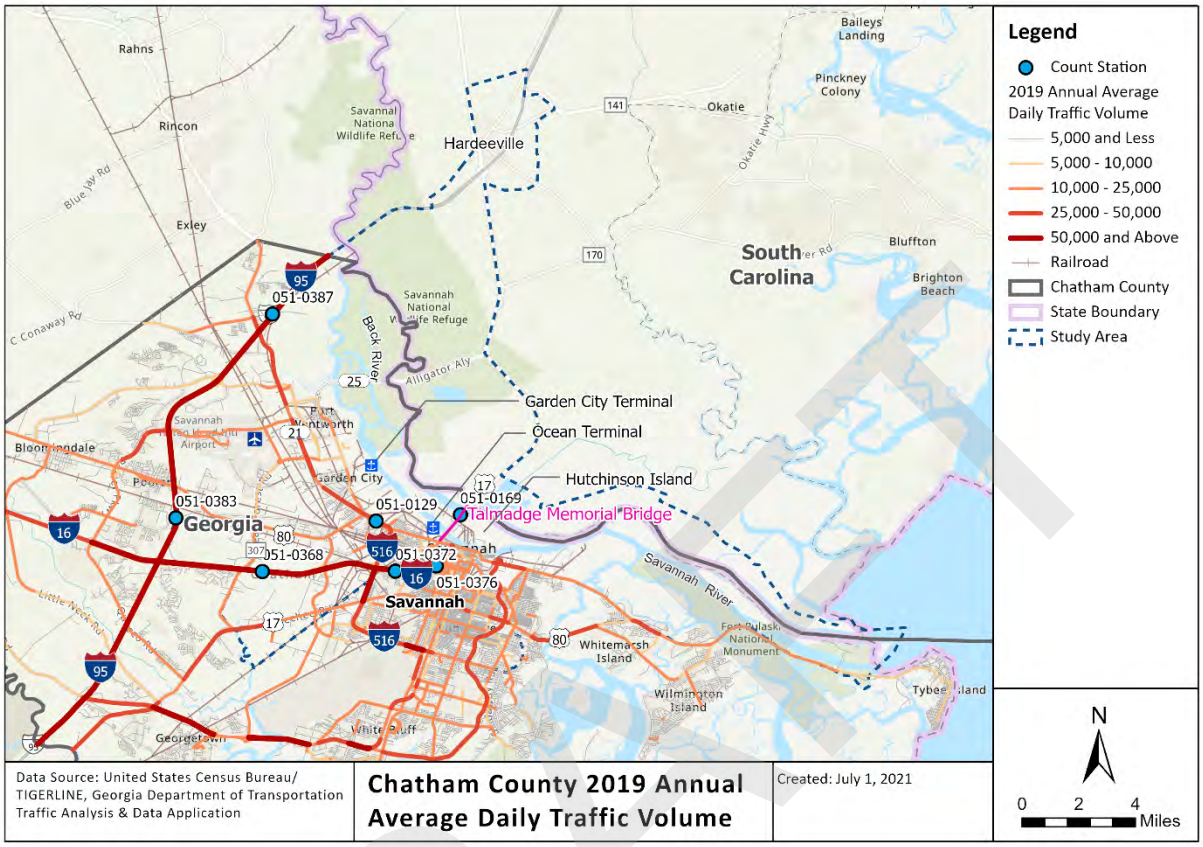


Figure 27. 2019 Annual Average Daily Traffic (AADT) Volume – TADA

The Study Team obtained 2015 daily total traffic volume from the Coastal Region (CORE) MPO Travel Demand Model. The modeled 2015 daily traffic volume is an estimate of the actual 2015 AADT. As shown in Figure 28, road segments of I-16, I-95, I-516, US 80, and SR 21 within the study area have daily traffic volumes ranging from 25,000 to 50,000As part of the CORE MPO adopted Metropolitan Transportation Plan (MTP), the 2015 base year model was validated based on the 2015 AADT, and the deviation and errors were within a reasonable range. This model was then used as a base to develop the CORE MPO 2045 future year model and the Coastal Empire Study (CES) 2020 and 2050 travel demand model.

DRAFT

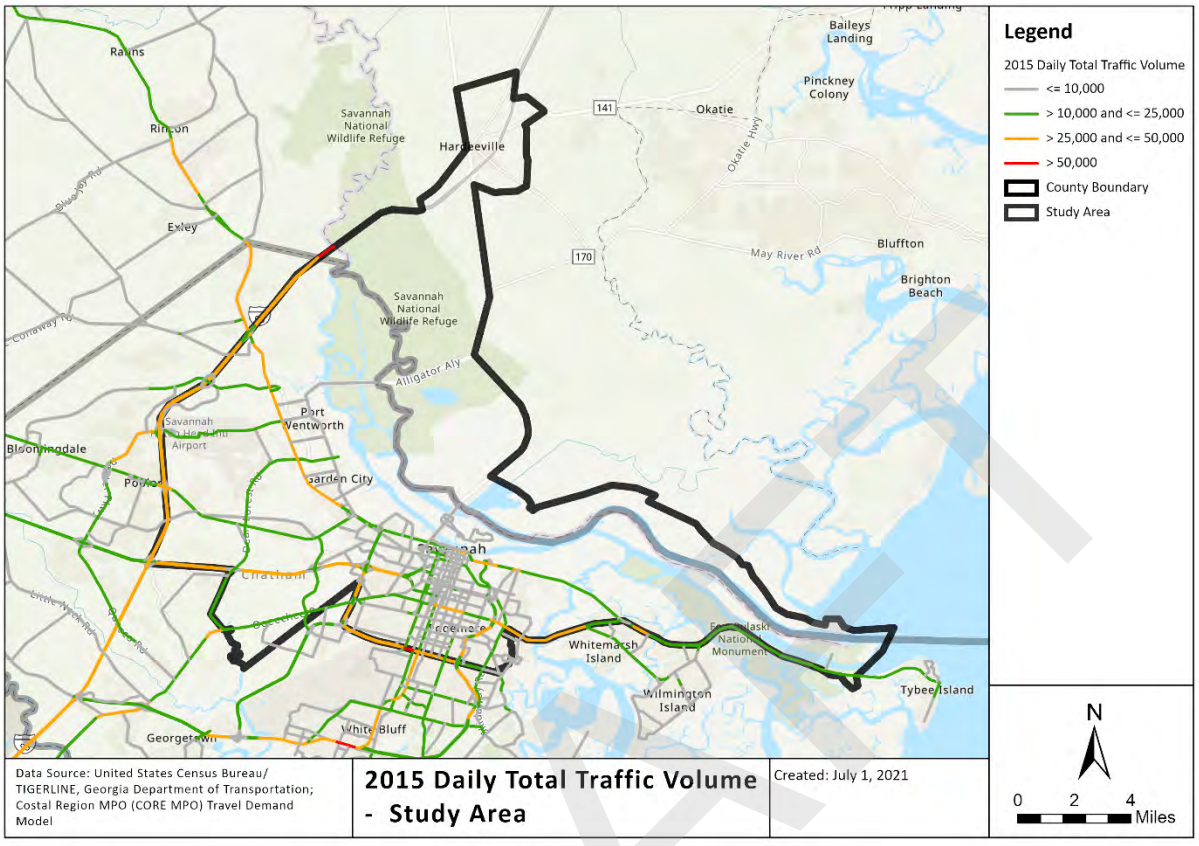


Figure 28. 2015 Daily Total Traffic Volume – CORE MPO Travel Demand Model

3.5.1.1.3 Truck Volume

The truck percentages at the traffic count stations are obtained to understand truck volume patterns within the study area. The corresponding annual average daily truck traffic (AADTT) are calculated based on the truck percentage and the total AADT, as shown in Figure 29 below. As shown in Table 13, I-95 carries the highest truck volumes among interstate segments in the study area. On I-95, the truck percentages are above 14%, with more than 10,000 trucks per day. I-16 has similar total daily traffic volumes as that of I-95, but its segments have much lower truck percentages and volumes, ranging from 5% to 6% in truck percentages and volumes less than 2,500 trucks per day.

The Talmadge Memorial Bridge carries a truck volume estimated at less than 2,500 per day – 10% of total volumes in 2019 and 13% in 2020. Truman Parkway, SR 21/DeRenne Avenue, and US 80/SR 26 Victory Drive as local corridors have much lower truck percentages, between 3% and 4%, with volumes close to or less than 1,000 per day. SR 25 (Houlihan) Bridge, a bridge with two total lanes west of the Talmadge Memorial Bridge, has the highest truck percentage of 25% among the selected count locations, with truck volumes slightly higher than 1,000 per day.

It should be noted that at the Talmadge Memorial Bridge, the total daily traffic volumes from 2019 to 2020 decreased while truck volumes increased, likely impacted by COVID-19. I-16 east of the Dean Forest exit has also experienced a similar trend.

DRAFT

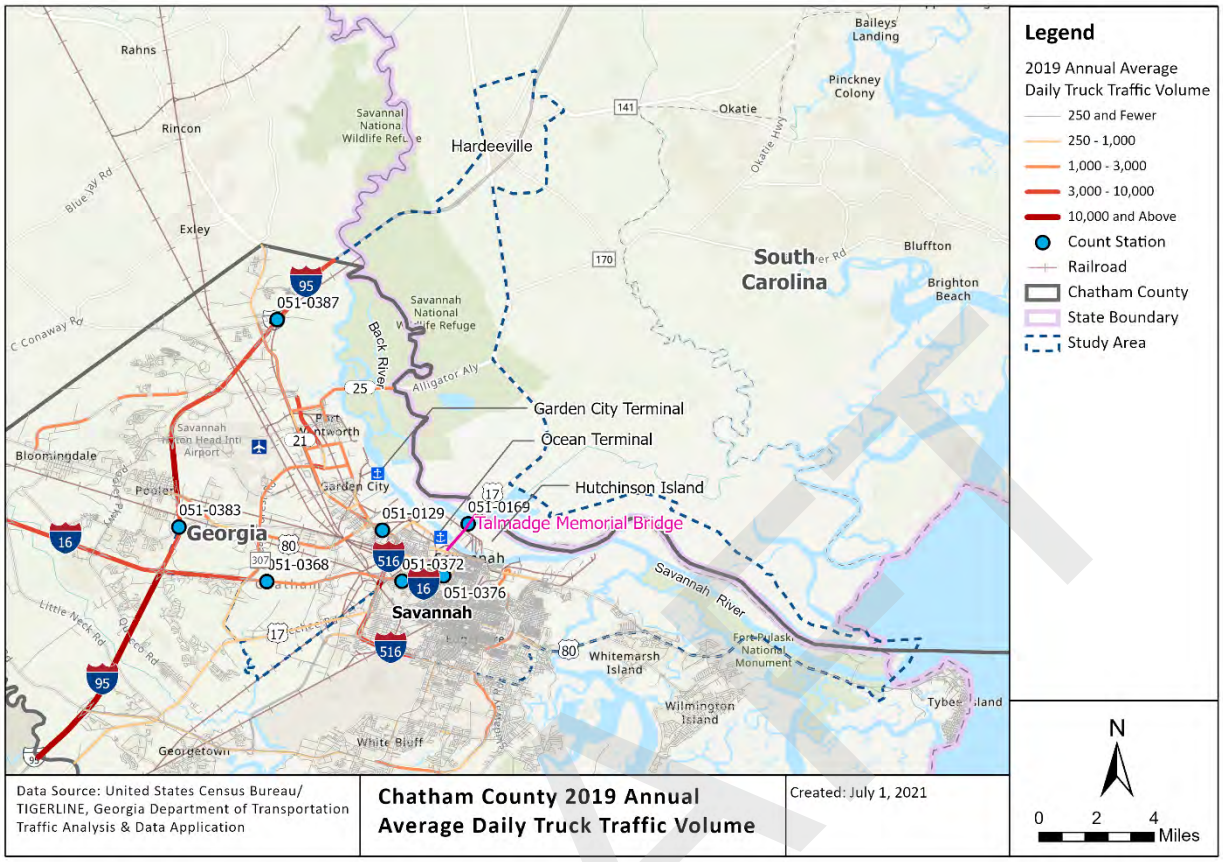


Figure 29. 2019 Annual Average Daily Truck Traffic Volume

DRAFT

Table 13. GDOT TADA Truck Percentages at Selected Count Locations in Study Area

Station ID	Location	2019 Total Counts	2019 Truck % (Calculated Truck Volume)	2020 Total Counts	2020 Truck % (Calculated Truck Volume)
051-0169	Talmadge Memorial Bridge north of Savannah Harbor Pkwy	*18,400**	10% (1,840)	*16,700**	13% (2,170)
051-0167	Talmadge Memorial Bridge south of Savannah Harbor Pkwy	*20,300**	10% (2,030)	19,200	13% (2,496)
051-0129	I-516 west of SR 25 Conn/W Bay St, Savannah	38,000	6% (2,280)	34,400	6% (2,064)
051-0376	I-16 north of W Gwinnett St and US-17/SR 404	24,800	5% (1,240)	20,100	5% (1,005)
051-0372	I-16 east of I-516	*60,000**	n/a	*52,000**	n/a
051-0387	I-95, north of SR 21 (Augusta Rd) @ SC state line	59,000	18% (10,620)	52,200	19% (9,918)
051-0368	I-16 east of Dean Forest exit	59,600	6% (3,576)	53,100	7% (3,717)
051-0383	I-95 between SR 26 and I-16	*87,400**	14% (12,236)	*79,200**	14% (11,088)
051-1103	Truman Pkwy north of E Victory Dr	32,500	3% (975)	*29,400**	3% (882)
051-0147	SR 21/ E DeRenne Ave between Abercorn St and Waters Ave	*35,200**	3% (1,056)	*31,800**	3% (954)
051-0142	SR 21/W DeRenne Ave between Mildred St and Montgomery St	55,400	n/a	*50,200**	n/a
051-0138	I-516 W of SR 204 & Montgomery St, Savannah	39,200	n/a	*35,500**	n/a
051-0274	US 80/SR 26/E Victory Drive west of Truman Pkwy	*25,500**	3% (765)	23,700	3% (711)
051-0205	US 80/SR 26/W Victory Drive east of I-516	18,200	4% (728)	*16,500**	4% (660)
051-0247	SR 25 west of Houlihan Bridge	*4,660**	25% (1,165)	4,000	25% (1,000)

* 2019 and 2020 counts in italics are estimated counts; non-italic numbers are actual counts

DRAFT

3.5.1.1.4 Travel Speeds

Travel speed could be used to measure traffic condition and congestion when compared to the designed speed or posted speed limits. The speed limits on main arterials within the study area vary from 40 miles per hour (mph) to 55 mph, except for interstates, which have speed limits ranging from 55 mph to 65 mph. Table 14 shows the speed limits along selected arterials in the study area.

Table 14. Speed Limits along Selected Arterials

Road	Segment	Speed Limit (mph)
US 17	From I-16 to South Carolina border	50
Truman Parkway	From President Street to DeRenne Ave	55
DeRenne Avenue	From Truman Parkway to I-516	40
I-516	From Mildred Street to SR 21	55
SR 21	From I-516 to US 80	55
SR 21	From US 80 to Bourne Avenue	45

Source: 2018 Truman Parkway Study, GPA

The average travel speeds during the AM and PM peak hours were obtained from the National Performance Management Research Data Set (NPMRDS) for 2019. The average speeds in the study area during AM and PM peak hours are illustrated in Appendix H and Appendix I, respectively. Based on NPMRDS data, the AM peak hour in Chatham County is 7 AM to 8 AM, and the PM peak hour is 5 PM to 6 PM. The port controls truck traffic and permits trucks to enter and leave the facility only between 5 AM and 5 PM.

Overall, traffic during the PM peak hour experienced more congestion than traffic during the AM peak hour. Compared to other roadways, I-516 experienced the most congestion during both AM and PM peak periods. Most of the road segments along I-516 and DeRenne Avenue have average speeds of less than 20 mph. A typical trip on DeRenne Avenue and I-516 between I-516 and Truman Parkway, with a distance of 3.6 miles, can take up to 15 minutes.

SR 21, SR 25, SR 204, US 80, East DeRenne Avenue, Skidaway Road, Wheaton Street, and East Montgomery Road also have delays during AM and PM peak hours. The Talmadge Memorial Bridge has an average speed for both automobiles and trucks of more than 50 mph during AM and PM peak hours without significant delays. The truck speeds may be lower on the incline portion of the bridge but could be higher on the decline portion of the bridge.

3.5.1.1.5 Level of Service (LOS)

Level of Service (LOS) is determined by the volume-to-capacity ratio and is a qualitative measure of traffic flow. It has letter designations from A to F, with LOS A representing the best operating conditions and LOS F represents the worst congestion. A facility may operate at a range of levels of service depending on time of day, day of the week, or period of the year. LOS for year 2015 was analyzed based on data from the CORE MPO Travel Demand Model.

Figure 30 shows 2015 daily LOS in the study area. Most roads operate at LOS D or better. A few segments operate at LOS E or F, including I-95 at interchanges, segments of SR 21 and Gulfstream Road near

DRAFT

Savannah/Hilton Head International Airport, segments of US 80, and segments of East DeRenne Avenue, which connects I-516 and Truman Parkway.

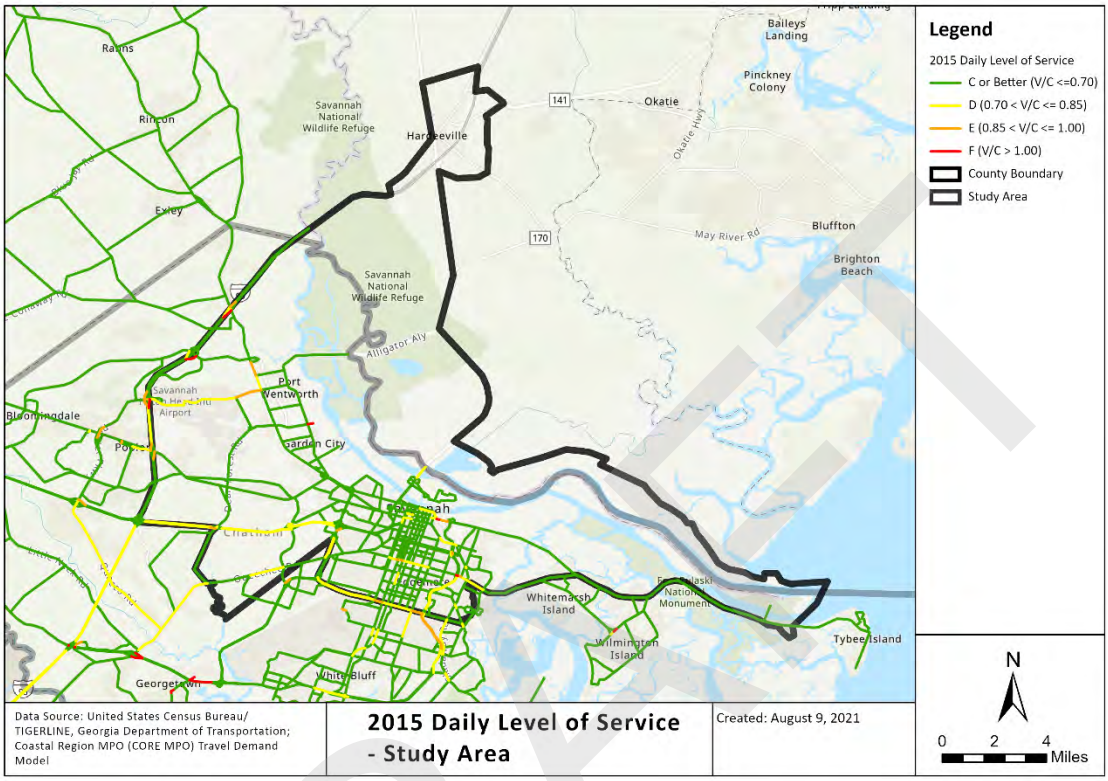


Figure 30. 2015 Daily Level of Service – CORE MPO Travel Demand Model

3.5.1.2 Crash Analysis

3.5.1.2.1 Study Area Total Crashes

Crash history including the crash type and severity is used to analyze roadway safety. Specifically, high crash rate would require measures to reduce crash. The Study Team obtained crash data from GDOT's Numeric dashboard for a five-year period from January 1, 2015, to December 31, 2019. Figure 31 summarizes the crash data by severity in the study area.

DRAFT



	2015	2016	2017	2018	2019
Fatal Crash	25	16	11	15	19
Serious Injury Crash	86	97	90	81	120
Minor Injury Crash	1,893	2,033	1,965	1,701	1,727
Property Damage Only	5,871	6,299	6,148	5,652	5,584
Unknown	349	390	363	311	324

Figure 31. 2015-2019 Crashes by Severity in the Study Area

Between 2015 and 2019, the annual number of crashes within the study area ranged from 7,760 to 8,835. Most crashes were property damage-only crashes. Fatal crashes happened every year in this period, and 2015 had the most the fatal crashes at 25. On average, there were 17 fatal crashes per year. There were seven fatal crashes along I-95 and one along US 17 with no trucks or commercial vehicles involved. Figure 32 shows the crashes related to commercial vehicles by severity in the study area, the number of which increased year by year. Among those crashes, 34% were sideswipe (including same direction and opposite direction) crashes, 26% were rear-end crashes, and 25% were angle (including left angle, right angle, and other angle) crashes. Sideswipe crashes might happen when vehicles change lanes without checking for traffic in the next lane or fail to yield to traffic when merging onto main roads.

