FINAL STUDY REPORT

Savannah River Crossing Feasibility Study

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GDOT
Georgia Department of Transportation

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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:

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This report is a working document that will be included in the Practical Alternative Review process as part of the larger NEPA process.

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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

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.

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.

Figure 1. Talmadge Memorial Bridge and Port Terminals

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.

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.

✓ Air Draft Analysis	✓ Planning and Conceptual Engineering	Detailed Engineering/ Environmental	Implementation
• Researched shipping trends • Documented air draft issues • Identified probable improvement ideas, including "high-level" cost/benefit analysis	• Planning feasibility study and conceptual engineering tasks • Detailed cost/benefit analysis • Environmental reviews and preferred alternative	• Engineering scoping and preliminary engineering activities • Environmental Phase 1/ existing conditions • Finalize environmental studies/National Environmental Policy Act (NEPA) and permitting	• Finalize design and operational solutions • Project funding • Right of way and construction
2019	2020-2022	2022-2026	2026-2032

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.

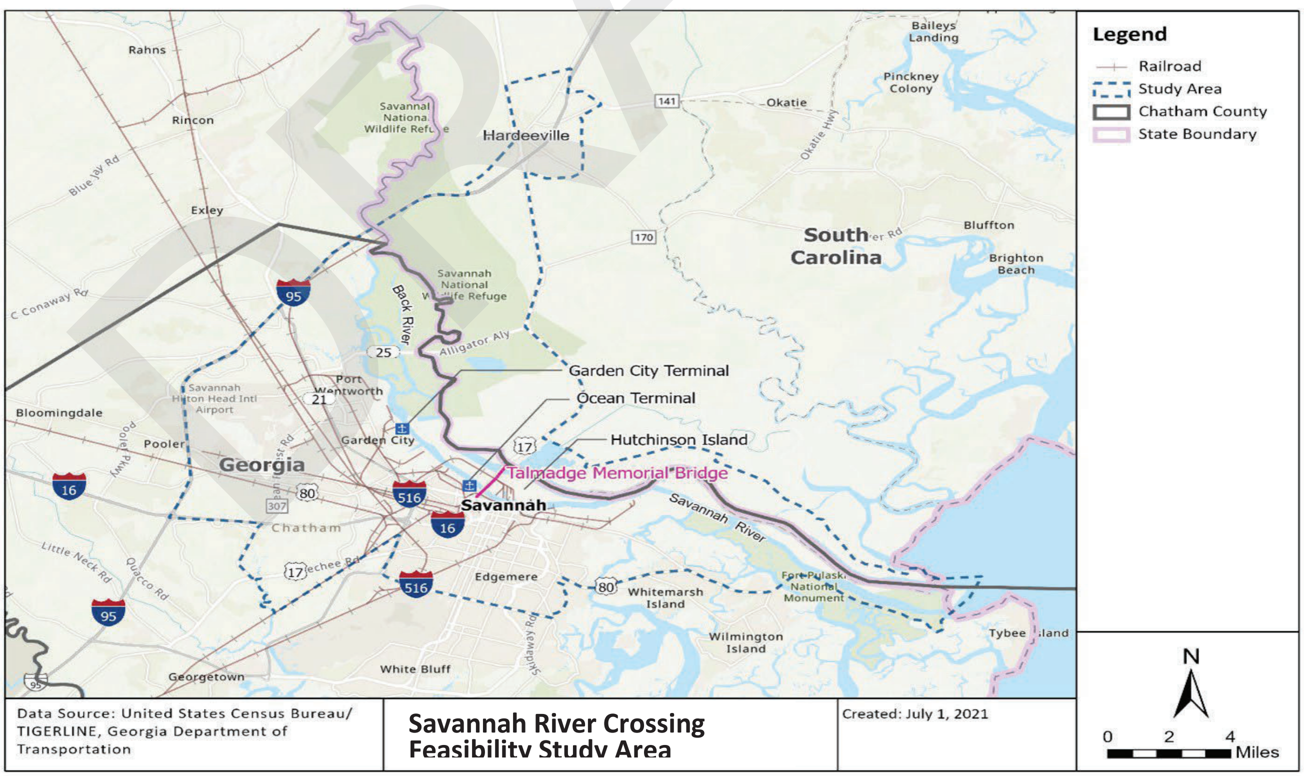

Figure 3. Savannah River Crossing Feasibility Study Area

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.

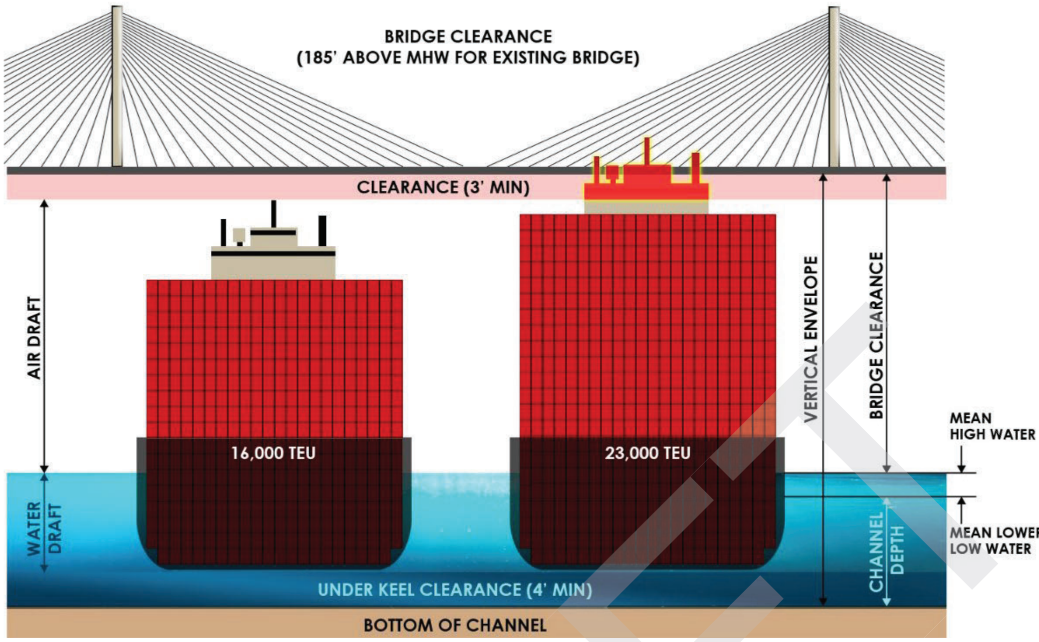

Figure 4. Maximum Clearance for Existing Talmadge Memorial Bridge

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.