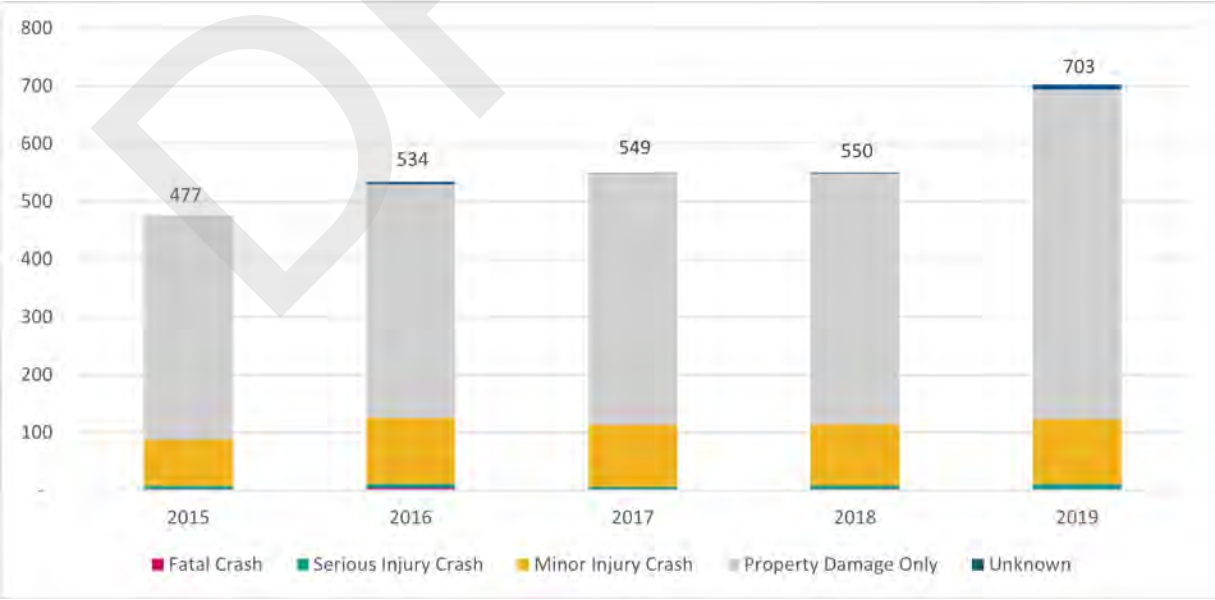


Figure 32. 2015-2019 Commercial Vehicle Crashes by Severity in the Study Area

DRAFT

3.5.1.2.2 Crashes at Talmadge Memorial Bridge

There were 106 crashes between 2015 and 2019 on the bridge segments of US 17 over the Savannah River and Little Back River and their ramps. Among the crashes, 80 (75%) had no injuries, 22 (21%) crashes had minor injuries or possible injuries, 4 (4%) had serious injuries, and there were no fatal crashes. The greatest number of commercial vehicles crashes occurred in 2019, with more rear end, sideswipe, and angle crashes.

The manner of the 106 collisions on the bridges are shown in Table 15. There were 44 (42%) crashes that were not related to other vehicles, which means the crashes happened between vehicles and other objects such as median barrier or guard rail fencing. The second and third leading types of collision on the bridges between 2015 and 2019 were rear end (28%) and same direction sideswipe (14%). The major contributing factor to the rear end crashes were following too closely and traveling too fast for the condition. There was no obvious connection shown for the time of the day and weather condition with the crashes. These percentages are within normal limits. Given that, grading and lane width can impact the distribution of crash type. Table 16 illustrates the 106 crashes broken down by most harmful event.

Table 15. 2015-2019 Crashes on Talmadge Memorial and Little Back River Bridges by Manner of Collision

Manner of Collision	Number of Collisions	Percentage
Not a Collision with Motor Vehicle	44	41.51%
Rear End	30	28.30%
Sideswipe-Same Direction	15	14.15%
Angle (Other)	8	7.55%
Left Angle Crash	4	3.77%
Right Angle Crash	2	1.89%
Head On	1	0.94%
Sideswipe-Same Direction	1	0.94%
None	1	0.94%

Table 16. 2015-2019 Crashes on Talmadge Memorial and Little Back River Bridges by Most Harmful Event

Most Harmful Event	Number of Collisions	Percentage
Motor Vehicle in Motion	65	61.32%
Median Barrier	11	10.38%
Guard Rail Fence	7	6.60%
Other Object (Not Fixed)	7	6.60%
Other – Fixed Object	6	5.66%
Guard Rail End	4	3.77%
Other Non-Collision	3	2.83%
Bridge Rail	2	1.89%
Overturn	2	1.89%
Curb	1	0.94%
Parked Motor Vehicle	1	0.94%

DRAFT

3.5.1.3 Commuter Origin-Destination (OD) Analysis

The Census Transportation Planning Products (CTPP) Program uses specialized data on commute trips from the American Community Survey (ACS) data set and is the single source of commute trip data in small geographies. CTPP data provides worker and household characteristics, travel modes and times, and commuter flows from home to work. The Study Team obtained the 2012-2016 ACS commuter trip data with origin-destination (OD) for Chatham County, which is the latest data CTPP provided. The commuter flows into Chatham County are shown in Table 17, and the commuter flows out of Chatham County are shown in Table 18. The largest workflow comes within Chatham County itself (approximately 120,000 commuters), followed by Effingham (approximately 15,000) and Bryan counties (approximately 7,600). Among the top 10 counties with the highest OD flows between Chatham County, two counties are in South Carolina.

Table 17. Top 10 Counties Commuting into Chatham County, Georgia

County Origin	Average Daily Commuters	Percent of Average Daily Commuters
Chatham County, GA	120,510	78.6%
Effingham County, GA	15,080	9.8%
Bryan County, GA	7,615	5%
Liberty County, GA	3,155	2.1%
Bulloch County, GA	2,850	1.9%
Beaufort County, SC	1,860	1.2%
Jasper County, SC	775	0.5%
Long County, GA	590	0.4%
McIntosh County, GA	510	0.3%
Wayne County, GA	450	0.3%

Table 18. Top 10 Counties Commuting out of Chatham County, Georgia

Workplace	Workers 16 and over	Percentage of workers 16 and over
Chatham County, GA	120,510	94.02%
Liberty County, GA	3,155	2.46%
Effingham County, GA	1,465	1.14%
Bryan County, GA	1,140	0.89%
Beaufort County, SC	1,125	0.88%
Jasper County, SC	205	0.16%
Bulloch County, GA	190	0.15%
Glynn County, GA	165	0.13%
Toombs County, GA	115	0.09%
Hampton County, SC	110	0.09%

DRAFT

For workplace-residence OD flows using Census tract data, the two Census Tracts that include Savannah/Hilton Head International Airport and the City of Port Wentworth are either the origin or destination of all the top 10 OD pairings. This means these two Census tracts either attract or distribute the largest number of trips between all the other top 10 Census tracts. The workplace-residence OD flow is mapped in Figure 33.

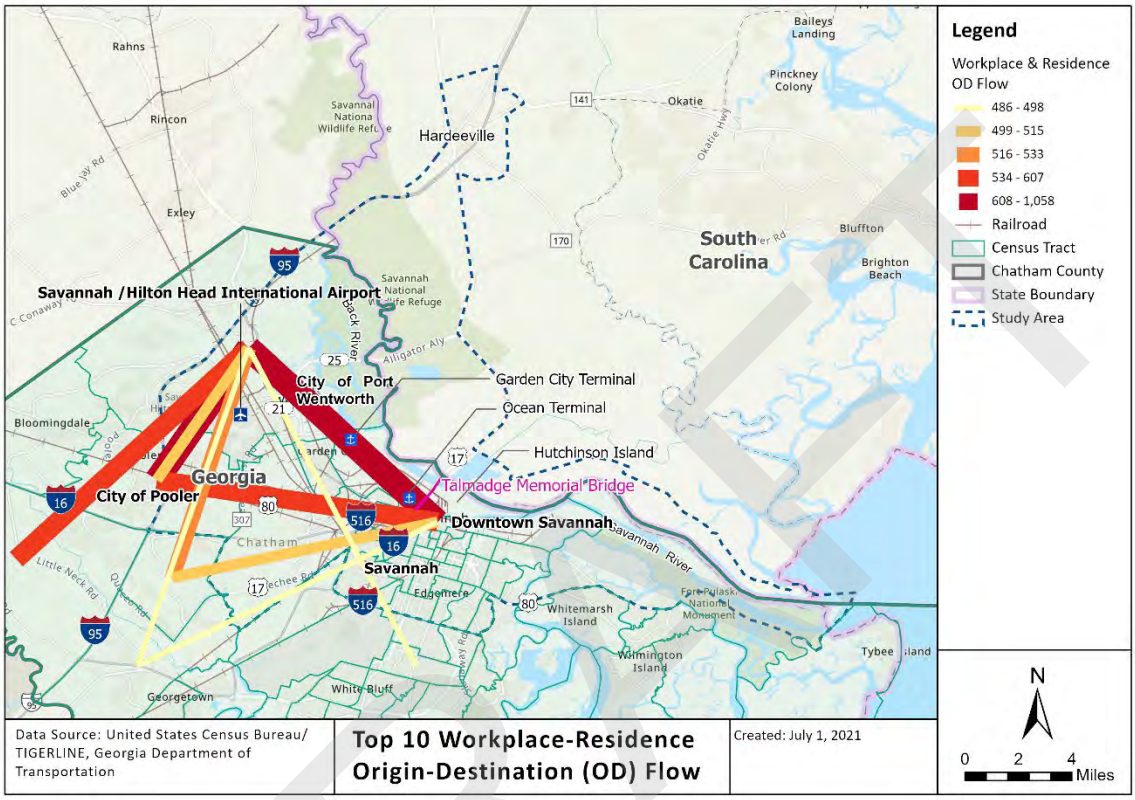


Figure 33. Top 10 Workplace and Residence Origin-Destination (OD) Flow

3.5.1.4 Freight Flow

The Study Team obtained Freight Analysis Framework Version 5 (FAF5) data, including freight flows by tonnage and by value between FAF zones. This data provides an understanding of the origins and destinations for Savannah's freight flows in 2017. Figure 34 shows 2017 total freight flows by tons that originated from the Savannah area using the FAF5 dashboard. Figure 35 shows the same freight flows by value.

DRAFT

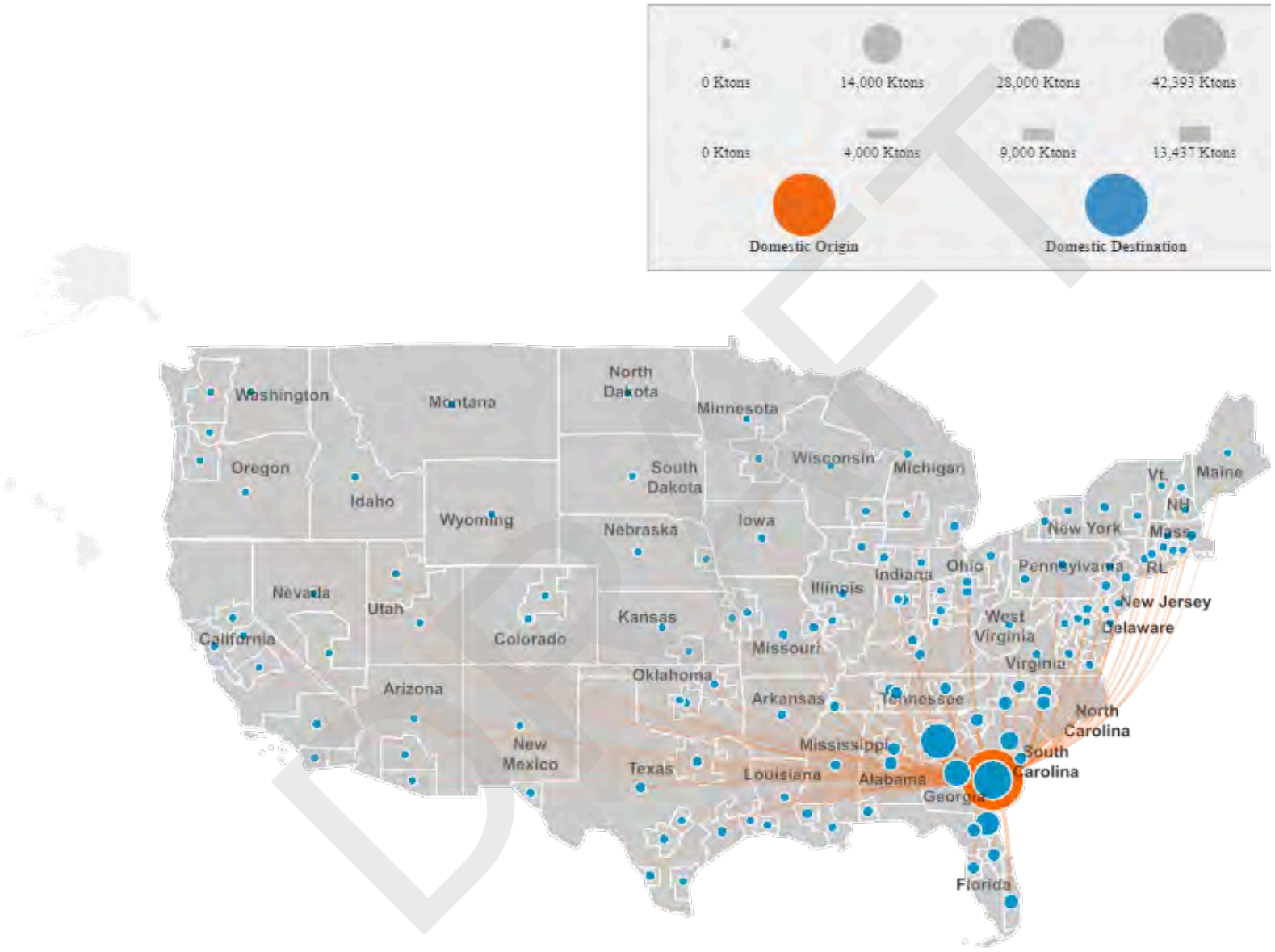


Figure 34. Total Freight Flows by Tons from Savannah Area in 2017

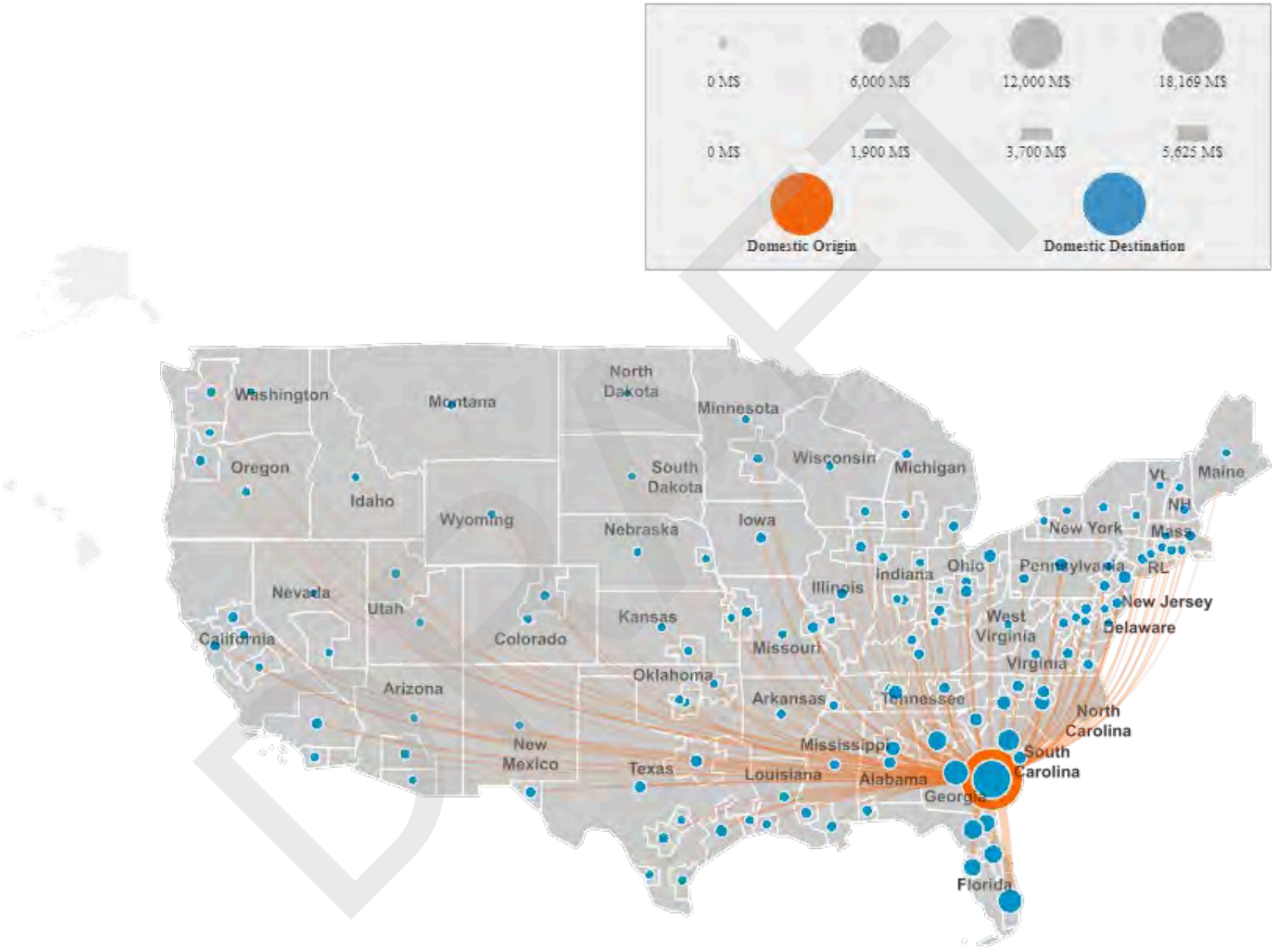


Figure 35. Total Freight Flows by Values (M$) from Savannah Area in 2017

The freight is transported by different modes including truck, rail, air, and water. The top 20 truck freight destinations by tonnage in 2017 are shown in Table 19. Approximately 70% of the truck freight tonnage destinations are in Georgia, 12% in Florida zones, and 6% in South Carolina zones. Of the cargo trips at the Port of Savannah, most cargo is taken to local warehouses for distribution.

Table 19. Top 20 Destinations of Truck Freight Flows by Tons that Originated from Savannah Area

Destination Zones	Thousand Tons in 2017	Percent of Total
132-Savannah GA	12,977	31.2%
131-Atlanta GA	11,023	26.5%
139-Rest of GA	5,003	12.0%
121-Jacksonville FL-GA CFS Area (FL Part)	3,753	9.0%
459-Rest of SC	1,719	4.1%
122-Miami FL	614	1.5%
371-Charlotte NC-SC (NC Part)	498	1.2%
379-Rest of NC	490	1.2%
019-Rest of AL	461	1.1%
129-Rest of FL	416	1.0%
452-Greenville SC	398	1.0%
373-Raleigh-Durham NC	369	0.9%
011-Birmingham AL	311	0.7%
472-Nashville TN	305	0.7%
123-Orlando FL	296	0.7%
451-Charleston SC	281	0.7%
479-Rest of TN	262	0.6%
372-Greensboro—Winston-Salem—High Point NC	255	0.6%
124-Tampa FL	248	0.6%
473-Knoxville-Morristown-Sevierville TN	191	0.5%

The top 20 truck freight destinations by value in 2017 are shown in Table 20. Approximately 60% of the truck freight value destinations, although not all final destinations, are in Georgia, 8.2% in Florida zones, and 7.3% in South Carolina zones.

DRAFT

Table 20. Top 20 Destinations of Truck Freight Flows by Values that Originated from Savannah Area

Destination Zones	Million Dollars in 2017	Percent of Total
131-Atlanta GA	$30,260.4	39.6%
139-Rest of GA	$8,719.4	11.4%
132-Savannah GA	$7,003.5	9.2%
459-Rest of SC	$3,077.6	4.1%
019-Rest of AL	$2,987.2	3.9%
122-Miami FL	$2,366.3	3.1%
011-Birmingham AL	$2,188.8	2.9%
452-Greenville SC	$1,633.6	2.1%
371-Charlotte NC-SC (NC Part)	$1,590.8	2.1%
472-Nashville TN	$1,445.1	1.9%
129-Rest of FL	$1,290.8	1.7%
373-Raleigh-Durham NC	$1,269.6	1.7%
479-Rest of TN	$1183.4	1.5%
379-Rest of NC	$1140.2	1.5%
124-Tampa FL	$948.2	1.2%
123-Orlando FL	$914.4	1.2%
451-Charleston SC	$851.9	1.1%
372-Greensboro—Winston-Salem—High Point NC	$782.4	1.0%
121-Jacksonville FL-GA CFS Area (FL Part)	$743.4	1.0%
473-Knoxville-Morristown-Sevierville TN	$655.8	0.9%

DRAFT

3.5.1.5 Rail System Data and Analysis

The Study Team downloaded rail system data from the Federal Railroad Administration (FRA). Currently, Georgia has multiple railway operators, including GDOT, Class I operators such as CSXT and Norfolk Southern (NS), and Class III operators. GDOT currently owns 10% of all railways in Georgia, Class I operators (CSXT/Norfolk Southern) own 69%, and Class III operators own the remaining 21%. Amtrak currently owns no rail in Georgia, although it has its own passenger facilities and trains.

Figure 36 shows railroad ownerships within the study area. Currently, there are three railway operators in the study area: CSXT, NS, and Georgia Central (GC) Railway. Excluding the railroads that have been abandoned, CSXT owns about 49 miles of railroads in the study area, NS owns about 37 miles, and GC owns 6 miles. Within the Port, GPA owns the Myd Harris Rail Yard, which connects to CSX and NS.