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 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]

[2] https://data.worldbank.org/indicator/IS.SHP.GOOD.TU?end=2019&start=2000&view=chart

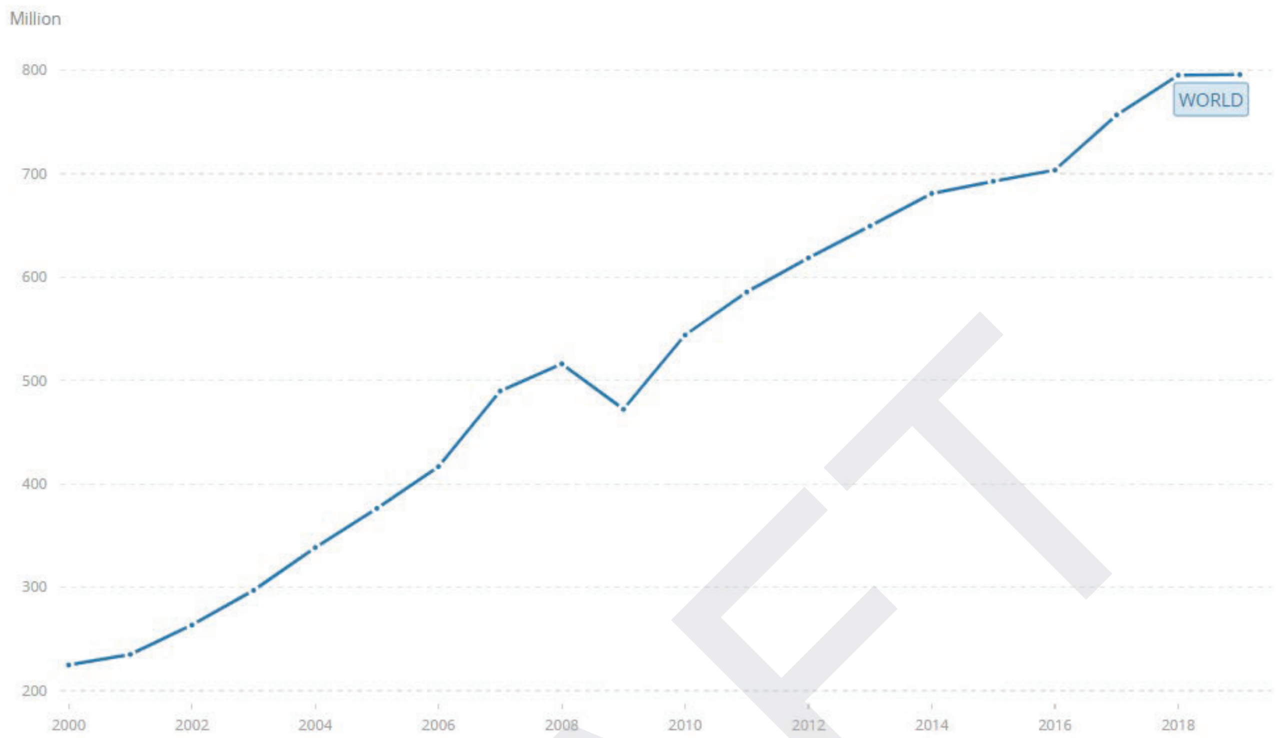

Figure 5. International Container Volume in TEU, 2000-2019

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.

[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.*

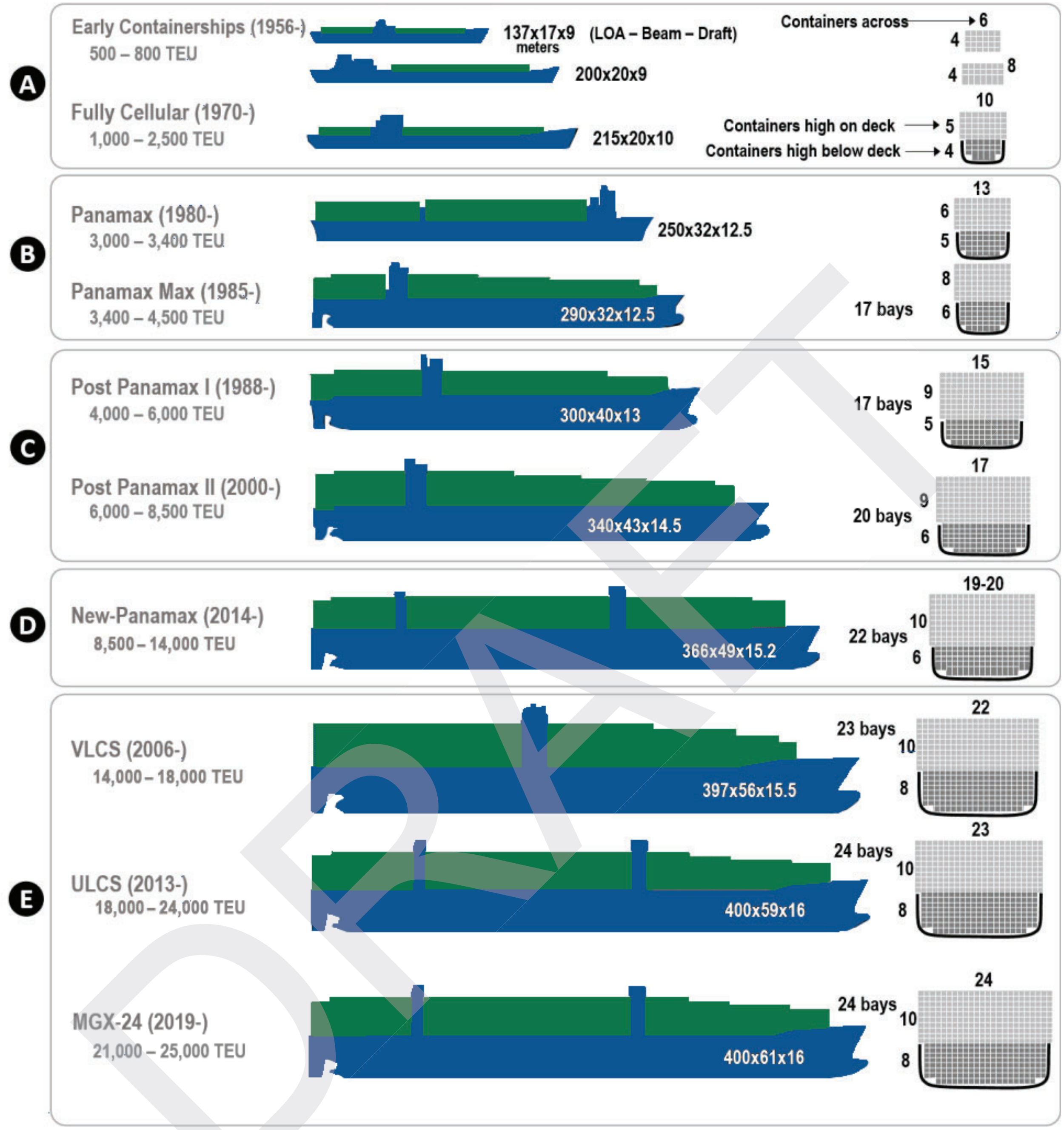

Figure 6. Evolution of Containership Dimensions (All Dimensions in Meters. 1 m = Approx. 3.28 ft)

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.

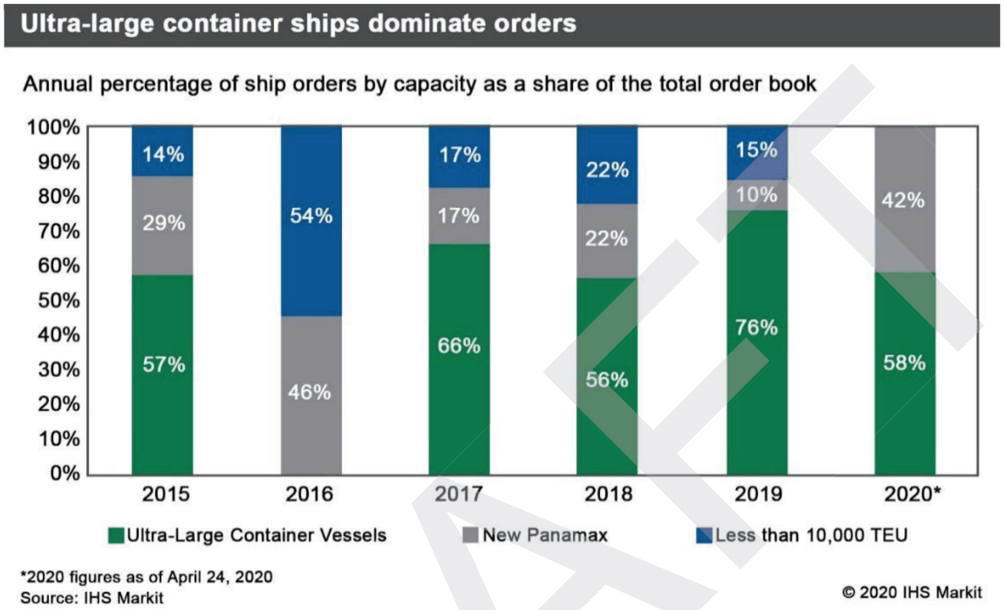

Figure 7. Order Book Shares Based on Ship Sizes, 2015-2020

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.*

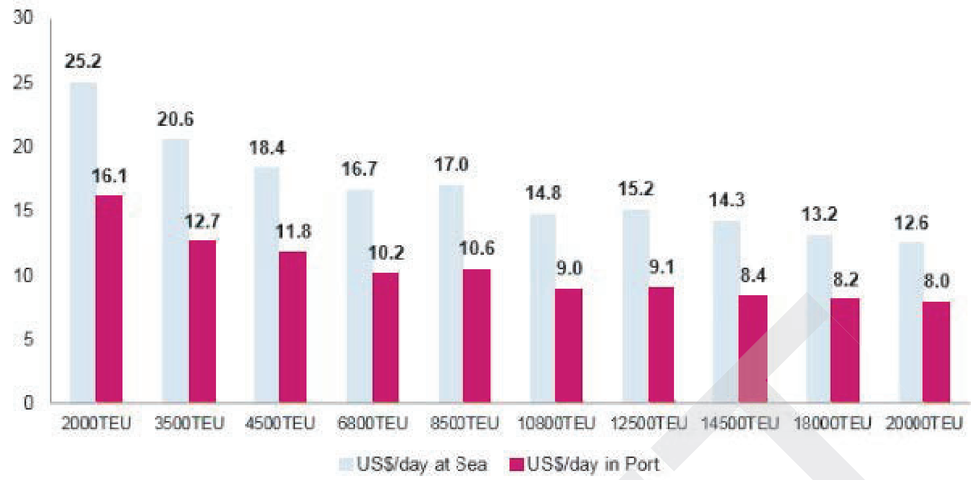

Figure 8. Economies of Scale in Container Shipping (US$/TEU)