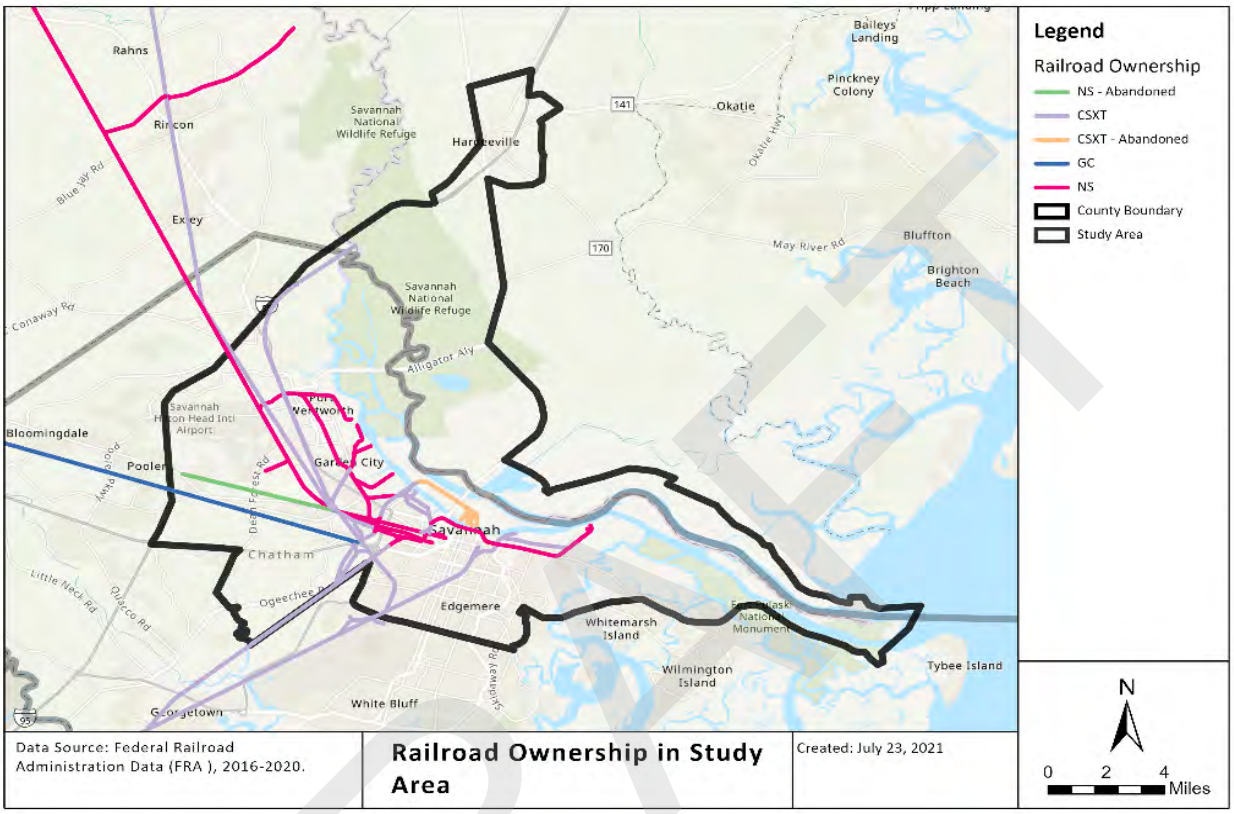


Figure 36. Railroad Ownership

There were 64,987 tons of cargo moved into and out of the Savannah area in 2017. Of this, 57,437.9 tons were moved by truck (88.4%), and 7,549.1 tons were moved by rail (11%). Truck shipments were responsible for 24,233.5 tons of cargo departing Savannah (89.4%) and 33,204.4 tons of cargo arriving in Savannah (87.3%). Rail shipments were responsible for 2,881.1 tons of cargo departing Savannah (10.6%) and 4,668 tons of cargo arriving in Savannah (12.3%). Figure 37 shows the total rail flows by tons from the Savannah area in 2017.

DRAFT

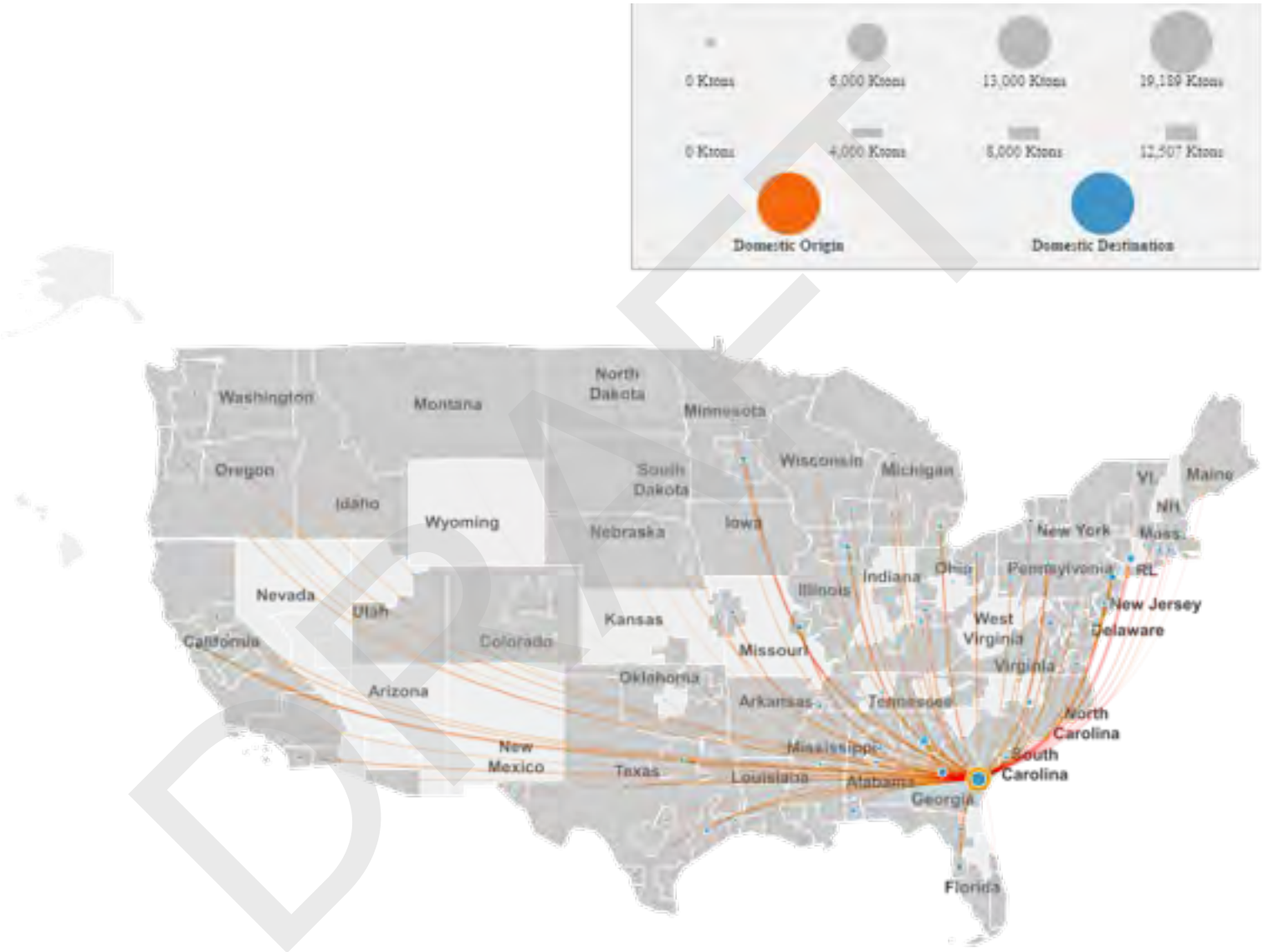


Figure 37. Total Rail Flows by Tons from Savannah Area in 2017

DRAFT

3.5.2 Future Travel Conditions

3.5.2.1 CORE MPO Travel Demand Model Future Forecast

Future travel demands within the study area were obtained from CORE MPO Travel Demand Model for the forecast year 2050 and year 2045 E+C (Existing and Committed Projects) scenario. In the 2045 E+C scenario, I-95, US 80, and East President Street have significant traffic volume changes from 2015 to 2045. Figure 38 shows the 2045 E+C daily total traffic volume within the study area. The total traffic volume annual growth rates of selected roads can be found in Table 21. It should be noted that the annual growth rates were calculated specifically for the road segments within the study area; segments outside the study area were not considered.

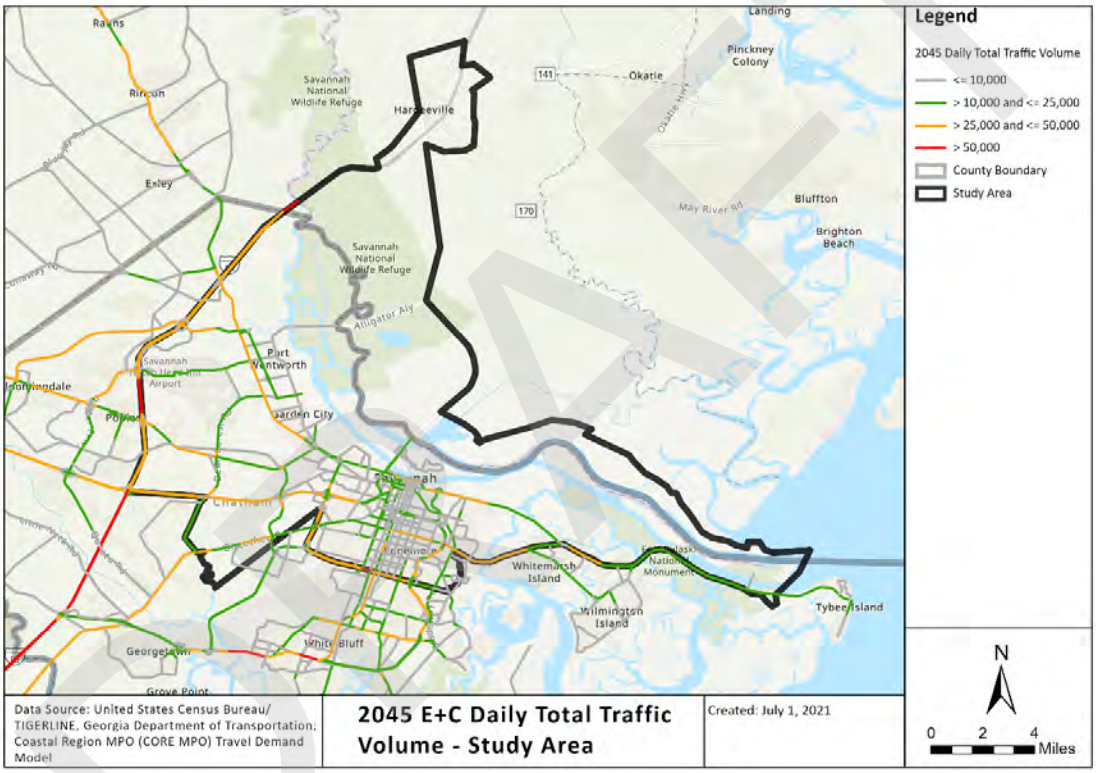


Figure 38. 2045 E+C Daily Total Traffic Volume - CORE MPO Travel Demand Model

Table 21. Total Traffic Volume Annual Growth Rates of Selected Roads

Road Name	Annual Growth Rates (CORE)	Annual Growth Rates (GSTDM)
Talmadge Memorial Bridge	1.9%	0.5%
I-516	0.2%	0.6%
I-95	0.9%	0.9%
US 17	2.0%	0.5%
SR 25	0.7%	0.7%

DRAFT

DeRenne Ave from Truman Pkwy to I-516	0.2%	0.8%
Truman Pkwy from I-516 to E President St	0.5%	0.5%

Figure 39 illustrates truck volumes in 2045 Existing + Committed (E+C) scenario. The E+C scenario represents conditions in 2045 if no further transportation improvements were implemented above and beyond what is already currently programmed. In 2045, daily truck volume on I-95 north of US 80 can experience a significant change in the range of 10,000 to 20,000 from 5,000 to 10,000, while daily truck volumes on I-16 between SR 307 and I-516, and on I-516 north of I-16 increase from less than 5,000 to 5,000 to 10,000. The average annual growth rate of truck volumes on these segments is 1.6%. More detailed annual growth rates will be calculated in the next phase of the study.

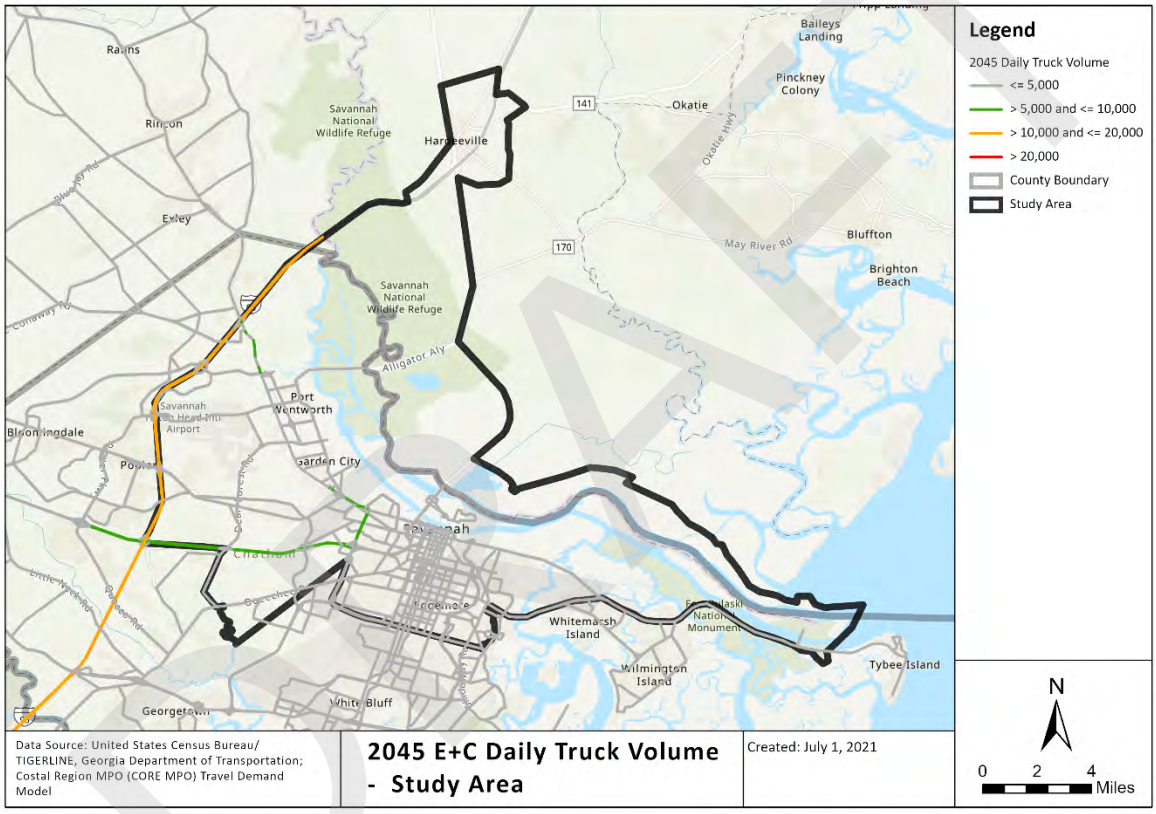


Figure 39. 2045 E+C Daily Truck Volume – CORE MPO Travel Demand Model

DRAFT

As shown in Figure 40, In the 2045 E+C scenario, I-95 between I-16 and Jimmy Deloach Parkway, Gulfstream Road near the airport, East DeRenne Avenue, and Truman Parkway south of US 80 operate at LOS E or worse; other roadways operate at LOS D or better. Compared with 2015, LOS on I-95, Truman Parkway, US 17, SR 21, and Gulfstream Road have significant changes.

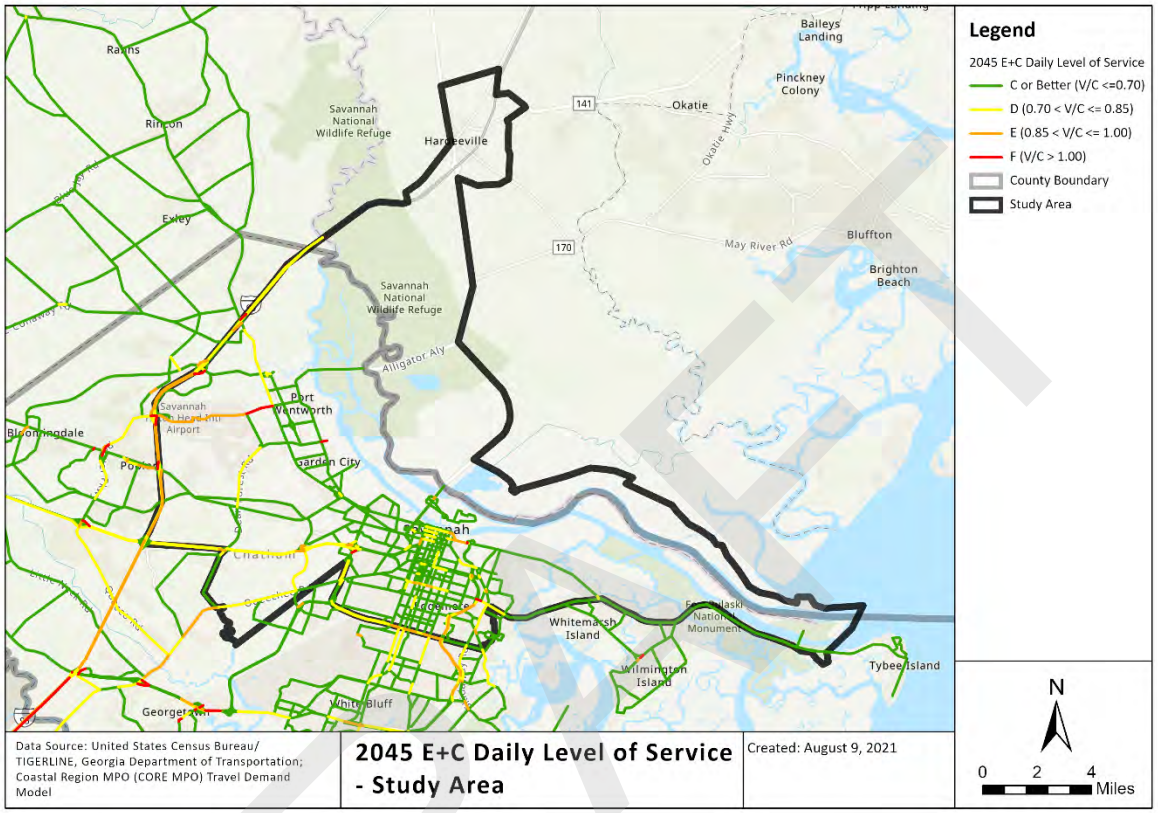


Figure 40. 2045 E+C Daily Level of Service – CORE MPO Travel Demand Model

3.5.2.2 VISUM Model Analysis

3.5.2.2.1 Traffic Counts Collection

To support the development of a VISUM model analysis of the alternatives, and specifically the calibration for base year condition in the vicinity of US 17, traffic counts were collected on Tuesday, April 19th and Wednesday, April 20th, 2022. 13 locations were selected to collect Average Daily Traffic (ADT) counts for 48 hours, and 23 locations were selected to collect turning movement counts (TMC) during AM (6 – 9 am) and PM (4 – 7 pm) periods. Figure 41 below shows ADT and TMC data collection locations.