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.*

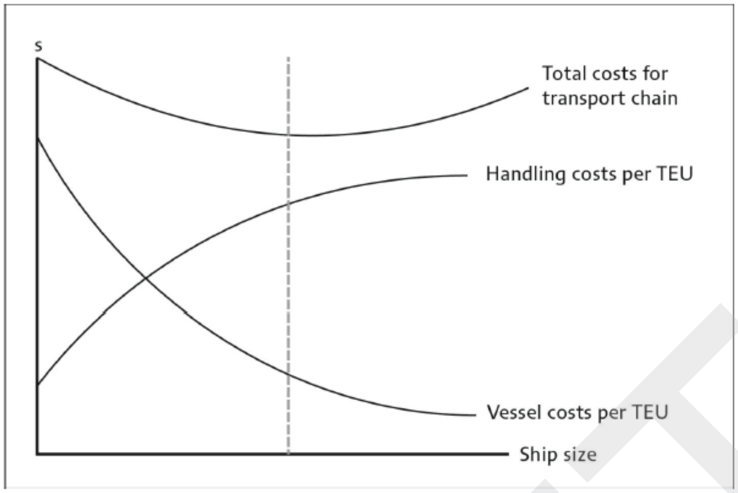

Figure 9. Relation Between Ship Costs and Handling Costs Per TEU

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.

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.

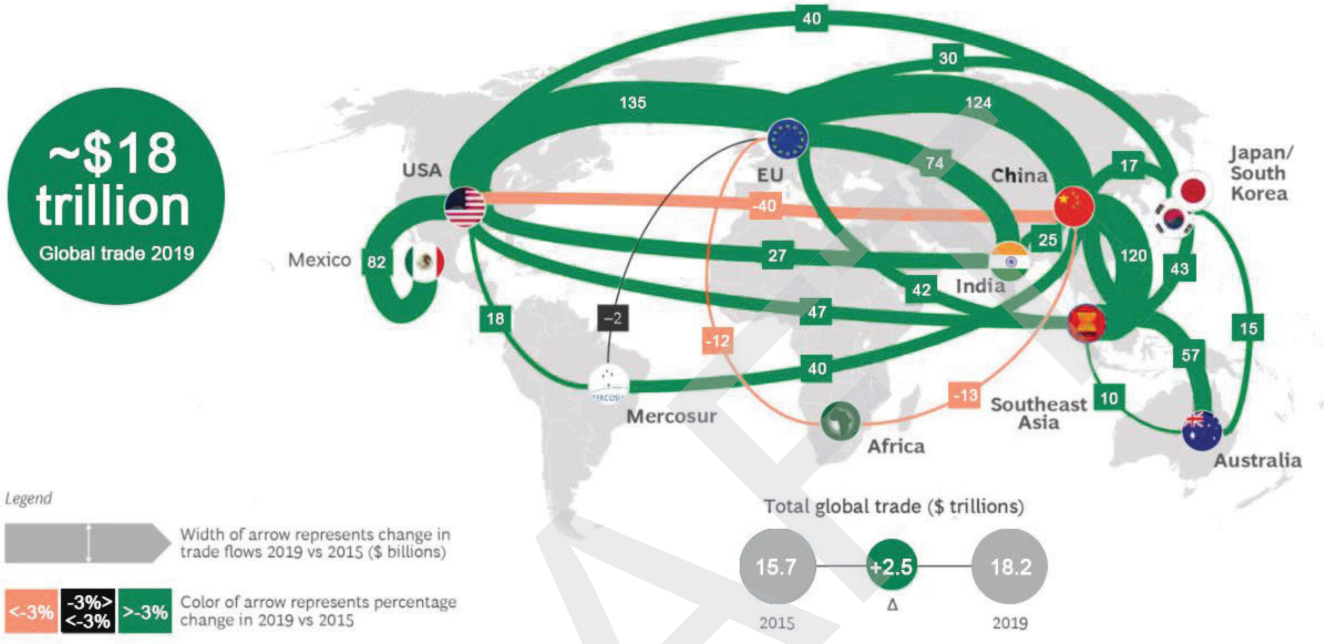

Figure 10. Changes in Volumes of Traded Goods, 2015-2019

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.