DRAFT

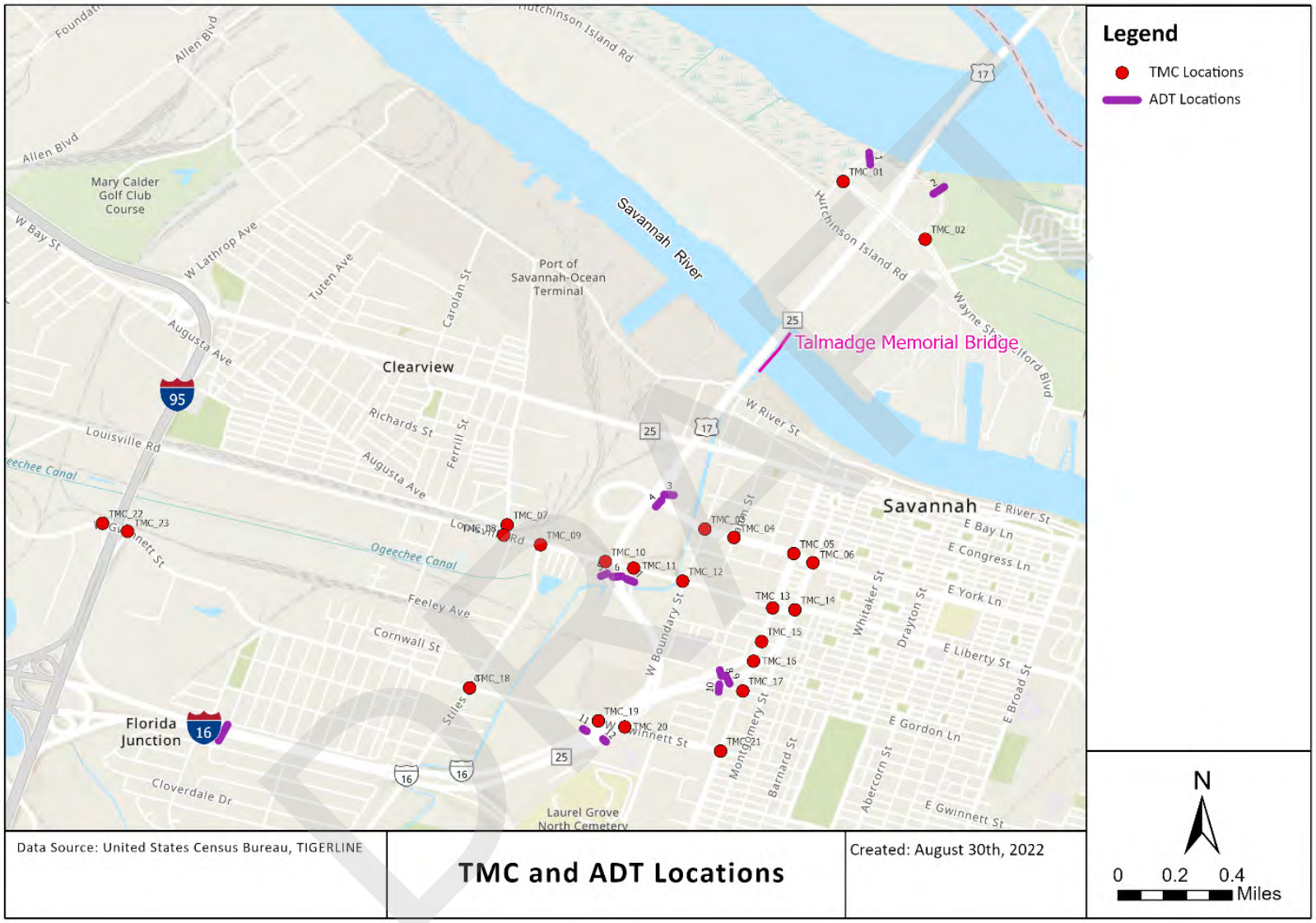


Figure 41. TMC and ADT Locations for Traffic Counts Collection

The ADT were collected and categorized by vehicle type and direction and summarized in every 15-minute interval. Table 22 below lists the ADT data collection locations and the corresponding ADT.

Table 22. ADT Locations

ADT ID	Location	ADT (veh/day)
1	US-17 SB Ramps North of Savannah Harbor Pkwy	1,530
2	US-17 NB Ramps North of Savannah Harbor Pkwy	1,631
3	US-17 NB On Ramp from W Oglethorpe Ave	7,225
4	US -17 SB Off Ramp to W Oglethorpe Ave	6,545
5	US -17 SB On Ramp from Louisville Rd	1,469
6	US -17 South of Louisville Rd	11,730
7	US -17 Nb Off Ramp to Louisville Rd	1,211
8	I-16 On Ramp from Martin Luther King Jr. Blvd	1,0327
9	I-16 Off Ramp to Montgomery St	8,859
10	I-16 Off Ramp to Martin Luther King Jr. Blvd	2,974
11	I-16 SB On Ramp from W Gwinnett St	2,115
12	US-17 NB Off Ramp to W Gwinnett St	2,162
13	I-16 East of I-516 Interchange	63,095

Table 23 lists the TMC locations. The traffic counts collected include the turning movement counts of motorized vehicles and the counts of pedestrians and bicycles on crosswalk in every 15-minute interval. The counts were categorized by vehicle type and direction. The TMC of the 23 locations in every 15-minute interval were summed up to identify AM and PM peak hours. Based on the collected counts, the AM peak hour is 7:30 – 8:30 am and the PM peak hour is 4:30 – 5:30 pm. As the PM period had the higher traffic volumes, the TMC of PM peak hour (4:30 – 5:30 pm) were selected to be balanced and used in the VISUM model.

During the turning movement balancing, the TMC locations were balanced in three subgroups due to the distances and gaps in between. TMC locations 1 and 2 on Hutchinson Island were balanced as a group. TMC locations 22 and 23 around I-516 were balanced as another group. And for the rest 19 TMC locations around US 17, each pair of adjacent two TMC locations was balanced except for TMC locations 20 and 21 due to missing an intersection in between during the data collection.

DRAFT

Table 23. TMC Locations

TMC ID	Location
1	Wayne Shackelford Pkwy & Savannah Harbor Pkwy
2	US-17 NB Ramps & Savannah Harbor Pkwy
3	W Boundary St & W Oglethorpe Ave
4	Fahm St & W Oglethorpe Ave
5	Martin Luther King Jr. Blvd & W Oglethorpe Ave
6	Montgomery St & W Oglethorpe Ave
7	E Lathrop Ave & Augusta Ave
8	E Lathrop Ave & Louisville Rd
9	Stiles Ave & Louisville Rd
10	US-17 SB On Ramp & Louisville Rd
11	US-17 NB Off Ramp & Louisville Rd
12	W Boundary St & Louisville Rd
13	Martin Luther King Jr. Blvd & Louisville Rd
14	Montgomery St & Liberty St
15	Martin Luther King Jr. Blvd & Jones St
16	Martin Luther King Jr. Blvd & W Taylor St
17	Martin Luther King Jr. Blvd & W Gaston St
18	Stiles Ave & W Gwinnett St
19	I-16 SB On Ramp & W Gwinnett St
20	US-17 NB Off Ramp & W Gwinnett St
21	Martin Luther King Jr. Blvd & W Gwinnett St
22	I-516 SB On Ramp & W Gwinnett St
23	I-516 NB Off Ramp & W Gwinnett St

DRAFT

3.5.2.2.2 VISUM Model Development and Alternative Analysis

A VISUM model was developed to evaluate the impact of different alternatives on future traffic condition in the immediate surrounding area of the project – the vicinity of US 17. As shown in Figure 42, there were three major steps in the development process, the 2020 base year model, the 2050 no build model, and the 2050 build alternative models.

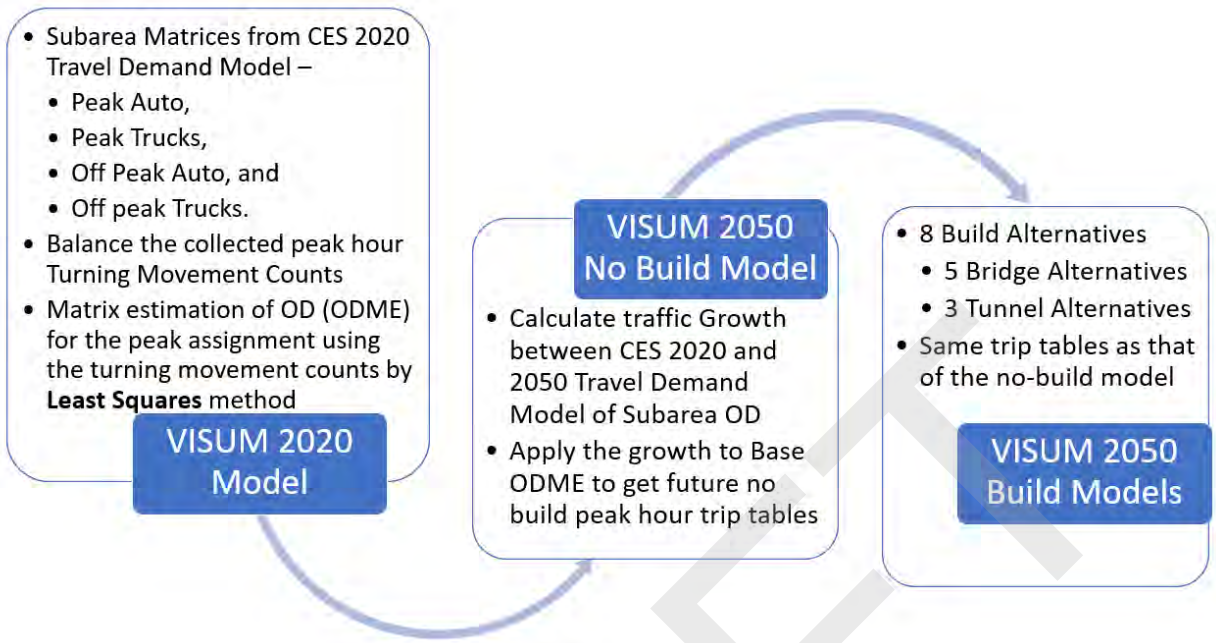


Figure 42. Flow Chart of the VISUM Model Development and Alternative Evaluation

The VISUM 2020 base year model was developed by extracting a subarea model from the Costal Empire Study (CES) (2022) travel demand model. The CES travel demand model is a regional model for four counties: Bryan, Bulloch, Chatham, and Effingham County. The subarea network extracted for VISUM model is with I-516 to the west, Whitaker St to the east, Little Back River to the north, and E DeRenne St to the south. The peak and off-peak matrices from the CES 2020 base year model were also extracted.

To calibrate the turning movements in the VISUM 2020 base year model, the collected and balanced turning movement counts (TMC) mentioned in the previous section 3.5.2.2.1 were used. The counts were coded for corresponding turning movements in the VISUM base year model. The origin destination matrix estimation (ODME) was done to match the estimated turning movement volumes from the model to the balanced turning movement counts by using Least Squares method in VISUM.

The Least Squares method provided by VISUM is an effective way to update matrices. It minimizes the overall squared distance between each pair of assignment value and the counted value. The structure of the original matrix is maintained while the squared distance between the old and new matrix values are minimized.

After the VISUM 2020 base year model was calibrated, the VISUM 2050 no build model was developed. Similar to the base year model, the future year no build model is based upon the CES 2050 future year model and uses a subarea of the latter. In CES 2050 model, the population and employment growth were forecasted to represent future year conditions, and the employment growth used the assumption that most of the industrial land in the four-county area, especially in Chatham County, will be developed by 2050. The traffic growth rates between the CES 2020 base year and CES 2050 future models for each origin-destination (O-D) pair in the subarea were calculated and those factors were then used to multiply by the ODME to get the future peak hour trip tables for the VISUM 2050 model. The ODME referred here was done earlier to calibrate the turning movements in the VISUM 2020 model. These future peak hour trip tables would be used by the future year model for all scenarios. This means that while the estimated volumes on individual links may change among the no-build and different build scenarios, the origin

DRAFT

destination (OD) matrices for zonal travel would be the same. In other words, replacing the existing Talmadge Memorial Bridge with either a new bridge or tunnel would not be expected to generate new trips, and if the new bridge or tunnel were to be roughly at the same location as the existing bridge, it would not be expected to change travel patterns significantly neither.

VISUM future year models were developed for 2050 no-build and eight ramp configuration alternatives within the build scenarios, including five bridge build scenarios and three tunnel build scenarios. The bridge scenario is to simulate the traffic condition when a new bridge is built to replace the existing Talmadge Memorial Bridge, with on/off ramp modifications along US 17 in Savannah downtown area and on Hutchinson Island. The tunnel scenario is to simulate the traffic condition when a new tunnel is built to replace the existing Talmadge Memorial Bridge, also with on/off ramp modifications along US 17 in Savannah downtown area and on Hutchinson Island.

The VISUM 2050 no build model was modified to develop the build scenarios based on the proposed design associated with each alternative. It is observed that there is no significant difference in the future traffic condition across the no build and eight build scenarios, in terms of vehicle hours of delay (VDH) and LOS during the peak hour for the modeling area as a whole or by five identified corridors. This would be in line with the forecast that US 17 will likely maintain good travel condition in the future by both the CORE MPO's travel demand model and CES travel demand model as daily models. The comparisons across the no-build and eight build scenarios are summarized in the tables below (Table 24, Table 25, and Table 26). The detailed LOS maps for the no-build and eight build scenarios are included in the appendix.

Table 24. Peak Hour Vehicle Hours of Delay (VHD) in VISUM Modeling Area across Alternatives

Scenario	Vehicle hour of delay	Reduction of VHD compared to No Build
No Build	17,878	
Bridge1	17,836	0.23%
Bridge2	17,855	0.13%
Bridge3	17,831	0.26%
Bridge4	17,865	0.07%
Bridge5	17,840	0.21%
Tunnel1	17,877	0.01%
Tunnel2	17,877	0.01%
Tunnel3	17,858	0.11%

Table 25. Peak Hour Vehicle Hours of Delay by Corridor across Alternatives

Scenario	US 17 (including TMB and ramps)	Louisville Rd	W Oglethorpe Ave	MLK Jr Blvd	Montgomery St
No Build	272	674	102	200	290
Bridge1	273	676	81	203	278
Bridge2	284	680	79	199	297
Bridge3	270	679	76	194	300
Bridge4	276	672	75	189	301
Bridge5	253	672	75	189	301
Tunnel1	270	679	76	194	300
Tunnel2	270	679	76	194	300
Tunnel3	251	679	-	194	300

DRAFT

Table 26. Peak Hour Level of Service by Corridor across alternatives

Scenario	US 17 (including TMB and ramps)	Louisville Rd	W Oglethorpe Ave	MLK Jr Blvd	Montgomery St
No Build	A/B	F	C	C	A/B
Bridge1	A/B	F	C	C	A/B
Bridge2	A/B	F	C	C	A/B
Bridge3	A/B	F	C	C	A/B
Bridge4	A/B	F	C	C	A/B
Bridge5	A/B	F	C	C	A/B
Tunnel1	A/B	F	C	C	A/B
Tunnel2	A/B	F	C	C	A/B
Tunnel3	A/B	F		C	A/B

3.5.3 Traffic Needs Summary

As discussed above, with US 17 in the study area including the Talmadge Memorial Bridge estimated to be in good travel condition in the future, the alternative analysis results show little differences of impact across all the new bridge and tunnel alternatives on peak hour travel condition, as well as against the future no build scenario. Therefore, at a high level, the impact on future traffic condition is not a differentiating factor for the eight ramp configuration scenarios evaluated.

However, for the feasible alternatives, it would be important to evaluate the key intersections for traffic control measures and to evaluate and minimize the traffic impacts during the construction.

While there are no sidewalks, bike lanes, or transit routes on the existing Talmadge Memorial Bridge, such opportunities could be explored as alternatives being developed. The feasible alternatives should also incorporate improved safety for the area of impact.

Table 27. Summary of Traffic Needs

Traffic Needs
Minimize negative impacts on traffic delays within the city
Minimize impacts to travel patterns on alternative routes during temporary closure and construction of US 17
Provide for safe and efficient routing for freight movements during the various stages of construction.
Improve safety to reduce crashes in the study area and along a new Savannah River crossing

DRAFT

3.6 Needs verification

The following table summarizes the physical, economic, environmental, and traffic needs discussed above and compares them to the draft goals and objectives to verify the relationship between each identified study objective and the data-driven study needs.

Table 28. Physical, Economic, Environmental, and Evaluation criteria for Traffic Needs

Study Need	Evaluation Criteria													
	Minimize impacts to cost and constuction.				Support the long-term economic efficiency and sustainability of the GPA and Georgia's economy.				Minimize adverse impacts on the built and natural environment.			Meet design standards.		
	Minimize construction impacts to the traveling public	Minimize construction impacts to operations of vessels navigating in and out of the Port facilities	Deliver the project at a reasonable cost	Leverage partnerships for successful infrastructure development and maintenance	Provide an air draft clearance to support Ultra Large Container Vessels (ULCV)	Provide freight accessibility to the existing port infrastructure	Provide accessibility and connectivity to both sides of the Savannah River	Deliver the project within a reasonable timeframe	Avoid, minimize, or mitigate impacts on community, historic, and visual resources	Minimize effects on environmentally sensitive areas, natural habitats, and water resources	Maximize alignment with existing plans	Provide for a safe passage of both ground transportation and vessels	Minimize increases to vehicular delay	Leverage innovative technology to promote safety and mobility
Physical Needs														
Address the existing air draft of the Talmadge Memorial Bridge, which limits the size of ships that can safely navigate the Savannah River to access the Port					✓			✓				✓		✓
Maintain a Savannah River crossing to connect Downtown Savannah, Hutchinson Island, and South Carolina via US 17	✓	✓				✓	✓	✓				✓		✓
Align the design of a new river crossing to the planned expansion of the Back River Bridge	✓					✓	✓	✓			✓	✓		✓
Meet the needs of travelers within and around the study area identified by the functional classification and characteristics of the roadway system	✓					✓	✓	✓				✓	✓	✓
Economic Needs														
Maintain the Port of Savannah as an economic driver for Chatham County, Georgia, South Carolina, and the East Coast	✓	✓			✓	✓	✓	✓			✓	✓		✓
Avoid constraining future growth of GPA's Port activity, including operations and efficiency		✓			✓	✓	✓	✓			✓	✓		✓
Align with other plans and developments in the area		✓			✓		✓	✓				✓		✓
Environmental Needs														
Minimize impacts to environmentally sensitive resources as much as possible or mitigate impacts when unavoidable		✓						✓	✓	✓		✓	✓	✓
Consider resiliency improvements to protect and preserve environmentally sensitive areas when applicable		✓						✓	✓	✓		✓	✓	✓
Traffic Needs														
Minimize negative impacts on traffic delays and crashes on both sides of the Savannah River	✓					✓		✓	✓			✓	✓	✓
Minimize impacts to travel patterns on alternative routes during temporary closure and construction of US 17	✓					✓		✓	✓			✓		✓

DRAFT

4 ALTERNATIVES DEVELOPMENT

As part of GDOT's Talmadge Memorial Bridge Air Draft Analysis in 2019, potential alternatives were identified to address the vertical clearance limitations of the bridge. The 2019 analysis, along with efforts during the current study, has produced a total of 27 potential alternatives. The Study Team stratified these alternatives into categories and selected the initial set of alternatives for this evaluation effort. Through future stakeholder engagement and/or the alternative analysis effort, other alternatives may be added to the screening analysis. All alternatives will be screened starting with Tier 1.

The categories and the identified alternatives are shown in Table 29. A No-Build option will be considered as part of the National Environmental Policy Act (NEPA) documentation, but it is not included in this evaluation and screening approach as the purpose is to identify a preferred build alternative.

DRAFT

Table 29. Build Alternatives Considered

1. Tunnel	a. Upstream of Existing Bridge with access to Hutchinson Island
	b. Downstream of Existing Bridge with access to Hutchinson Island
	c. Next to Existing Bridge without access to Hutchinson Island
	d. Tunnel at a different location
2. New Bridge - Same Location	a. 215' Bridge Clearance (Bayonne Bridge)
	b. >230' Bridge Clearance (Future Scenario per ship projections)
	c. 230' Bridge Clearance Upstream of Existing Bridge
	d. 230' Bridge Clearance Downstream of Existing Bridge
	e. New Draw Bridge
	f. 220' Bridge Clearance Upstream of Existing Bridge
	g. 220' Bridge Clearance Downstream of Existing Bridge
3. New Bridge - Truman Parkway Extension	a. 220' Bridge Clearance
	b. 230' Bridge Clearance
	c. 215' Bridge Clearance (Bayonne Bridge)
	d. >230' Bridge Clearance (Future Scenario per ship projections)
	e. New Draw Bridge
4. Remove Bridge and Re-Route US 17 Traffic	a. Without Ferry Service
	b. With Ferry Service
	c. Widen SR 25 to accommodate additional traffic; Re-route US 17 designation to SR 25
5. Modify Existing Bridge	a. Raise existing deck by shortening stays
	b. Raise existing deck by jacking with new cable anchorage boxes
	c. Build new deck at higher elevation
	d. Raise to provide 215' Bridge Clearance (Bayonne Bridge)
	e. Raise to provide >230' Bridge Clearance (Future Scenario per ship projections)
	f. Convert central span of existing bridge to a draw bridge
6. Downriver Port Facilities	a. Fig Island site
	b. Kemira Road site

4.1 Collaboration

Throughout the alternative development and design process, the GDOT Study Team has met weekly with GPA staff. These meetings are used to confirm and share data, discuss challenges and opportunities of alternatives, and answer questions. Additionally, the Study Team has met with many internal departments at GDOT to share information, discuss potential project risks, and receive feedback.

One outcome on this ongoing collaboration was the identification of potential conflicts between the Ocean Terminal berth reconstruction and the tunnel alternative. The Ocean Terminal berth reconstruction project was able to be modified to avoid conflicts if the tunnel is the selected alternative. In addition, the Study

DRAFT

Team identified potential conflicts between the tunnel alternative and an existing GPA warehouse slated for demolition. GPA decided to extract the existing piles during demolition to avoid future conflicts.

The Study Team also met with the Back River Bridge Design Team to discuss opportunities to modify the new parallel bridge project to best align with the future Savannah River Crossing. Depending on the preferred alternative selected for the Savannah River Crossing, some modification may be needed to the existing and proposed Back River Bridges. Ongoing collaboration between these teams will minimize the amount of reconstruction needed in the future.

4.2 Fact Sheets for Alternative Categories

For each of the identified alternative categories, a fact sheet was created to summarize the location, description, conceptual design, impacts, and cost estimate. The fact sheets for each broad category appear on the pages that follow.

DRAFT

Alternative Category 1

Tunnel

SUMMARY SAVANNAH RIVER CROSSING FEASIBILITY STUDY

Alternative Overview

Boring a tunnel under the Savannah River would eliminate future concerns about clearance for ships visiting the Port of Savannah.

The tunnel would be constructed as two parallel bores with each bore containing two lanes of traffic: northbound in one bore and southbound in the other. The bores would each be approximately 50 feet in diameter and would be constructed 50 feet apart from each other.

The minimum cover over the tunnel at each portal would be 50 feet. The tunnel bores would be periodically connected by cross-tunnels to allow emergency egress.