[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

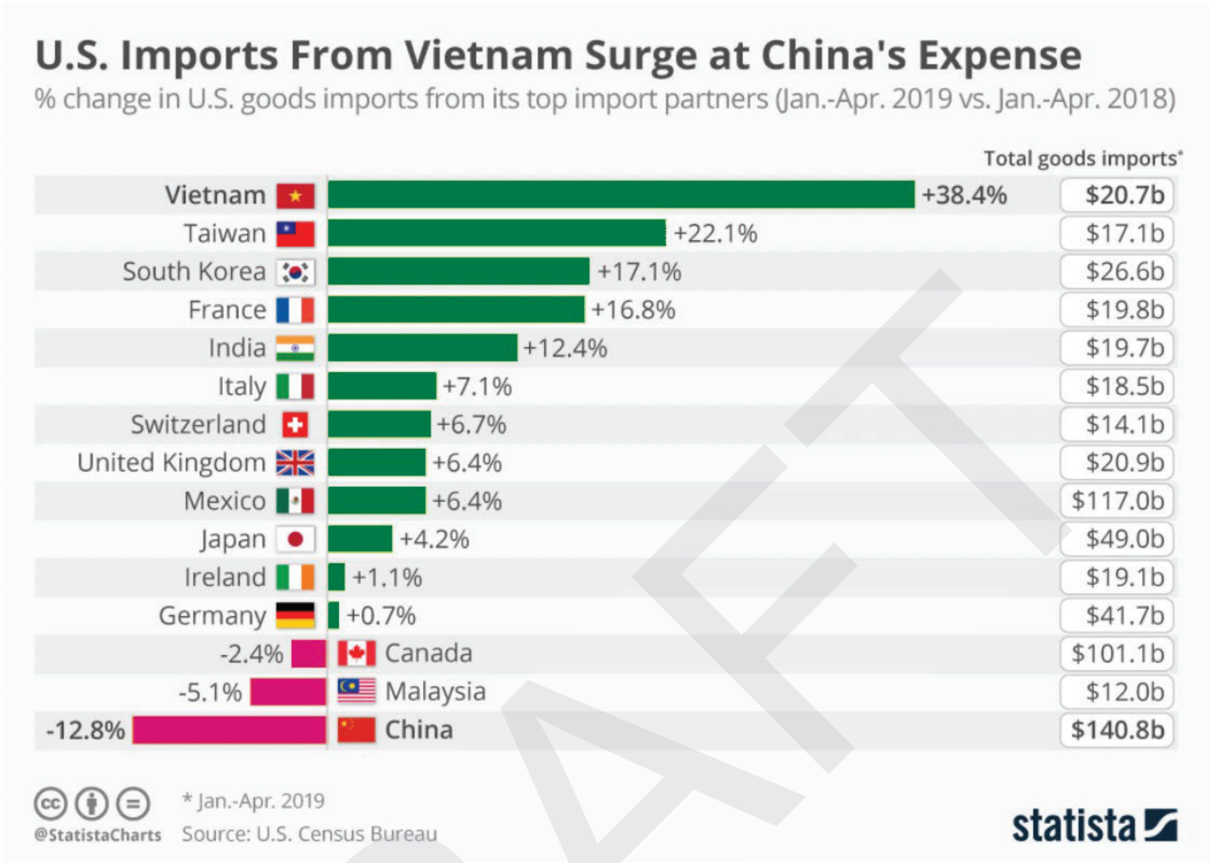

Figure 11. Changes in U.S. Import Origin, 2018-2019[18]

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

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[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

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]

[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%.

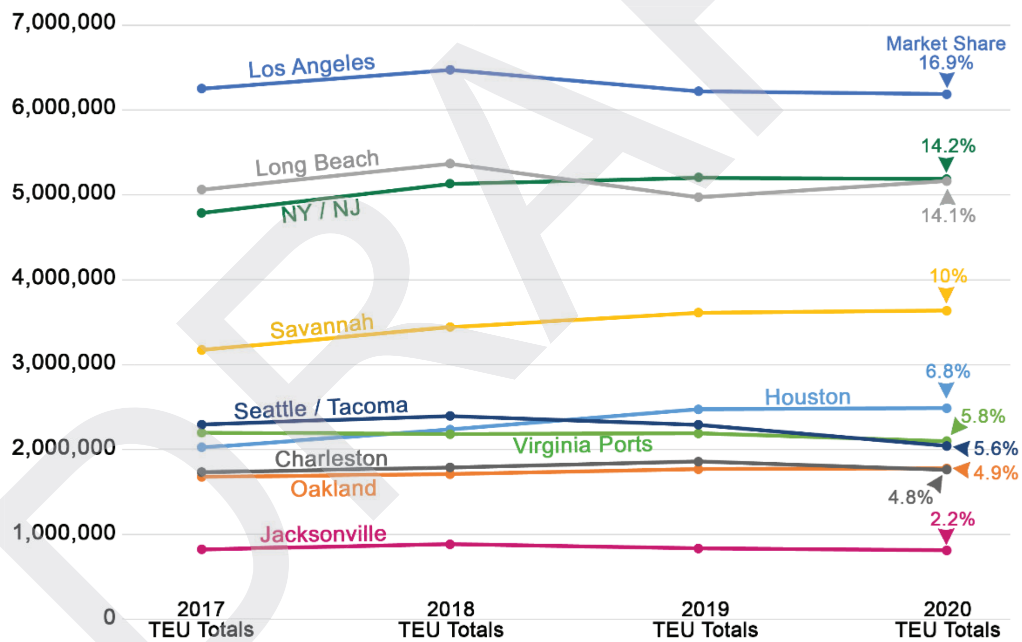


Figure 12. Largest U.S. Ports, measured in Laden TEUs (Excluding Empties)

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]

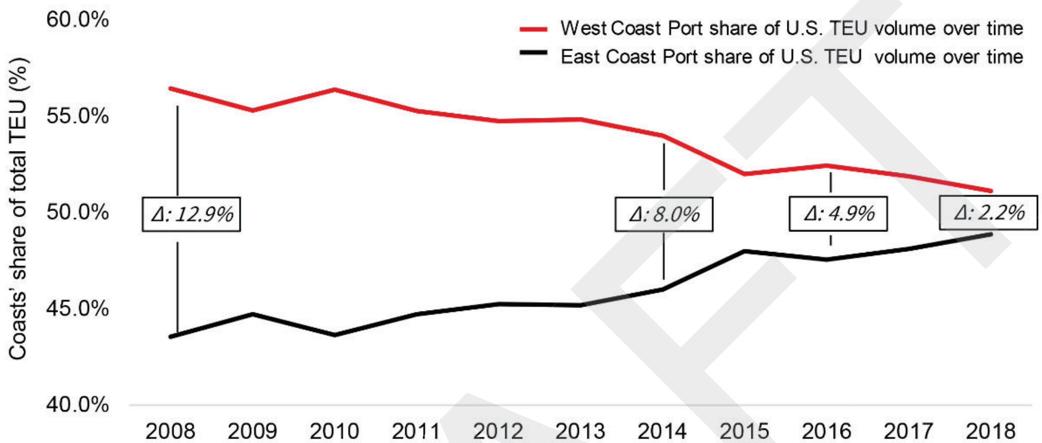
Asia to U.S. West Coast						
	2014	**2015**	**2016**	**2017**	**2018**	**2019**
Ship Count	314	312	280	250	258	253
Total Deployed TEUs	2,208,536	2,339,185	2,212,439	2,008,466	2,111,700	2,199,634
Avg. Ship Size	7,034	7,497	7,902	8,034	8,185	8,694
Weekly Deployed TEUs	289,125	276,964	265,712	276,758	287,105	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

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]



West Coast Ports include: *Long Beach, Los Angeles, Oakland, and Seattle-Tacoma*
East Coast Ports include: *Baltimore, Charleston, Houston, Jacksonville, Miami, New York/New Jersey, Savannah, and Virginia*

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.