Tunnels require many life-safety considerations such as ventilation, fire suppression, emergency access and egress, and lighting. The tunnel would require an on-site operations building and has long-term operation and maintenance costs.

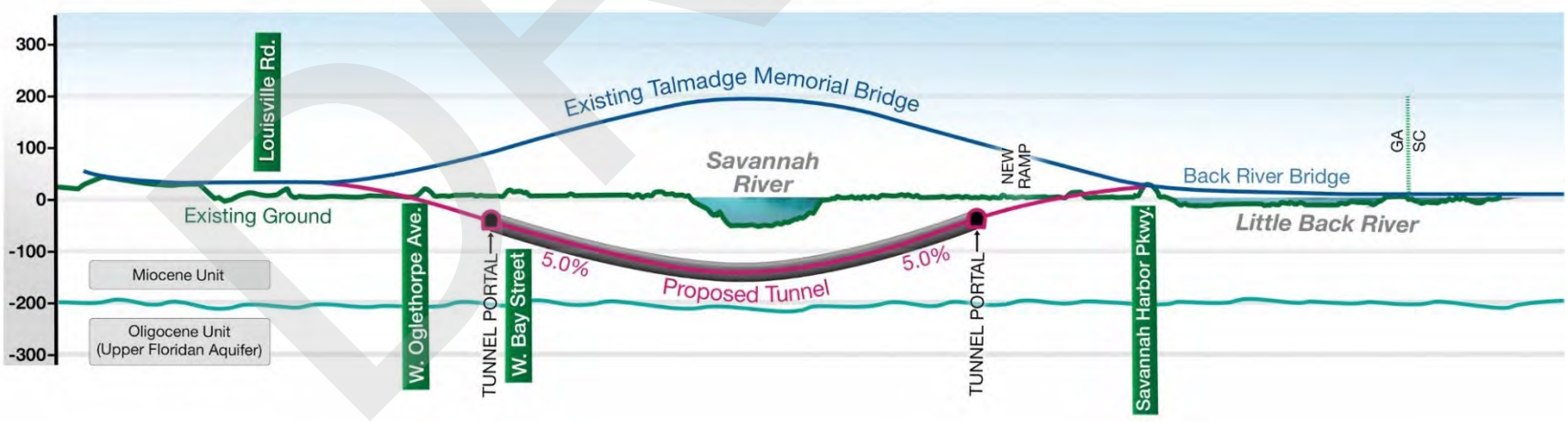
The existing bridge will be removed after construction of the new tunnel.



*Tunnel Boring Machine

Conceptual Design

The tunnel is proposed to be adjacent to and upstream (west) of the existing Talmadge Memorial Bridge. The tunnel alternative allows for a connection to Hutchinson Island but would require the existing connection at West Oglethorpe Avenue to be closed and diverted to Louisville Road. The tunnel alignment can tie into the existing and proposed Back River bridges with minimal reconstruction.



Timeline for Implementation

2021-2022
Feasibility and Planning Studies

2022-2026
Environmental Documentation, Pre-Let Development, Design-Build Procurement

2026-2032
Final Design and Construction

DRAFT

Alternative Category 1

Tunnel

Transportation & Mobility Impacts

The tunnel alternative has moderate impact to vehicular or vessel traffic during construction.

Vehicular Traffic

Can be constructed while maintaining traffic on the existing bridge and road network. Some staging of traffic will be needed, with periods of time that the lanes will be reduced to one in each direction and downtown access will be temporarily diverted to I-16, I-516, and West Bay Street.

Vessel Traffic

Eliminates future concerns about clearance for ships. Impacts to navigation will be minimal as tunnel construction will be under the riverbed. Demolition of the existing bridge will be the only potential for impacts.

Transportation Network

This alternative maintains the current US 17 route and will provide the same number of lanes and connectivity between Savannah, Hutchinson Island, and South Carolina.

Final Phase of Tunnel Construction

Graphic shows construction sequence and maintenance of traffic during bridge demolition.



Environmental, Community, & Safety Impacts

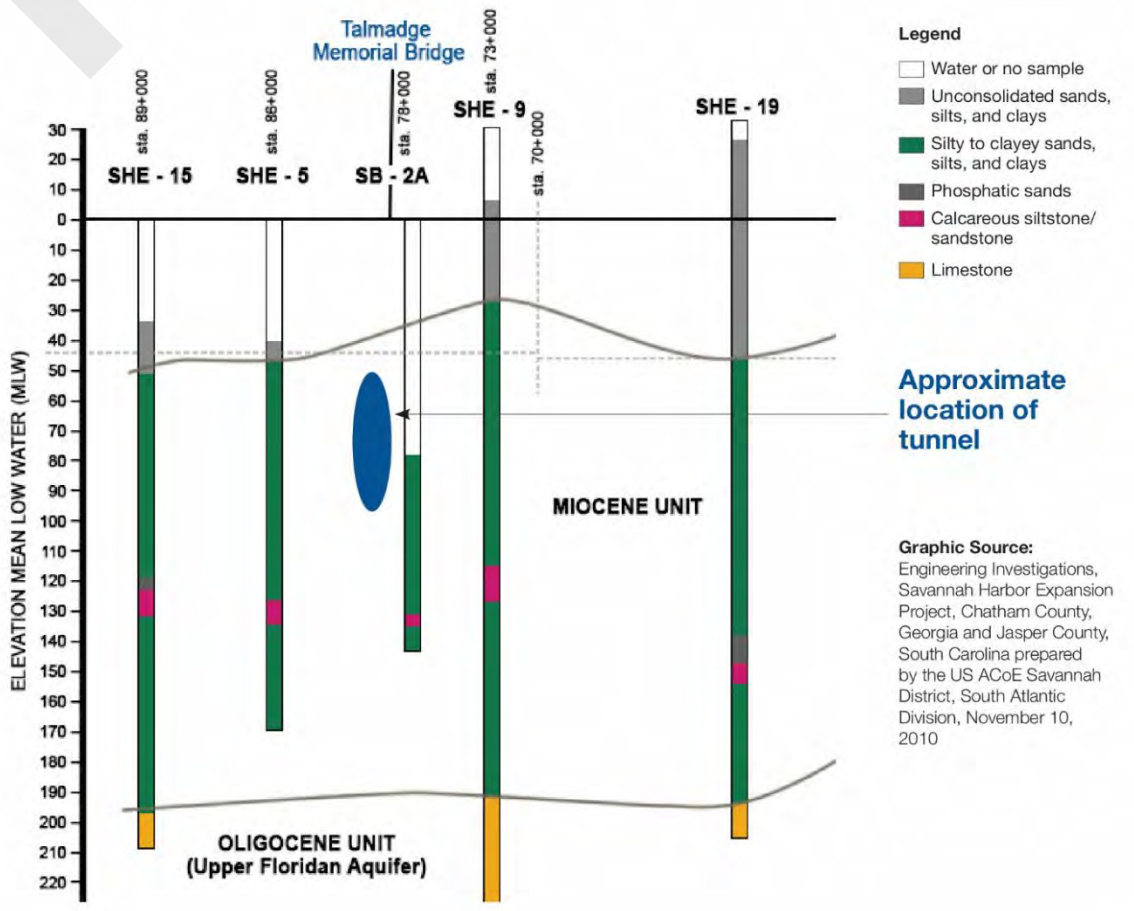
Impacts to natural, environmental, and cultural resources are likely for this alternative.

Aquifer

Project site is underlain by the Upper Floridan Aquifer, which provides drinking water to the City of Savannah.

The proposed tunnel would have to be completely contained within the upper confining Miocene Unit.

A bored tunnel poses less risk of saltwater intrusion to the aquifer than other tunneling methods. Exploratory geotechnical borings are being conducted during the Tier 3 screening to verify the depth of Upper Floridan Aquifer.



Graphic Source:
Engineering Investigations, Savannah Harbor Expansion Project, Chatham County, Georgia and Jasper County, South Carolina prepared by the US ACoE Savannah District, South Atlantic Division, November 10, 2010

Tunnel

Environmental, Community, & Safety Impacts (continued)

Environmental Resources

The bored tunnel alternative on the upstream side of the existing bridge would minimize impacts to the City of Savannah and associated cultural resources, residents, and environmental justice communities because the tunnel would be primarily under GPA property. Although impacts to the Savannah River during tunnel construction would be low, there is a higher probability of impacts to protected species and critical habitat during demolition and removal of the existing bridge.

There is a high probability for the presence of underwater archaeological resources along the riverbed; however, the deep bored tunnel would be at depths well below the floor of the riverbed.

Community

Members of the community may be concerned about the loss of an iconic structure. In addition, the community may be concerned about vibration during construction and demolition and its effects on the area, particularly nearby historic buildings.



Cost-Benefit Analysis

Construction Estimate

$1.4B*

Costs

- Construction
- Design
- Right-of-Way

Benefits

- Eliminates future concerns about vertical clearance
- Minimizes impacts to environmental, community, and cultural resources

**Cost reported in current dollars. Includes allowance for PE, ROW; Final Design and Construction Oversight under a Design-Build Procurement Scenario. Also includes 40% contingency.*

Options Considered but Screened Out

Immersed tube tunnel and cut and cover tunnel

These tunnel construction options are more disruptive to the riverbed as they require dredging for construction, resulting in increased impacts to Savannah River ecological resources and navigation. There is also a higher risk of saltwater intrusion to the underlying aquifer. These shallower tunnels may limit future deepening of the navigation channel.

Downstream tunnel

The downstream location has greater impacts to the City of Savannah and associated cultural and community resources.

Tunnel without access to Hutchinson Island

Access can be provided, so this alternative was not considered.

Tunnel at another location

No alternate location has been identified for further study.

DRAFT

Alternative Category 2

New Bridge: Same Location

SUMMARY SAVANNAH RIVER CROSSING FEASIBILITY STUDY

Alternative Overview

Constructing a new bridge adjacent to the existing bridge was evaluated with both upstream (west) and downstream (east) alignments. The assumed clearance envelope for the new bridge is 600 feet wide and 230 feet above Mean High Water (MHW). This results in a profile approximately 45 feet higher than the existing bridge. The proposed bridge would carry two lanes of traffic in each direction separated by a median barrier resulting in a total bridge width of approximately 98 feet. The existing bridge will be removed after construction of the new bridge.

Upstream (West) Alignment

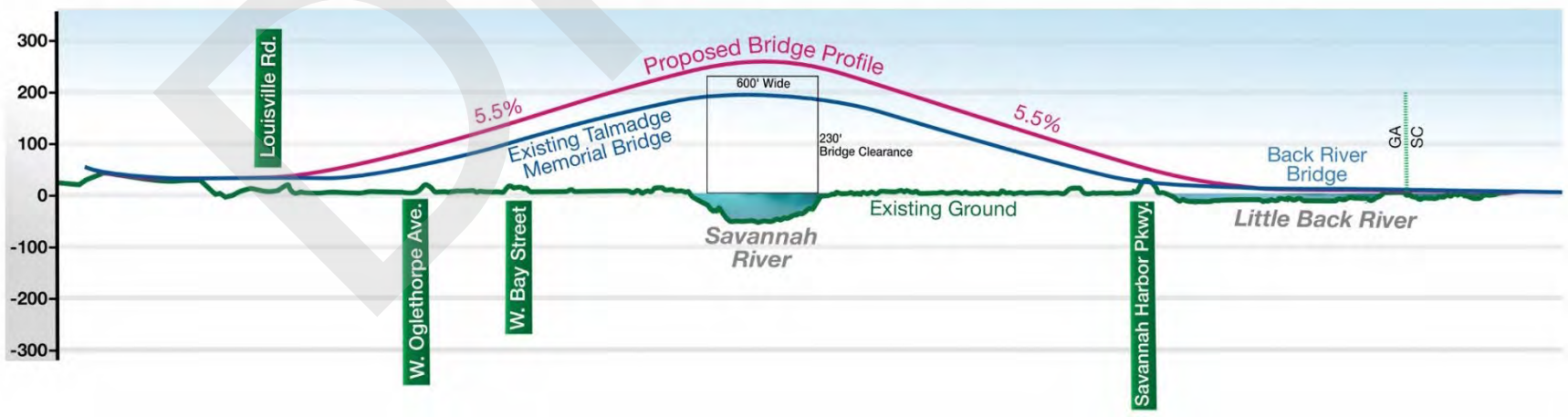


Downstream (East) Alignment



Conceptual Design

The alignment for the new bridge is adjacent to the existing Talmadge Memorial Bridge. This alternative allows for a connection to Hutchinson Island, with ramp reconstruction at the interchange with Savannah Harbor Parkway. It would require the existing connection at West Oglethorpe Avenue to be closed and diverted to Louisville Road. This alternative will impact the existing Back River Bridge, requiring it to be completely or partially replaced. Further refinement of the alignment will be undertaken during Tier 3 screening to minimize impacts to environmental and community resources as well as Georgia Ports Authority (GPA) operations.



Timeline for Implementation

2021-2022
Feasibility and Planning Studies

2022-2026
Environmental Documentation, Pre-Let Development, Design-Build Procurement

2026-2032
Final Design and Construction

Alternative Category 2

New Bridge: Same Location

Transportation & Mobility Impacts

The bridge alternative has moderate impact to vehicular or vessel traffic during construction.

Vehicular Traffic

Can be constructed while maintaining traffic on the existing bridge and road network. Some staging of traffic will be needed, as there would be periods of time in which the lanes will be reduced to 1 in each direction and downtown access will be diverted to detours on I-16, Martin Luther King Jr. Boulevard, and West Oglethorpe Avenue.

Vessel Traffic

Impacts to navigation will be minimal as no work will occur in the water. Construction and demolition of the main spans of the bridge will be the only potential for impacts.

Transportation Network

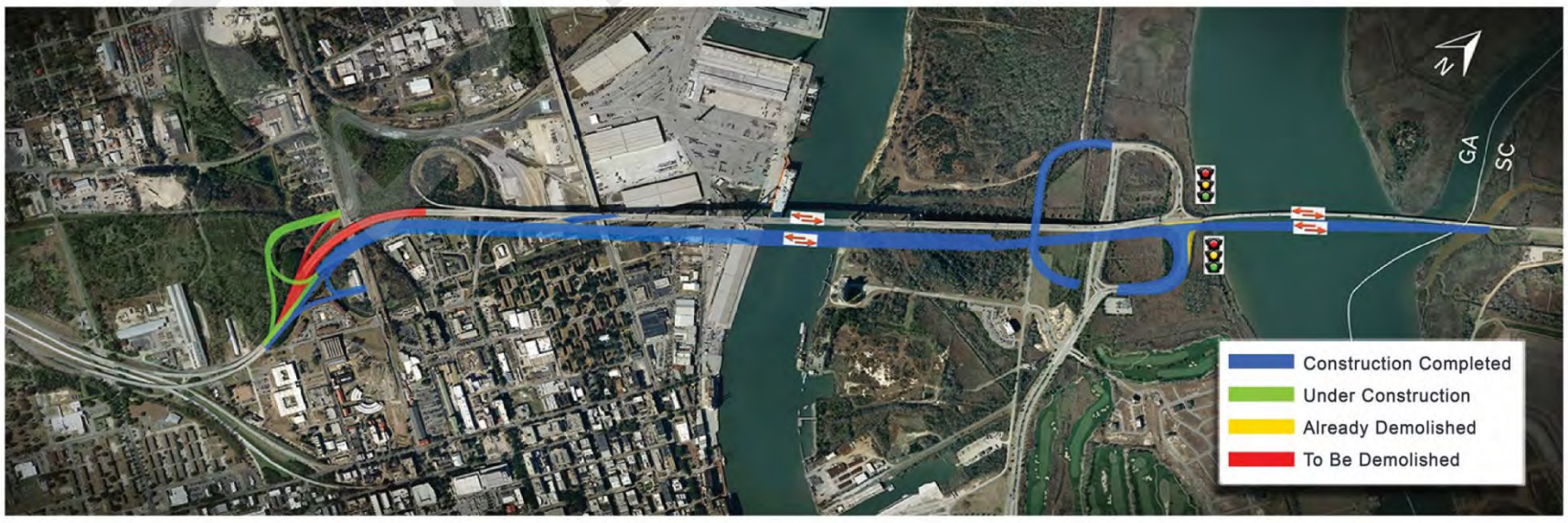
This alternative maintains the current US 17 route and will provide the same number of lanes and connectivity between Savannah, Hutchinson Island, and South Carolina.

Upstream (West) Alignment

One of the last stages of construction showing construction sequence and maintenance of traffic just prior to demolition of the existing bridge.



Downstream (East) Alignment



Alternative Category 2

New Bridge: Same Location

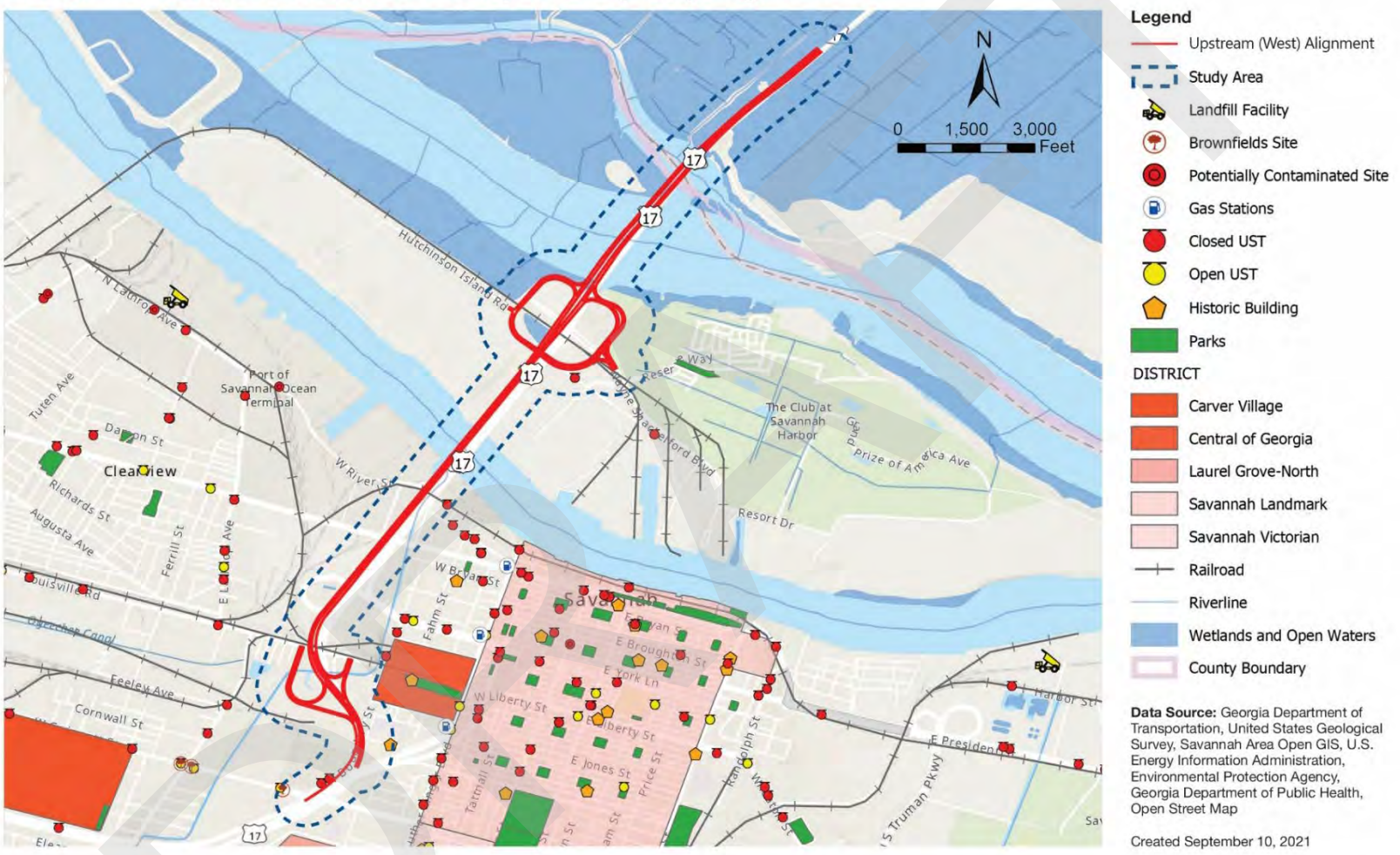
Environmental, Community, & Safety Impacts

Impacts to environmental and cultural resources are likely for this alternative.

Environmental Resources

The bridge alternative on the upstream side of the existing bridge will minimize impacts to the City of Savannah and associated cultural resources, residents, and environmental justice communities as the alignment would primarily impact GPA property. Although minimal construction is proposed in the Savannah River, there is a higher probability of impacts to protected species and critical habitat during demolition and removal of the existing bridge. There is a high probability for the presence of underwater archaeological resources along the Savannah Riverbed. This alternative will require construction and demolition in the Back River. Due to the presence of existing buildings and infrastructure, the downstream alignment has greater potential for impacts to historic and community resources and will be further evaluated during Tier 3 screening.

Environmental Constraints: Shown for Upstream (West) Alignment



Data Source: Georgia Department of Transportation, United States Geological Survey, Savannah Area Open GIS, U.S. Energy Information Administration, Environmental Protection Agency, Georgia Department of Public Health, Open Street Map

Created September 10, 2021

Cost-Benefit Analysis

Construction Estimate

$1.13B*

Costs

- Construction
- Design
- Right-of-Way

Benefit

Accommodates future need for vertical clearance for navigation

**Cost reported in current dollars. Includes allowance for PE, ROW; Final Design and Construction Oversight under a Design-Build Procurement Scenario. Also includes 30% contingency.*

Options Considered but Screened Out

New bridge 215 feet above MHW

Providing 215 feet above MHW, same as the Bayonne Bridge in New Jersey, provides a lower overall vertical clearance envelope than the Bayonne Bridge due to differences in the channel depth and tidal fluctuation.

New bridge greater than 230 feet above MHW

Vessel projection forecasts do not show the need for more than 230 feet of clearance.

New bridge 220 feet above MHW

The project limits and cost are not sensitive to a reduction in clearance of 10 feet as compared to 230 feet high bridge. Providing 230 feet, per the vessel projection forecast, ensures the bridge will accommodate future vessels.

Moveable bridge

The longest existing moveable bridge span is 330 feet. The span length needed for a moveable bridge at this site would be approximately 500 to 600 feet, making it infeasible to design and construct. In addition, port and ship operations would require lengthy bridge openings of 2 to 6 hours due to the inability to stop or turn incoming and outgoing ships. This will be a significant interruption to traffic on US 17. This alternative will also require construction of bridge pier within Savannah River with probability of impacts to protected species and critical habitat.

Alternative Category 3

New Bridge: Truman Parkway Extension

SUMMARY SAVANNAH RIVER CROSSING FEASIBILITY STUDY

Alternative Overview

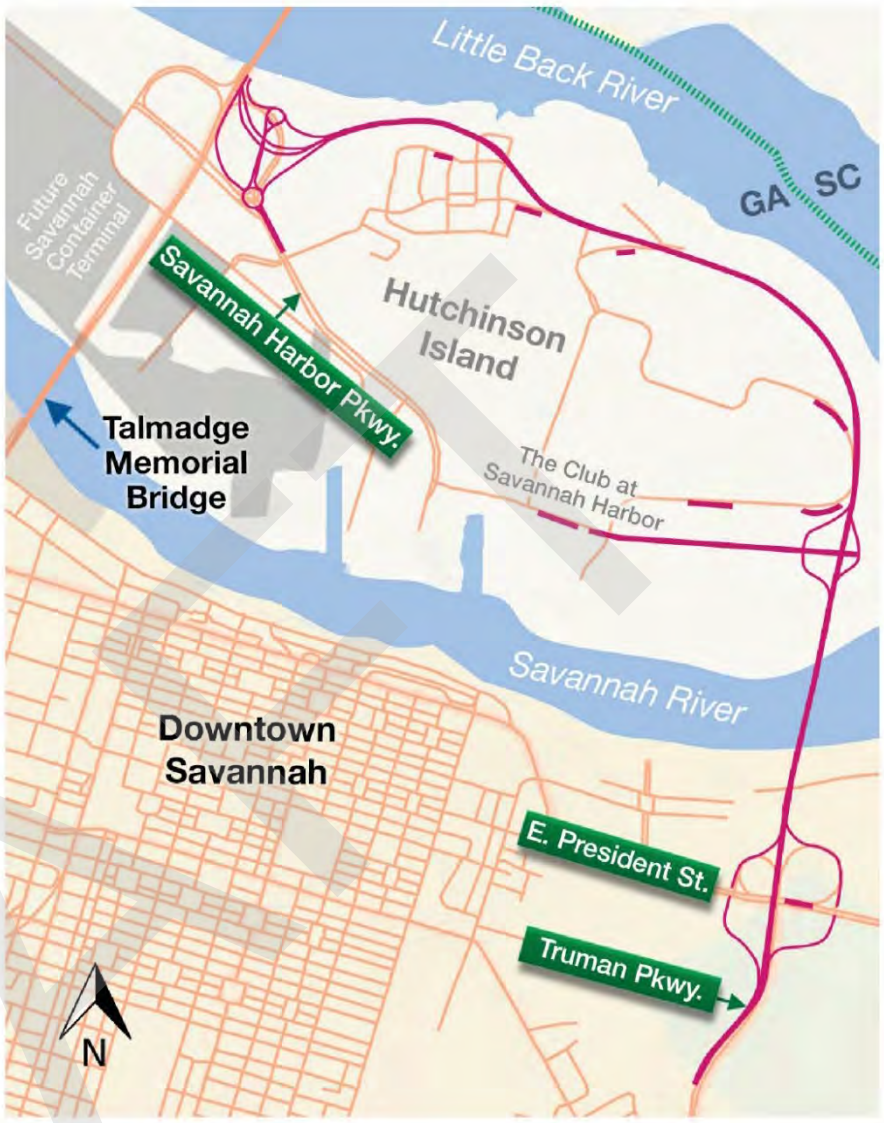
This alternative proposes to construct a new highway crossing further downstream from the existing Talmadge Memorial Bridge in the vicinity of Truman Parkway. Truman Parkway will be extended from the existing terminus at President Street with a new bridge to connect to SR 17 on Hutchinson Island prior to crossing the Back River.

The assumed clearance envelope for the new bridge over the Savannah River is 600 feet wide and 230 feet above Mean High Water (MHW). This results in a profile approximately 45 higher than the existing bridge. The proposed bridge would carry two lanes of traffic in each direction separated by a median barrier resulting in a total bridge width of approximately 98 feet. The existing bridge will be removed after construction of the new bridge.

Conceptual Design

The Truman Parkway extension requires vertical realignment of approximately one-half mile of the existing Truman Parkway south of President Street. The new alignment extends along Hutchinson Island as a limited access highway connecting to SR 17 near the existing ramps at Savannah Harbor Parkway.

The alignment extension would minimize potential environmental and property impacts including wetlands, future development sites, Hillcrest Abbey East Cemetery, and The Club at Savannah Harbor golf course. Significant sections of the new Truman Parkway extension will be bridges to minimize impacts and accommodate the poor soil conditions. The vertical realignment also requires reconstruction of the existing loop ramps at President Street. This alternative provides an extension of Savannah Harbor Parkway to a new interchange at Truman Parkway on the western side of Hutchinson Island. A new interchange is also provided at Savannah Harbor Parkway near the existing interchange with SR 17.



Transportation & Mobility Impacts

The Truman Extension Alternative has the potential to improve traffic flows from/on Hutchinson Island but could cause significant congestion and mobility delays on highway network in Savannah.

Vehicular Traffic

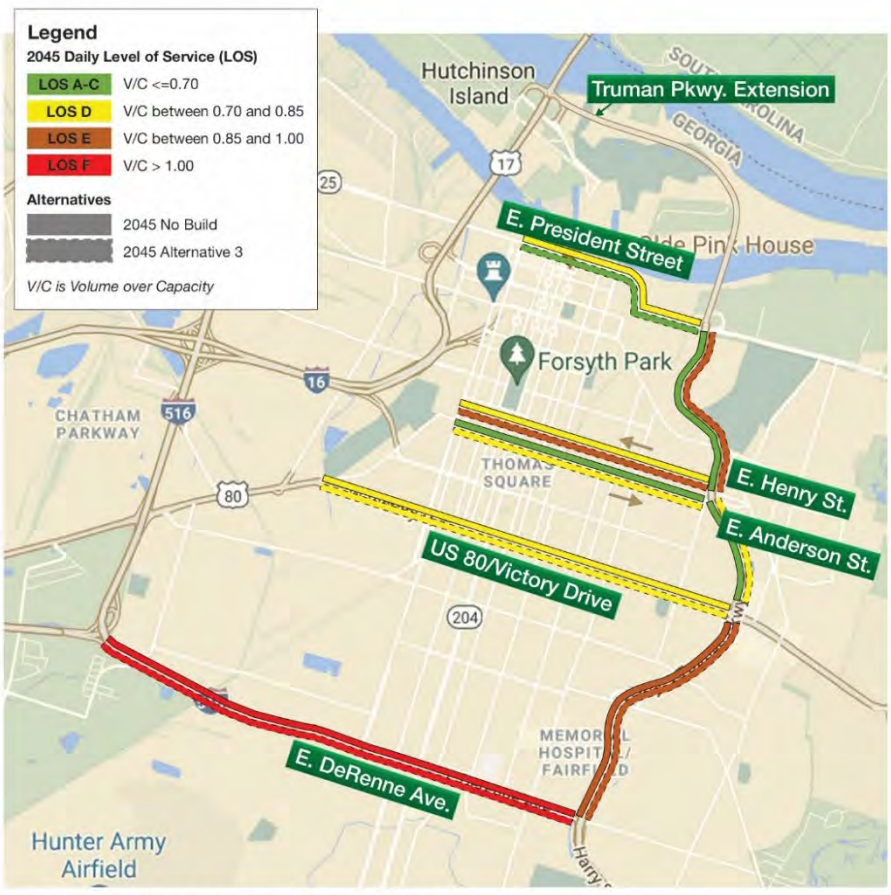
Requires extensive Maintenance of Traffic efforts to vertically realign Truman Parkway near President Street.

Vessel Traffic

Impacts to navigation will be minimal as no work will occur in the water. Construction and demolition of the main spans of the bridge will be the only potential for impacts.

Transportation Network

- Improve accessibility of Hutchinson Island and South Carolina from east side of Savannah
- Improve connectivity within Hutchinson Island
- Diversion of traffic will significantly impact the operations along Truman Parkway and could potentially lower Levels of Service of existing interchanges and local roadway network
- Eliminates direct access between South Carolina and I-16
- Will require realignment of US 17 to Truman Parkway. Changes to a US route will require AASHTO subcommittee approval and a joint application with South Carolina.
- May require additional improvements along DeRenne Avenue



DRAFT — WORK IN PROGRESS:
Map will be updated after further analysis in the next phase.

Alternative Category 3

New Bridge: Truman Parkway Extension

Timeline for Implementation

2021-2022
Feasibility and Planning Studies, Including Additional Traffic Studies

2022-2027
Environmental Documentation, Right-of-Way Acquisition, Pre-Let Development, Design-Build Procurement

2027-2034
Final Design and Construction

Environmental, Community, & Safety Impacts

The Truman Extension has the potential to cause significant environmental and community impacts, such as:

- Potential displacement of existing homeless populations near the reconstructed Truman Parkway at President Street
- Maintenance of traffic and detours for reconstructing Truman Parkway could impact accessibility of community resources
- Impacts to environmental resources including protected species, critical habitat, possible archaeological sites, residential development, and existing golf course on Hutchinson Island
- Improvements on DeRenne Avenue due to increased traffic could impact Environmental Justice populations along DeRenne. Improvements may require encroachment into parallel residential streets, placing homes on a busy road.



Cost-Benefit Analysis

This alternative was eliminated through fatal flaw screening early in the study, and no construction costs were developed.

Construction Estimate

TBD

Costs
- Construction
- Design
- Right-of-Way

Benefit
Accommodates future need for vertical clearance for navigation

Options Considered but Screened Out

New bridge 215 feet above MHW
Providing 215 feet above MHW, same as the Bayonne Bridge in New Jersey, provides a lower overall vertical clearance envelope than the Bayonne Bridge due to differences in the channel depth and tidal fluctuation.

New bridge greater than 230 feet above MHW
Ship projection forecasts do not show the need for more than 230 feet of clearance.

New bridge 220 feet above MHW
The project limits and cost are not sensitive to a reduction in clearance of 10 feet. Providing 230 feet, per the vessel projection forecast, ensures the bridge will accommodate future vessels.

Moveable bridge
The longest existing moveable bridge span is 330 feet. The span length needed for a moveable bridge at this site would be approximately 500 to 600 feet, making it infeasible to design and construct. In addition, port and ship operations would require lengthy bridge openings of 2 to 6 hours due to the inability to stop or turn incoming and outgoing ships. This will be a significant interruption to traffic on US 17.

Alternative Category 4

Remove Bridge & Re-Route US 17 Traffic

SUMMARY SAVANNAH RIVER CROSSING FEASIBILITY STUDY

Alternative Overview

This alternative includes several options for removing the bridge and re-routing US 17 traffic.

Options include removing the bridge and rerouting US 17 to existing SR 25, removing the bridge and providing ferry service, and constructing a connector road along Hutchinson Island from US 17 to SR 25.

Currently, US 17 has an ADT of approximately 20,000, 13% of which are trucks, which would be routed to other corridors.

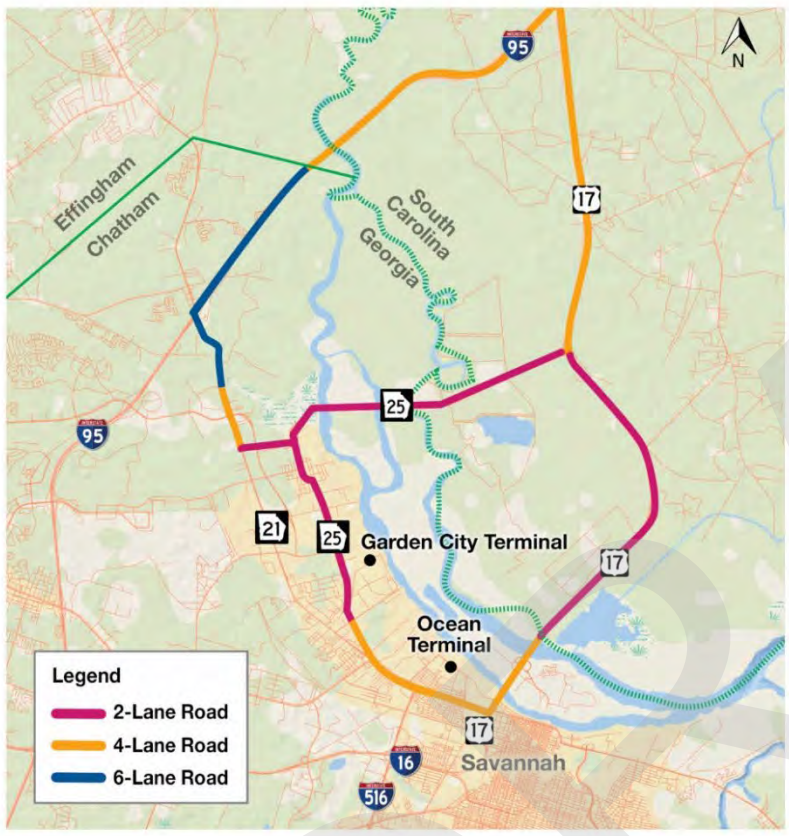
Conceptual Design

Limited conceptual layout was completed for the US 17/SR 25 connector road. This proposed road has been routed along the north side of Hutchinson Island and would impact marshland and pass through a wildlife refuge. Widening of SR 25 would be needed to accommodate the additional traffic rerouted from US 17.

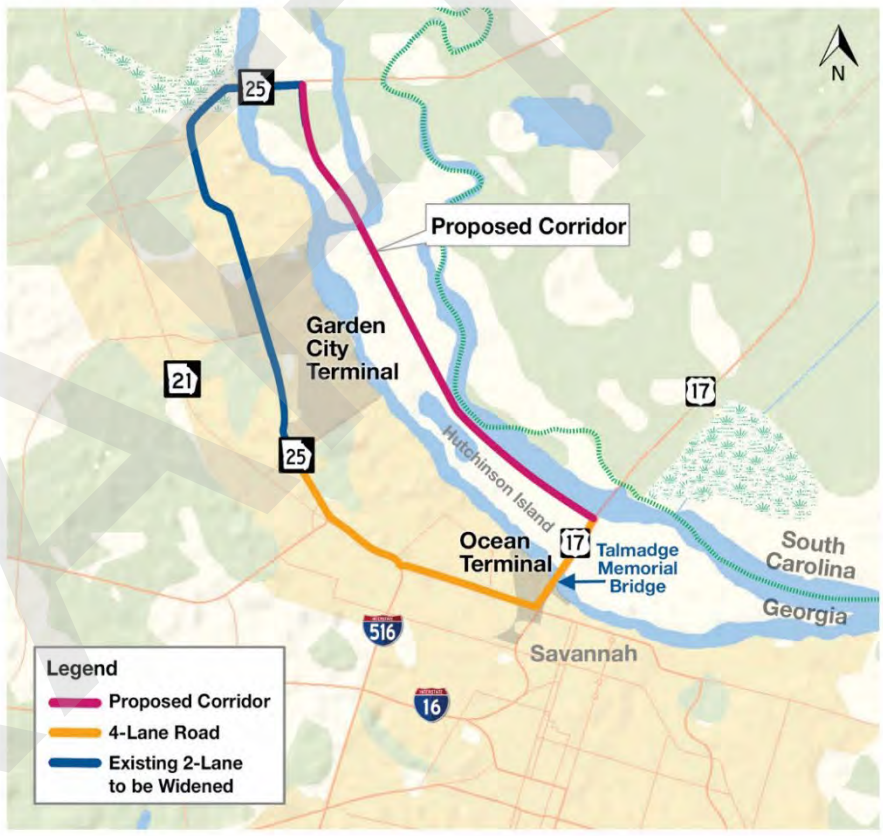
Timeline for Implementation

Not applicable

Transportation Network Overview



Transportation Network Modifications



Transportation & Mobility Impacts

This alternative will significantly impact Savannah to South Carolina and South Carolina to I-16 connectivity.

Vehicular Traffic

Permanent rerouting of US 17 could require significant improvement to other corridors, likely requiring construction on large transportation networks in Georgia and South Carolina.

Vessel Traffic

The ferry option could pose a challenge to navigation.

Transportation Network

- Reduces accessibility of Hutchinson Island and connection to South Carolina from Savannah
- Eliminates direct access between South Carolina and I-16
- Increased traffic and truck volumes on SR 25 and I-95
- Will require improvement to other corridors
- Will require realignment of US 17 to SR 25. Changes to a US route will require AASHTO subcommittee approval and a joint application with South Carolina.



Alternative Category 4

Remove Bridge & Re-Route US 17 Traffic

Environmental, Community, & Safety Impacts

This alternative has the potential to cause significant environmental and community impacts.

- Impacts to environmental resources, including protected species, critical habitat, possible archaeological sites, and wildlife refuge.
- Improvements to other corridors may require right of way from adjacent properties.

Cost-Benefit Analysis

This alternative was eliminated through fatal flaw screening early in the study, and no construction costs were developed.

Costs
Not available

Benefit
Eliminates vertical clearance restriction for navigation



Options Considered but Screened Out

All options under this alternative were ruled out due to reasons described below:

Removing the bridge and re-routing traffic to SR 25

This alternative significantly increases the travel time from Savannah to Hutchinson Island and South Carolina. The re-routing of US 17 would require AASHTO approval, which would be difficult to obtain due to the much longer route. SR 25 and other streets would need to be upgraded to handle the additional traffic and truck volumes.

Removing the bridge and providing ferry service

The traffic volume crossing the existing bridge is too high to be accommodated by a ferry service. The ferry also has the potential to impact vessel navigation to and from the Port of Savannah.

Constructing a connector road from US 17 to SR 25

This alternative significantly increases the travel time from Savannah to Hutchinson Island and South Carolina. The re-routing of US 17 would require AASHTO approval, which would be difficult to obtain due to the much longer route. SR 25 and other streets would need to be upgraded to handle the additional traffic and truck volumes. In addition, this alternative has the potential to significantly impact environmental resources.

Alternative Category 5

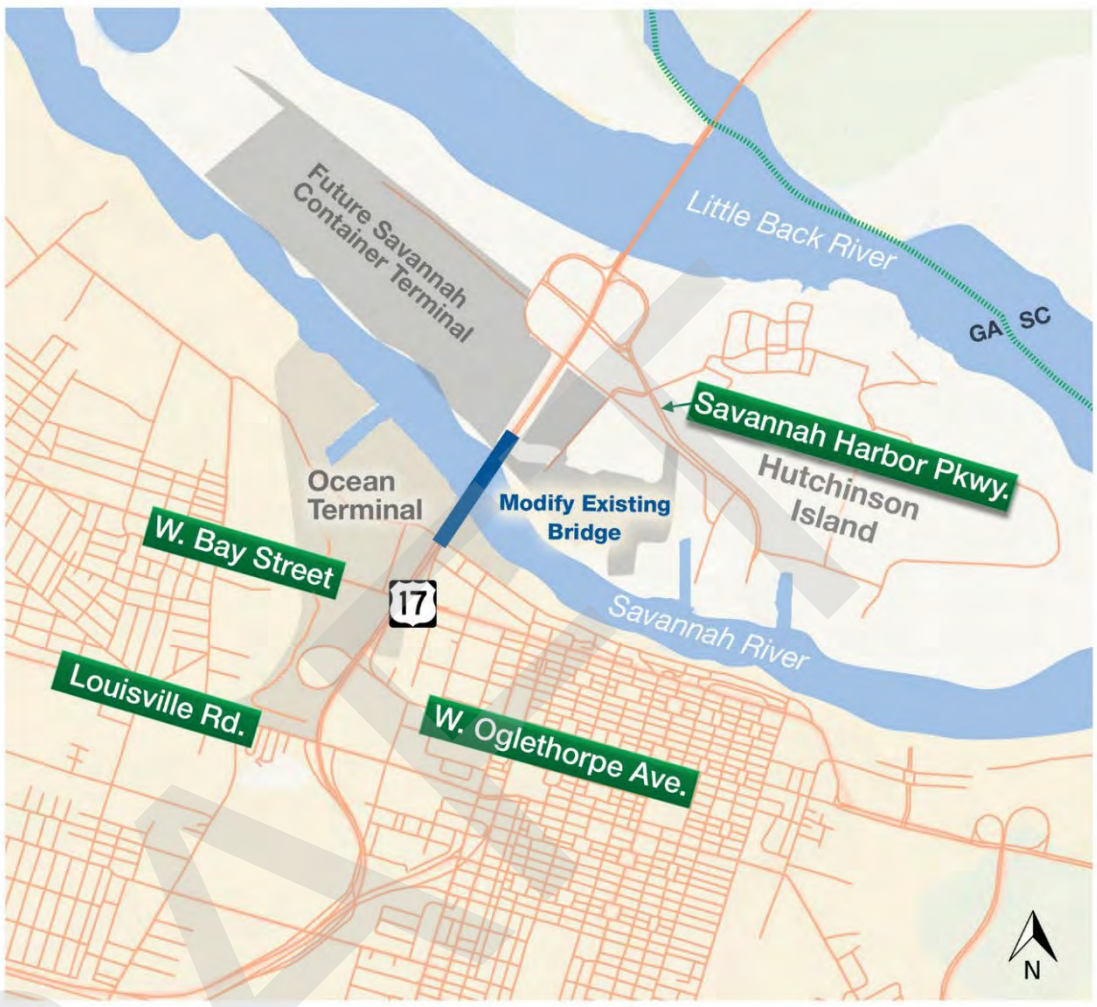
Modify Existing Bridge

SUMMARY SAVANNAH RIVER CROSSING FEASIBILITY STUDY

Alternative Overview

This alternative proposes to retain the existing bridge structure but increase the vertical clearance to 230 feet by modifying the existing bridge.