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.

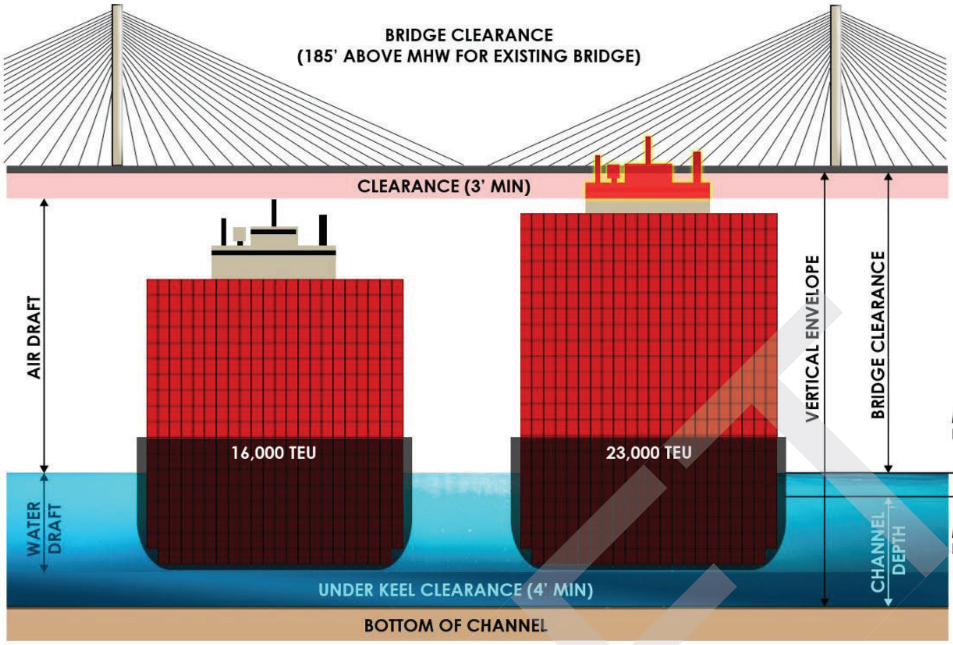


Figure 15. Current Vertical Envelope of the Talmadge Memorial Bridge

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.

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**

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.

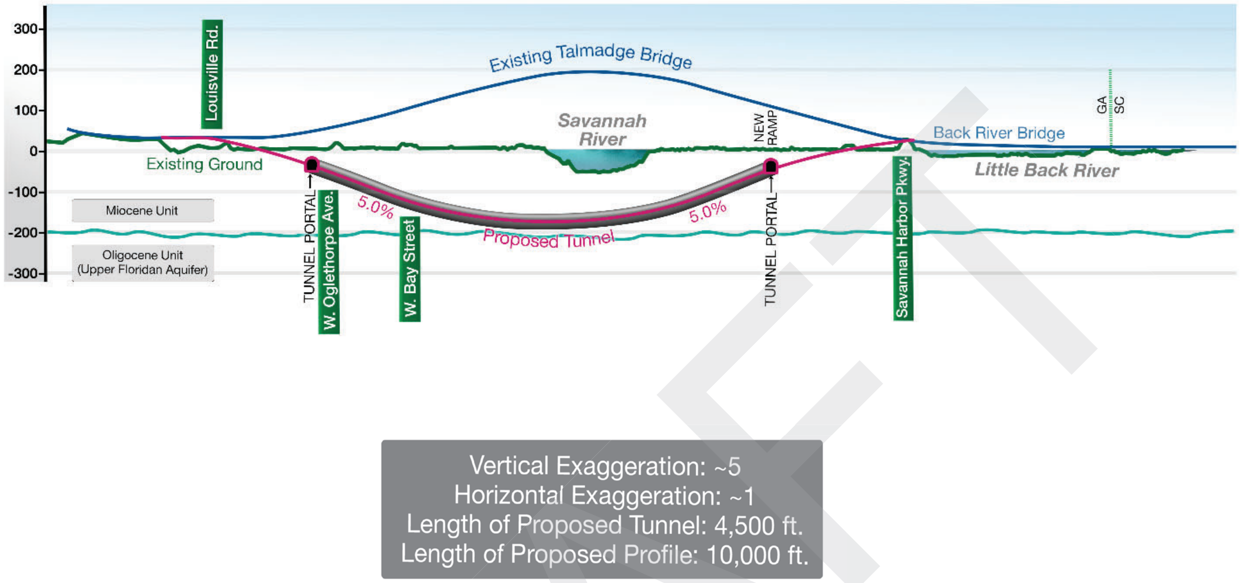


Figure 16. Proposed Tunnel Profile

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.