The main cable-stay spans as well as the approach spans will require modification. In addition, partial reconstruction or replacement of the existing Back River Bridge will be needed to accommodate the new profile.



Conceptual Design

In future phases, additional design and analysis will be conducted to evaluate the extent of structural modification needed to the cable-stay spans and the approach spans.

Possible modifications, in addition to the raising/reconstruction of the deck, include strengthening the existing pylons, strengthening the foundations, and strengthening the bents supporting the approach spans.

The higher profile will require reconfiguration of the ramps at Savannah Harbor Parkway, removing the access point at West Oglethorpe Avenue, and providing additional access at Louisville Road.



Timeline for Implementation

To be determined

Alternative Category 5

Modify Existing Bridge

Transportation & Mobility Impacts

Vehicular Traffic

Extended bridge closures and an off-site detour are anticipated during construction operations. This will significantly impact access to Hutchinson Island.

Vessel Traffic

Coordination with ports and vessels will be required in order to maintain vessel traffic during construction operations.

Transportation Network

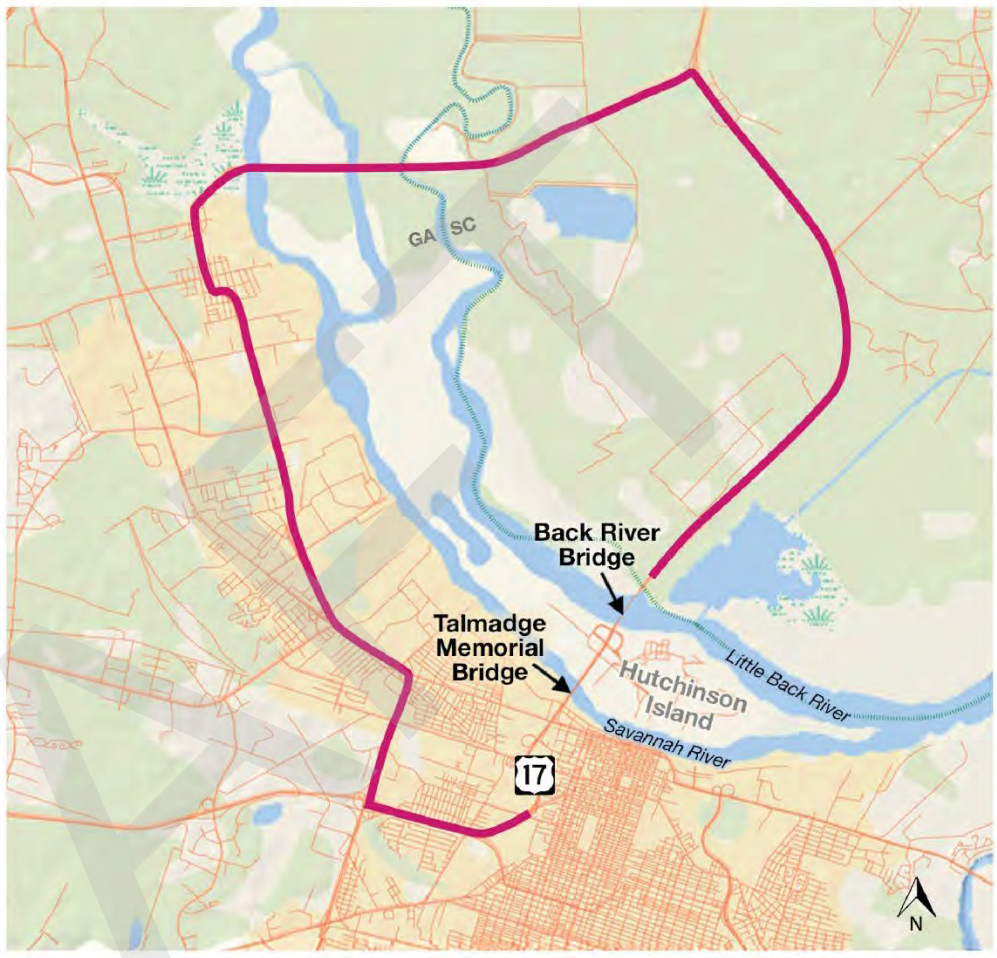
Increased traffic and truck volumes on detour routes will negatively impact the capacity of other corridors.

Environmental, Community, & Safety Impacts

Maintaining the location of the existing bridge will minimize impacts to environmental, cultural, and community resources.

The community will be negatively impacted by the detour required during construction between Savannah and Hutchinson Island and beyond into South Carolina.

Potential Detour Route



Cost-Benefit Analysis

Construction Estimate

TBD

Costs

- Construction
- Design

Benefit

Maintain footprint of existing bridge

Options Considered but Screened Out

Raise existing bridge to provide 215' clearance above MHW

Providing 215 feet above mean high water (MHW), same as the Bayonne Bridge in New Jersey, provides a lower overall vertical clearance envelope than the Bayonne Bridge due to differences in the channel depth and tidal fluctuation.

Raise existing bridge to provide greater than 230' clearance above MHW

Vessel projection forecasts do not show the need for more than 230 feet of clearance.

Convert central span of existing bridge to draw bridge

This alternative was determined to be infeasible. The longest existing moveable bridge span is 330 feet; the central span of the existing bridge is 1,100 feet, making it infeasible to design and construct. In addition, port and ship operations would require lengthy bridge openings of 2 to 6 hours due to the inability to stop or turn incoming and outgoing ships. This alternative would result in a significant interruption to traffic on US 17.

DRAFT

Alternative Category 6

Downriver Port Facilities

Alternative Overview

This alternative proposes that the Georgia Ports Authority (GPA) build a new terminal downriver from the existing Talmadge Memorial Bridge. This alternative would negate the vertical clearance limitation, as ships would no longer need to navigate beneath the bridge to access the terminal. This alternative would require that GPA identify, purchase, and develop riverfront property or properties of adequate size and with adequate landside access to accommodate cargo volumes projected to arrive and/or depart on ships too large to pass under the existing bridge. Considering a design year of 2040, GPA has forecasted that approximately 4.5 million twenty-foot equivalent units (TEUs) of cargo will call on the Port on ships restricted by the existing bridge. This analysis considered two sites: Fig Island and Kemira Road.



Conceptual Design

To accommodate a new terminal downriver of the existing Talmadge Memorial Bridge with a throughput capacity of 4.5 million TEUs, a property/site must meet nine site criteria. They are as follows:

1. Be located within the State of Georgia;
2. Be located immediately adjacent to the Savannah Harbor;
3. Be located between the Talmadge Memorial Bridge and the Atlantic Ocean.
4. Be approximately 450 acres (one acre of gross land equates to approximately 10,000 TEUs per year of yard capacity);
5. Have at least 7,200 linear feet of river frontage (1,600 linear feet of wharf equates to approximately 1 million TEUs per year of berth capacity);
6. Be accessible by trucks and trains to transport containerized cargo;
7. Have adequate roadways and highways to accommodate high volumes of truck traffic;
8. Not result in significant impacts to environmental or cultural resources; and
9. Be available for purchase by GPA.

Options Considered but Screened Out

Fig Island Site

This site is only 150 acres, less than the minimum size requirement. Additionally, it only has approximately 4,000 linear feet of river frontage, less than the required wharf length. Therefore, Fig Island is not a feasible site to develop a new container terminal.

Kemira Road Site

This site is only 178 acres (less than the minimum size requirement), and a significant portion is occupied by a wetland mitigation bank. It can accommodate only 3,200 linear feet of wharves, less than the required wharf length. Also, a terminal at this site would significantly impact local traffic as well as environmental and cultural resources. As a result of these factors, Kemira Road is not a feasible location.

Transportation and Mobility Impacts

Vehicular Traffic

This alternative does not affect the Talmadge Memorial Bridge, so no vehicular traffic impacts to the bridge are expected due to construction activities. However, if a new terminal is constructed on Hutchinson Island, vehicular traffic on the bridge will be affected due to additional truck traffic accessing the new terminal via the bridge.

Vessel Traffic

Construction of a new terminal would have minimal impacts on ship traffic because in-water work would take place outside of the navigation channel. However, dredging of the new terminal berths would need to be coordinated with the Port so that dredge pipes do not impact ship traffic.

Transportation Network

Any new terminal built downriver of the Talmadge Memorial Bridge would be farther from interstate highways than GPA's existing terminals. Increased truck traffic on roadways between the new terminal and Interstates would impact the transportation network.

Environmental, Community, & Safety Impacts

The development of a terminal downriver of the Talmadge Memorial Bridge could cause significant environmental impacts, including water quality degradation, freshwater and salt marsh filling, and air quality and noise impacts from terminal construction and operation.

Negative impacts to cultural resources are probable due to the prevalence of historic sites in the area.

A new terminal would increase truck traffic, negatively affecting the community. Additionally, the terminal would likely be in the view shed of residential communities and would impact noise and air quality with the terminal's construction and operation.

4.3 Fact sheets for specific alternatives

After the Tier 2 Screening was completed, three alternatives were further developed: a tunnel upstream of the existing bridge, a new bridge at the same location that crosses over the existing bridge and raising the existing bridge to 230 feet. Fact sheets for these 3 refined alternatives appear on the pages that follow.

Through the Tier 3 screening, discussed in more detail in the next section, the alternative to raise the existing bridge was ruled out.

DRAFT

Feasible Alternative

New Crossover Bridge

SUMMARY SAVANNAH RIVER CROSSING FEASIBILITY STUDY

Alternative Overview

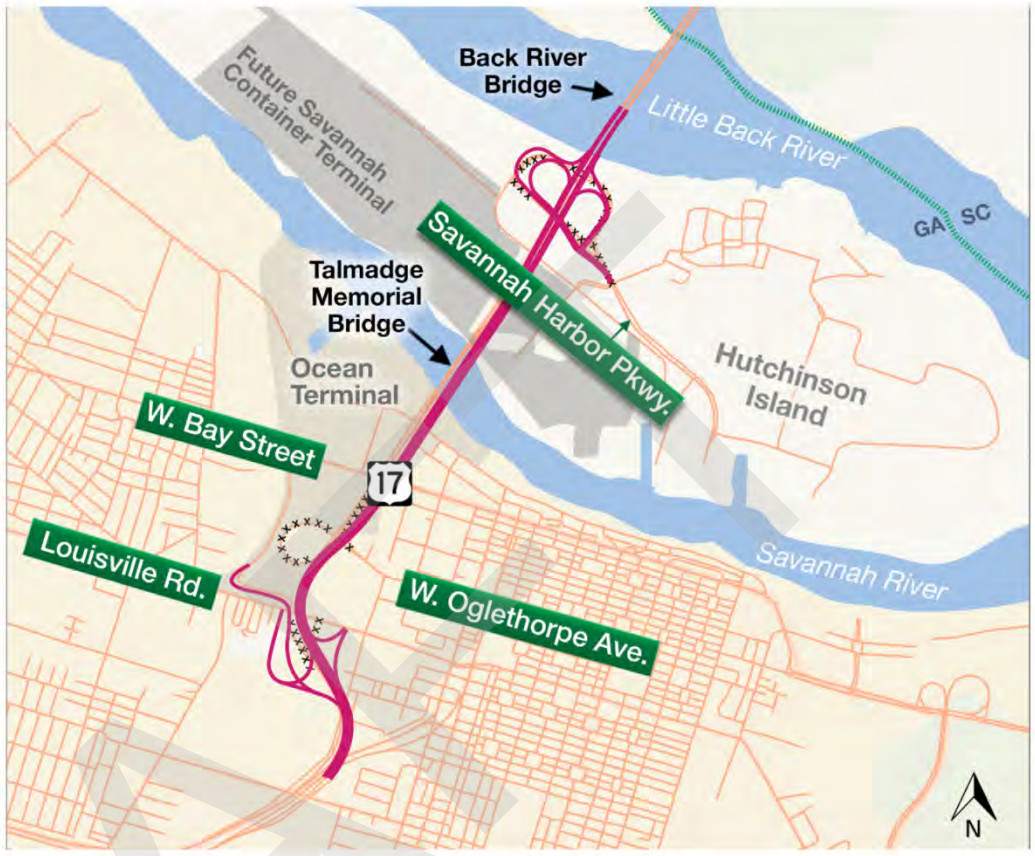
This alternative proposes a crossover bridge that combines the previously studied upstream and downstream bridge alternatives.

Starting with the upstream alternative, the bridge crosses over the existing Talmadge Memorial Bridge, around West Oglethorpe Avenue, and follows the path of the downstream bridge alternative.

This alternative avoids impacts to the Port of Savannah and the SCAD campus buildings that resulted from the upstream and downstream locations, respectively.

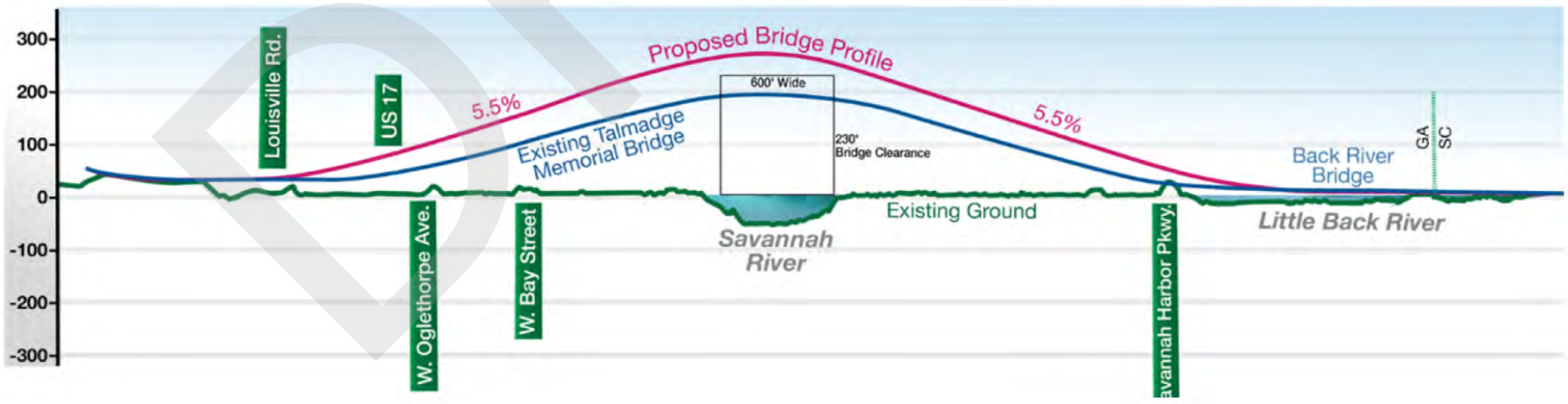
The assumed clearance envelope for the new bridge is 600 feet wide and 230 feet above Mean High Water (MHW). This results in a profile approximately 56 higher than the existing bridge.

The proposed bridge would carry two lanes of traffic in each direction separated by a median barrier resulting in a total bridge width of approximately 98 feet. The existing bridge will be removed after construction of the new bridge.



Conceptual Design

The alignment for the crossover bridge runs adjacent to the existing Talmadge Memorial Bridge except for the area where it crosses over the existing Talmadge Memorial Bridge. This alternative allows for a connection to Hutchinson Island, with ramp reconstruction at the interchange with Savannah Harbor Parkway. It would require the existing connection at West Oglethorpe Avenue to be closed and diverted to Louisville Road. This alternative will impact the existing and proposed new Back River Bridges, requiring them to be partially raised and widened.



Timeline for Implementation

2021-2022
Feasibility and Planning Studies

2022-2026
Environmental Documentation, Pre-Let Development, Design-Build Procurement

2026-2032
Final Design and Construction

DRAFT

Feasible Alternative

New Crossover Bridge

Transportation & Mobility Impacts

The crossover bridge alternative has moderate impact to vehicular or vessel traffic during construction.

Vehicular Traffic

Can be constructed while maintaining traffic on the existing bridge and road network. Some staging of traffic will be needed, with periods of time that the lanes will be reduced to 1 in each direction and downtown access would be diverted to detours on I-16, Martin Luther King Jr. Boulevard, and West Oglethorpe.

Vessel Traffic

Impacts to navigation will be minimal as no work will occur in the water. Construction and demolition of the main spans of the bridge will be the only potential for impacts.

Transportation Network

This alternative maintains the current US 17 route and will provide the same number of lanes and connectivity between Savannah, Hutchinson Island, and South Carolina.

Crossover Bridge Alignment

Final stage of construction showing construction sequence and maintenance of traffic after complete demolition of the existing bridge.



Environmental, Community, & Safety Impacts

Environmental Resources

The crossover alignment seeks to balance impacts on the Savannah side of the river, but may impact some cultural resources, residents and environmental justice communities.

Although minimal construction is proposed in the Savannah River, there is a higher probability of impacts to protected species and critical habitat during demolition and removal of the existing bridge. There is a high probability for the presence of underwater archaeological resources along the Savannah Riverbed.

This alternative will require construction and demolition in the Back River, which will impact ecological resources and require agency coordination and permitting.

Cost-Benefit Analysis

Construction Estimate

$1.17B*

Costs

- Construction
- Design
- Right-of-Way

Benefit

Accommodates future need for vertical clearance for navigation

**Cost reported in current dollars. Includes allowance for PE, ROW; Final Design and Construction Oversight under a Design-Build Procurement Scenario. Also includes 30% contingency.*

Feasible Alternative

Tunnel

SUMMARY

Alternative Overview

This tunnel alternative is similar to the previously studied Alternative 1.

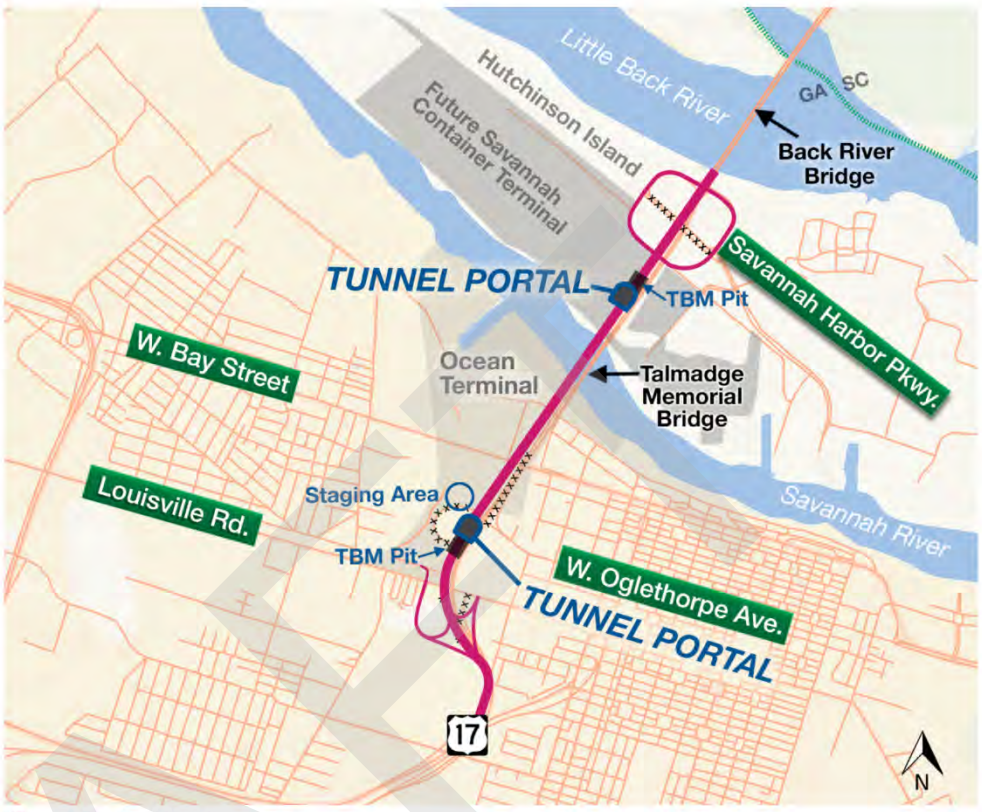
Refinements include a different vertical profile, relocated portal locations to minimize long-term operational impacts on GPA facilities, and a slight modification to curve the alignment toward the Back River Bridge in the Hutchinson Island area.

Like Alternative 1, this alternative would also be constructed as two parallel bores with each bore containing two lanes of traffic: northbound in one bore and southbound in the other. The bores would each be approximately 50 feet in diameter and would be constructed 50 feet apart from each other.