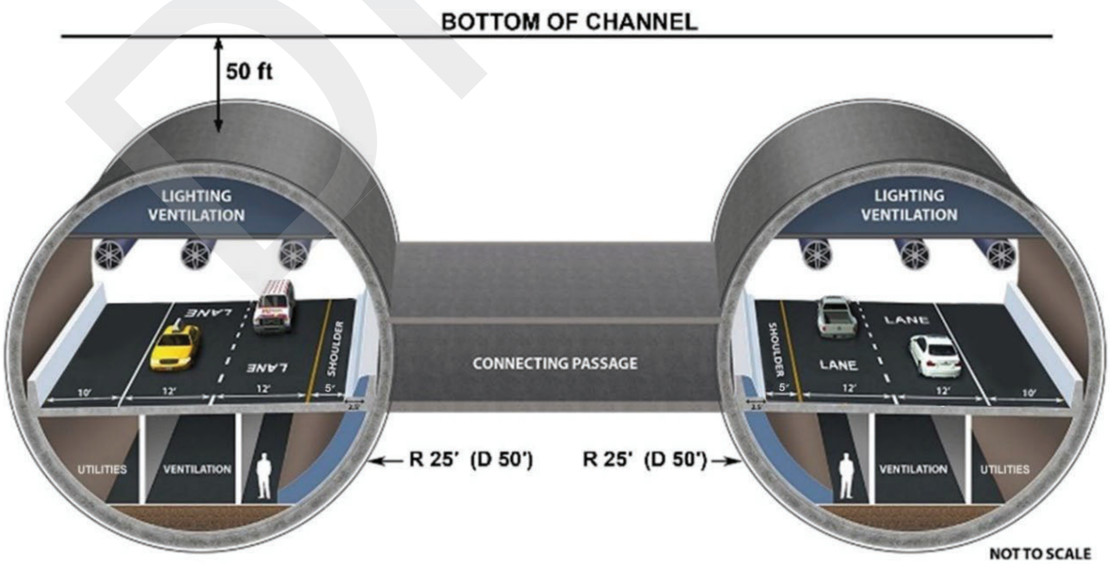


Figure 17. Potential Design for Tunnel Option

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.

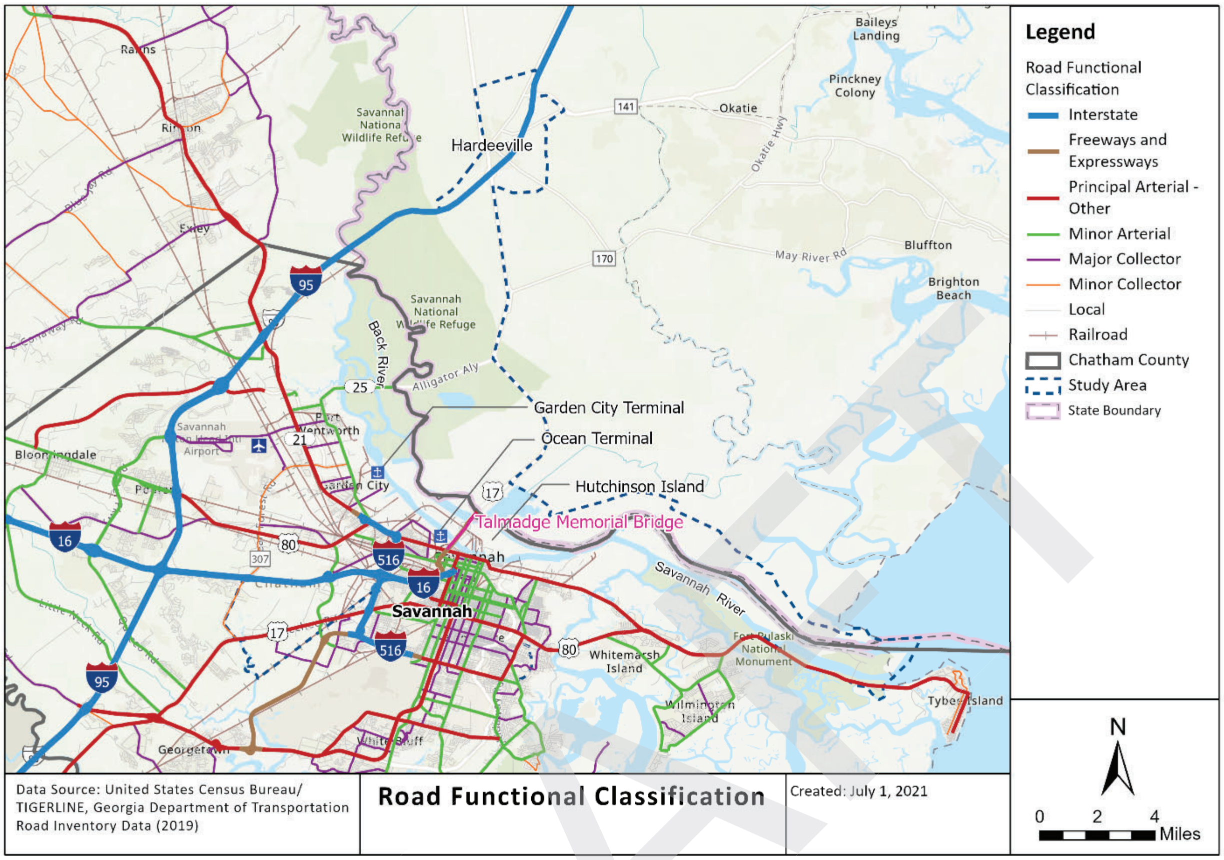


Figure 18. Road Functional Classification

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.