The minimum cover over the tunnel at each portal and under the Savannah River would be 50 feet. The tunnel bores would be periodically connected by cross-tunnels to allow emergency egress.

Tunnels require many life-safety considerations such as ventilation, fire suppression, emergency access and egress, and lighting. The tunnel would require an on-site operations building and has long-term operation and maintenance costs.

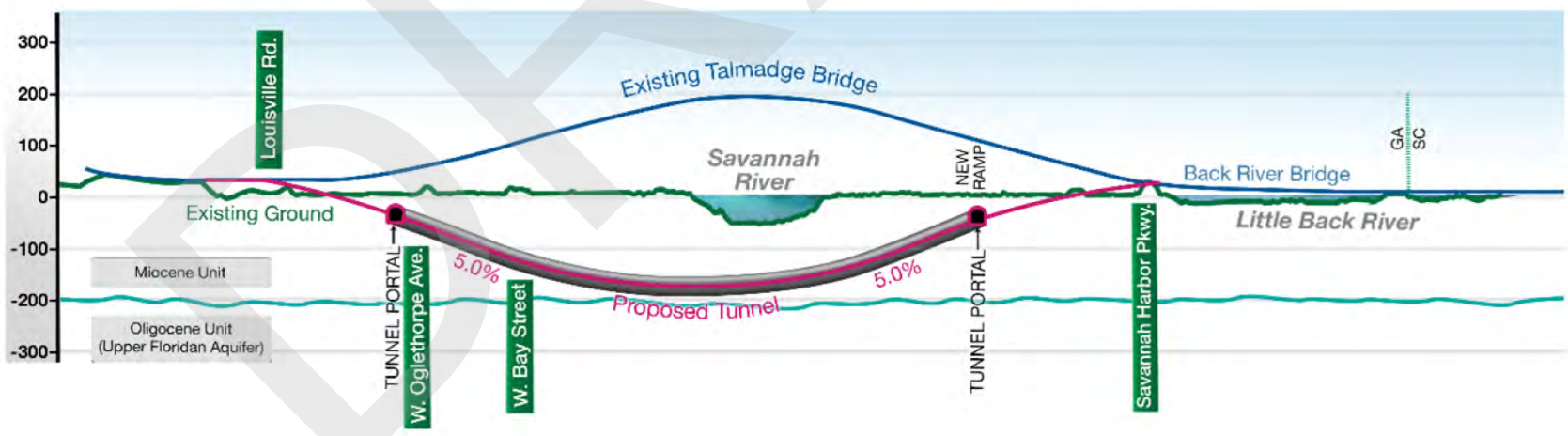
The existing bridge will be removed after construction of the new tunnel.



*Tunnel Boring Machine

Conceptual Design

The tunnel is proposed to be adjacent to and upstream (west) of the existing Talmadge Memorial Bridge. The tunnel alternative allows for a connection to Hutchinson Island but would require the existing connection at West Oglethorpe Avenue to be closed and diverted to Louisville Road. The tunnel alignment can tie into the existing and proposed Back River Bridges with minimal reconstruction.



Timeline for Implementation

2021-2022
Feasibility and Planning Studies

2022-2026
Environmental Documentation, Pre-Let Development, Design-Build Procurement

2026-2032
Final Design and Construction

Feasible Alternative

Tunnel

Transportation & Mobility Impacts

The tunnel alternative has moderate impact to vehicular or vessel traffic during construction.

Vehicular Traffic

Can be constructed while maintaining traffic on the existing bridge and road network. Some staging of traffic will be needed, with periods of time that the lanes will be reduced to one in each direction and downtown access will be temporarily diverted to I-16, I-516, and West Bay Street.

Vessel Traffic

Eliminates future concerns about clearance for ships. Impacts to navigation will be minimal as tunnel construction will be under the riverbed. Demolition of the existing bridge will be the only potential for impacts.

Transportation Network

This alternative maintains the current US 17 route and will provide the same number of lanes and connectivity between Savannah, Hutchinson Island, and South Carolina.

Final Phase of Tunnel Construction

Graphic shows construction sequence and maintenance of traffic after complete demolition of the existing bridge.



Environmental, Community, & Safety Impacts

Impacts to natural, environmental, and cultural resources are likely.

Aquifer

Project site is underlain by the Upper Floridan Aquifer, which provides drinking water to the City of Savannah. The proposed tunnel would have to be completely contained within the upper confining Miocene Unit. A bored tunnel poses less risk of saltwater intrusion to the aquifer than other tunneling methods. Exploratory geotechnical borings were conducted to further define the depth of the Upper Floridan Aquifer.

Environmental Resources

The bored tunnel alternative on the upstream side of the existing bridge would minimize impacts to the City of Savannah and associated cultural resources, residents, and environmental justice communities because the tunnel would be primarily under GPA property. Although impacts to the Savannah River during tunnel construction would be low, there is a higher probability of impacts to protected species and critical habitat during demolition and removal of the existing bridge. There is a high probability for the presence of underwater archaeological resources along the riverbed; however, the deep bored tunnel would be at depths well below the floor of the riverbed.

Community

Members of the community may be concerned about the loss of an iconic structure. In addition, the community may be concerned about vibration during construction and demolition and its effects on the area, particularly nearby historic buildings.

Cost-Benefit Analysis

Construction Estimate

$2.01B*

Costs

- Construction
- Design
- Right-of-Way

Benefits

- Eliminates future concerns about vertical clearance
- Minimizes impacts to environmental, community, and cultural resources

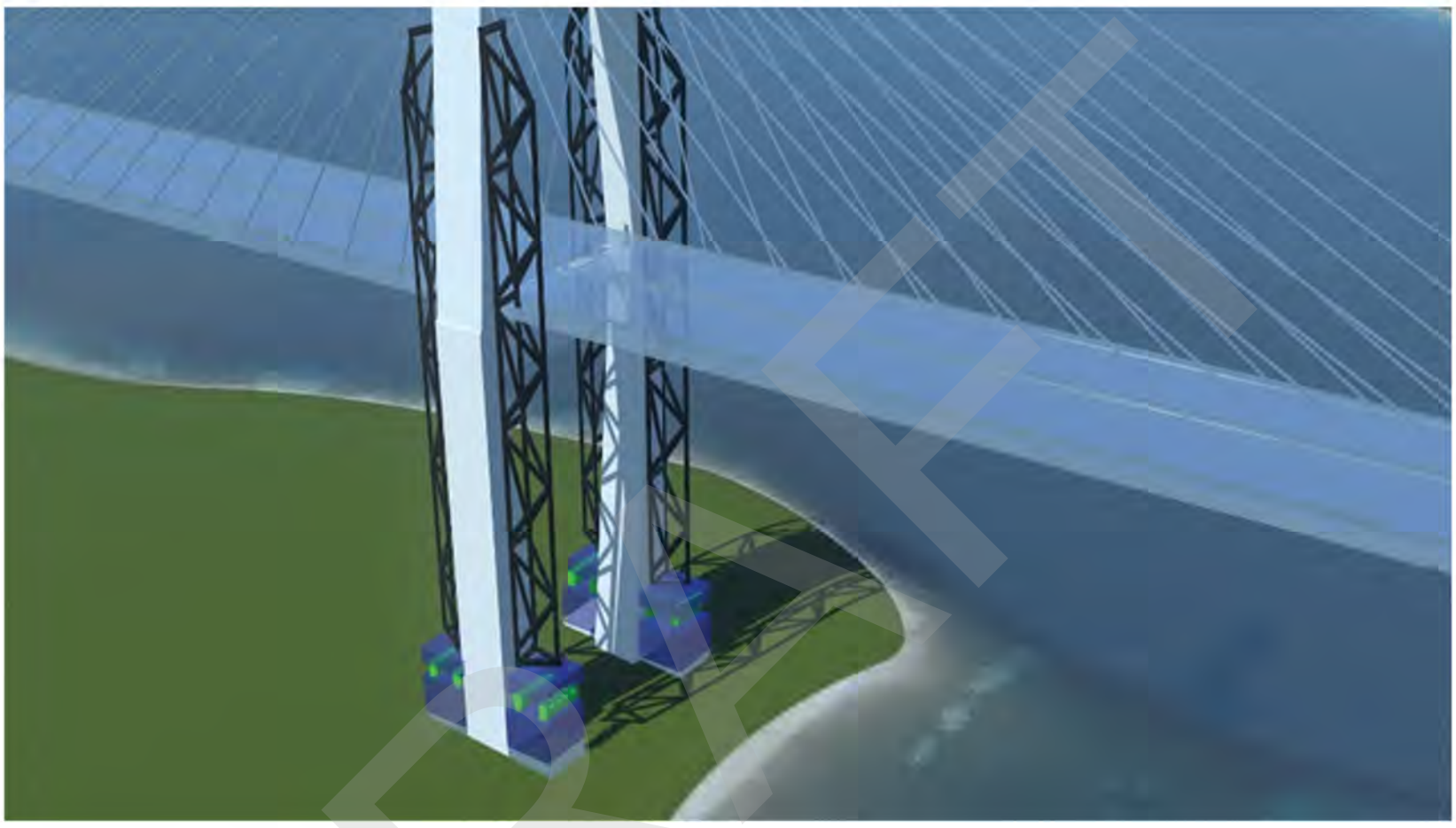
**Cost reported in current dollars. Includes allowance for PE, ROW; Final Design and Construction Oversight under a Design-Build Procurement Scenario. Also includes 40% contingency.*

Alternative Evaluated But Ruled Out

Modify Existing Bridge

Alternative Overview

This alternative proposes to retain the existing main cable stayed unit by increasing the existing tower height to allow for 230 feet of vertical clearance. The existing towers and foundations supporting the main cable stayed unit will require extensive modification, and the approach spans will require full replacement. Little Back River Bridge will require partial replacement, as the new profile over the Savannah River will touch down after the beginning of this bridge. Ramps from West Oglethorpe Avenue and Louisville Road will require reconstruction for realignment to the new mainline profile on US 17.



Conceptual Design

Increasing the vertical clearance of the existing cable stay bridge by roughly 45 feet will require extensive high tonnage hydraulic jacking equipment and temporary towers or shoring.

While this design alternative would allow for the retention of the existing cable stay, this type of jacking operation on a cable stay bridge could be considered the first of its kind throughout the country, with few past projects to derive best practices. To minimize reconfiguration of the existing cable stay, the towers would be lifted at the base of the column.

Regardless of lift location, this would require extensive analysis and likely specially designed equipment. To bring the approach bridges up to the new profile, full replacement would be the most intuitive method for cost effectiveness.

Straddle bents would be constructed where possible as supports for the new approach bridges, with the expectation that traffic on the existing bridge would remain open. This would expedite eventual closure duration on US 17.

Total construction time would be heavily dependent on available crews and equipment, but straddle bent construction could reduce total closure time by up to one year.

Timeline for Implementation

2021-2022
Feasibility and Planning Studies

2022-2024
Environmental Documentation, Pre-Let Development, Design-Build Procurement

2024-2029
Final Design and Construction

Alternative Evaluated But Ruled Out

Modify Existing Bridge

Transportation & Mobility Impacts

Vehicular Traffic

A minimum 9-month shutdown of US 17 is anticipated during lifting operations. Reconstruction of approach spans can occur concurrently and is not expected to extend shutdown. Detours along SR 25 or I-95 will be required as they are the nearest crossings of the river. The maximum detour will be 21 miles (approximately 40 min.) from Savannah's Historic District to Hutchinson Island.

Vessel Traffic

Intermittent closures during jacking operations will be required for the 9-month duration of the lifting procedure. Each closure period could last up to 24 hours.

Transportation Network

Detour lengths will significantly increase travel times. Due to this, increased traffic volumes along other corridors could exceed their capacities. This significant construction cost will also not improve the service life of the approximately 30-year-old bridge, which has a current NBIS condition of "satisfactory." Typical service life is generally considered 75 years.

Environmental, Community, & Safety Impacts

Access to Hutchinson Island will be impacted during the 9 months of construction activities. The US 17 detour and duration will negatively impact the surrounding community, with a maximum detour of 21 miles (approximately 40 min.) from Savannah's Historic District to Hutchinson Island.

The possibility of an extreme load event such as a hurricane or seismic event should be considered during analysis of construction phases. While the probability of such an event does not increase during construction, due to the configuration of the structure during some phases the inherent risk is much more significant.

During construction, and more specifically the jacking operation, the entire cable stay structure will be supported by jacks and temporary towers. Resistance to extreme forces during this condition may be impractical or may require extensive external systems to provide stability. In addition, the risk of this operation may make it difficult for potential contractors or vessels in route to the Port to acquire insurance.

Cost-Benefit Analysis

Construction Estimate

$800M*

Costs

- Construction
- Design

Benefits

Maintain existing footprint and provide future clearance

**Cost reported in current dollars. Includes allowance for PE, ROW; Final Design and Construction Oversight under a Design-Build Procurement Scenario. Also includes 40% contingency.*

Options Considered but Screened Out

Raise existing bridge to provide 230' clearance above MHW

Raising the profile by jacking from existing tower cross ties, to reduce number of jacks and shoring needed, instead of jacking from tower column base.

Although this would reduce the overall load that would bear on the jacks, the bearing force of the jacks would still likely exceed the capacity of the cross ties. This would require the existing cross ties to stay in the current relative location on the towers.

Therefore, there would no practical way to permanently fixate the deck to the towers during jacking procedures or construct cross ties at the new elevation. In addition, this would change the angle of the cable stays, which would significantly increase tension forces.

Because there is no way to temporarily and continuously support the main span deck in lieu of the cable stays, this option was screened out.

DRAFT

5 ALTERNATIVES SCREENING

5.1 Three-Tiered Screening

Using the goals and objectives identified above, the Study Team developed a three-tiered screening approach to ultimately identify the feasible alternatives that will best meet the needs of the local area, region, and state. This tiered screening approach, as outlined below and in Figure 42, provides for elimination of alternatives, in which any alternative not meeting the criteria in a tier does not advance for further evaluation.

- **Tier 1 screening** identifies any fatal flaws in the proposed build alternatives such as insufficient vertical clearance or the general inability to feasibly construct the alternative. For those alternatives that meet the criteria identified in Tier 1, they advance to Tier 2.
- **Tier 2 screening** focuses on the feasibility and practicality of the alternative. The criteria include assessing the potential environmental and cultural impacts while also considering impacts on existing infrastructure and nearby properties. Alternatives that meet the criteria in Tier 2 advance to Tier 3.
- **Tier 3 screening** focuses on implementing the alternative and includes detailed screening criteria. These detailed criteria include financial feasibility, benefit/cost, travel/traffic impacts, and infrastructure impacts. The Tier 3 screening identified two feasible alternatives, which will advance to conceptual engineering and analysis and evaluation under the NEPA process.

DRAFT

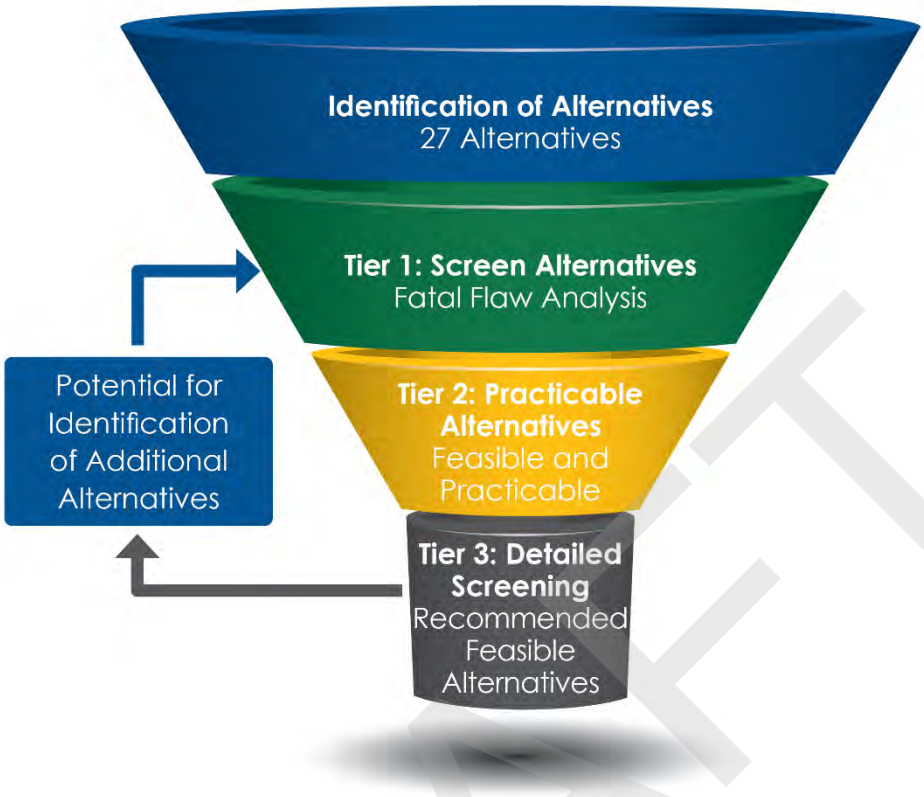


Figure 43. Alternatives Evaluation Approach

5.2 Tier 1 Fatal Flaw Analysis

The first tier of screening evaluates each alternative against fatal flaw criteria to ensure the alternative under consideration meets the goals and objectives of the study. Fatal flaw criteria include:

- Does the alternative address the vertical clearance restrictions at the crossing?
- Is the alternative reasonable to implement from a design and construction perspective?
- Can the alternative be implemented without having significant impacts on the transportation network that are not reasonable to address?

The Tier 1 evaluation ruled out 16 of the initial 27 alternatives.

5.3 Tier 2 Feasibility, Practical Operation, and Construction

The second tier of screening further evaluates the alternatives remaining after the Tier 1 screening. The Tier 2 screening evaluates the feasibility and practicality of each alternative to construct and operate. Tier 2 criteria include:

- Does the alternative avoid or minimize significant impacts to environmental or community resources?
- Can the alternative be implemented without having major impacts to existing infrastructure or utilities that are not feasible to address?

DRAFT

- If the alternative is substantially equal in cost, alignment, and impact as another alternative, does it provide greater benefits?

The Tier 2 evaluation ruled out five alternatives and resulted in combining the bridge upstream and the bridge downstream of the existing bridge into one alternative, new crossover bridge.

5.4 Tier 3 Detailed Evaluation

Tier 3 focused on further developing the remaining three build alternatives and included a detailed evaluation for financial feasibility, benefit/cost, travel/traffic and infrastructure impacts, such as ramp locations, connections to the Back River Bridge, and tunnel portal locations. The Tier 3 evaluation considered how each alternative fared compared to all the identified goals and objectives as shown in the Evaluation Matrix. The Tier 3 evaluation eliminated one alternative- Modifying the Existing Bridge. Modifying the existing bridge (raising the bridge to 230 feet of vertical clearance) was determined to not be a feasible long-term solution due to serious impacts to roadway traffic, construction complexity, operations and maintenance, and future-proofing objectives.

Unlike the interim maintenance project, which would elevate the bridge no more than 10 feet, raising the bridge 45 feet would require rebuilding all the approaches to the bridge to meet the new height and constructing a new deck and support structure. Such a complex project would require bridge closures, potentially for months, significantly impacting roadway traffic.

DRAFT

5.5 Evaluation Matrix

The three alternatives evaluated in the Tier 3 evaluation were compared against each of the goals and objectives as shown in Figure 44.

			Tier 3: Implementation of Alternatives													
			Construction Impacts (including demo)				Delivery & ROI			Post-Construction Impacts				Long-term Considerations	
			Impact to GPA Operations	Impact to Shipping Channel	Impact to Roadway Traffic	Construction Complexity	Project Delivery Time	Benefit Cost	Right of Way	Impact to GPA Operations	Impact to Roadway Traffic	Impact to Safety for Vehicles	Neighborhood Effects including those on EJ Populations	Operations and Maintenance	Future Proofing of Alternative
ALTERNATIVES	Tunnel	Upstream of Existing Bridge with access to Hutchinson Island													
	New Bridge	230' Bridge Clearance Upstream/ Downstream Crossover													
	Modify Existing Bridge	Raise to provide 230' Bridge Clearance (bridge jacking)													

Figure 44. Evaluation Matrix

DRAFT

6 NEXT STEPS

The presentation of two feasible alternatives marked a major study milestone, but it is not the final step. As of August 2022, the study shifts to a conceptual project phase, with the alternatives evaluated under a more intense microscope.

Because the project currently anticipates federal funding and approvals, it will be evaluated under the National Environmental Policy Act (NEPA) as a next step. A lead federal agency, anticipated to be the Federal Highway Administration (FHWA), will oversee the NEPA process. In addition to the lead agency, the project team will engage with other potential regulatory agencies to ascertain concerns and formulate measures to address these concerns early in project development.

Under NEPA, detailed statements that assess environmental impacts will be prepared, and the public will have an opportunity to review and comment on those evaluations. Other stakeholders will also be engaged. They include the City of Savannah, Chatham County, Jasper County, S.C., and a number of regional agencies as well as neighborhood and Environmental Justice (EJ) groups.

Through stakeholder engagement and/or the alternative analysis effort, other alternatives may be added for evaluation. A No-Build option will also be considered as part of the NEPA documentation.

For both the tunnel and new bridge alternatives, environmental documentation, pre-let development, and Design-Build procurement are expected to run from 2022-2026. Depending on the outcome, final design, right-of-way acquisition, and construction for either alternative are anticipated to start in 2026.

DRAFT

APPENDIX

DRAFT

2839 Paces Ferry Road
#900
Atlanta, Georgia 30339
Tel 770 431 8666
Fax 770 435 2666

www.arcadis.com

DRAFT

ARCADIS