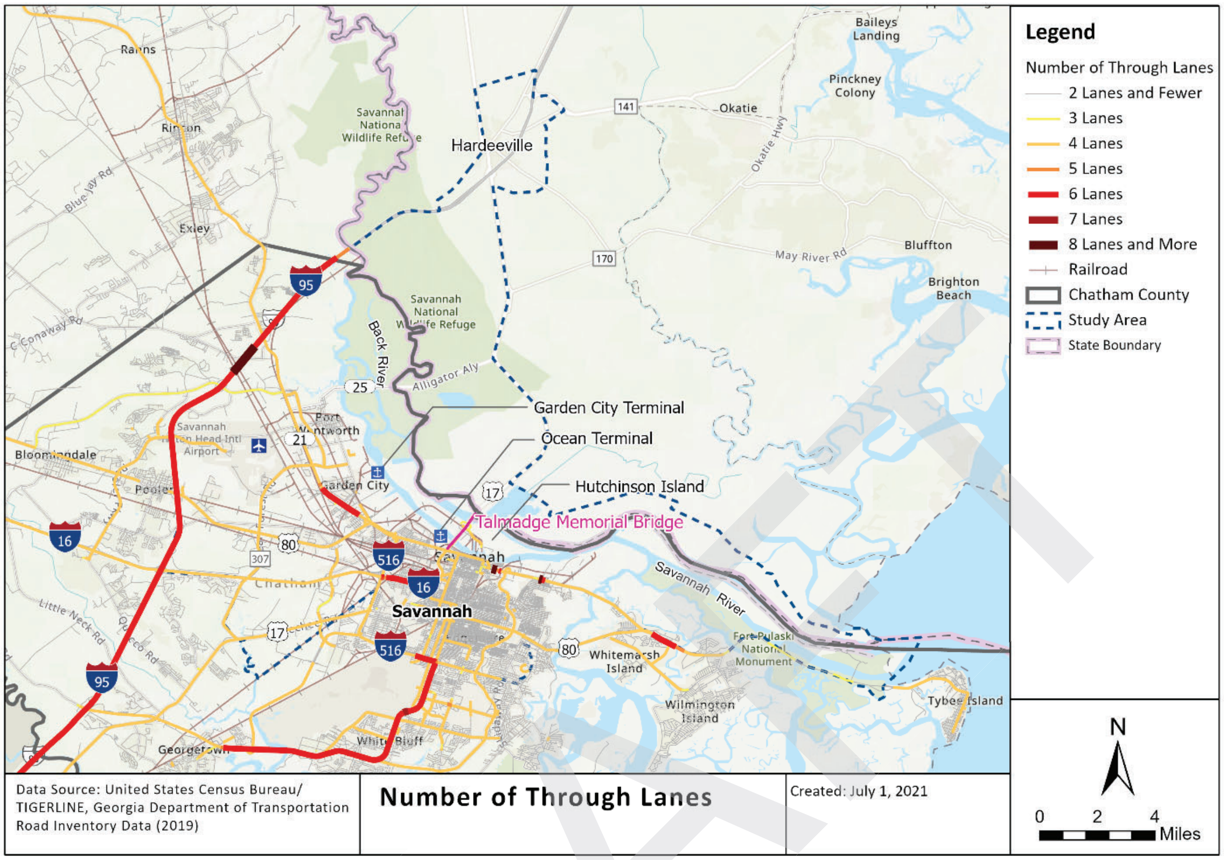


Figure 19. Number of Through Lanes in Study Area

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

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 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.

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[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.*

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

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

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.

[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

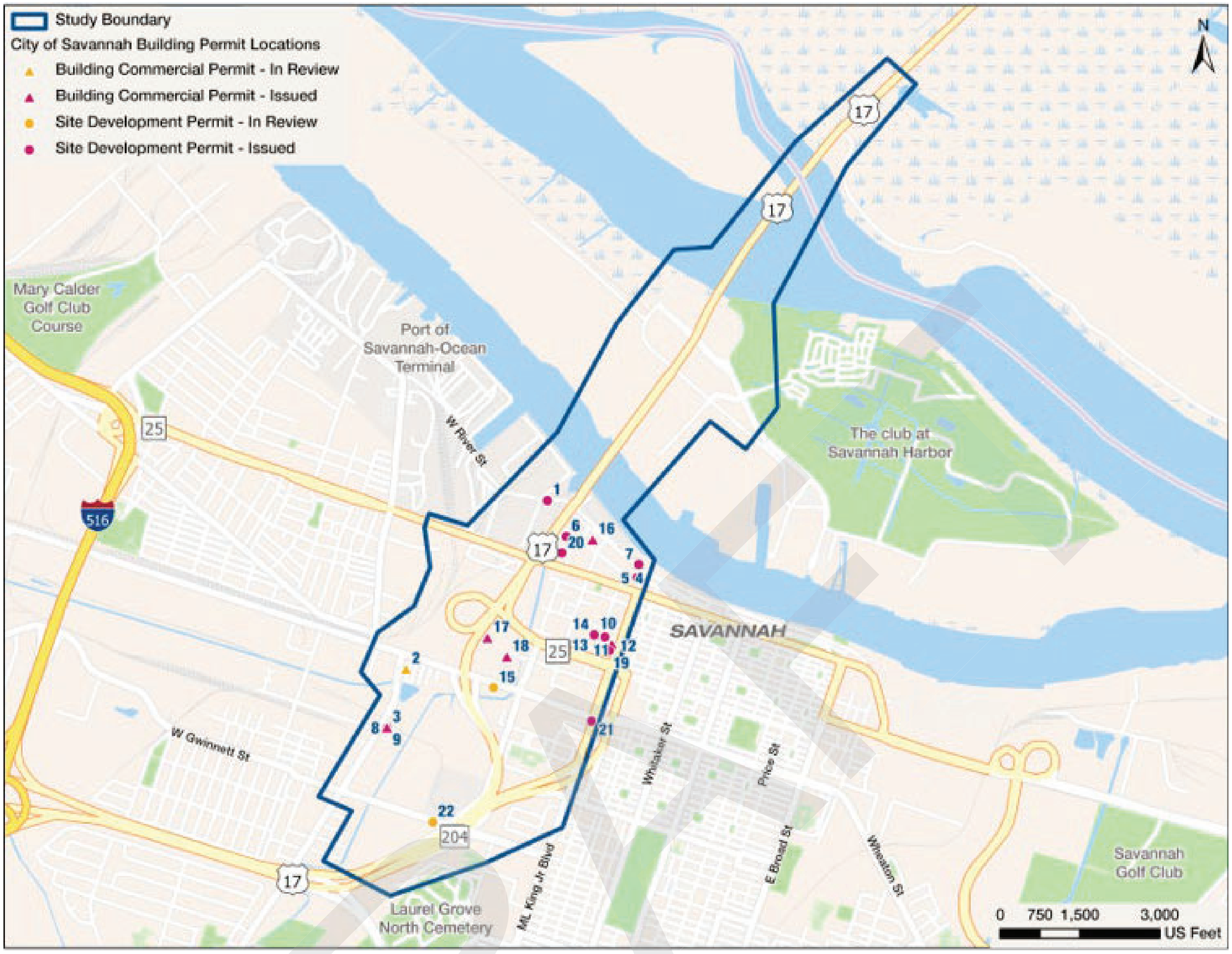


Figure 20. Building Permit Locations

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).

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

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.

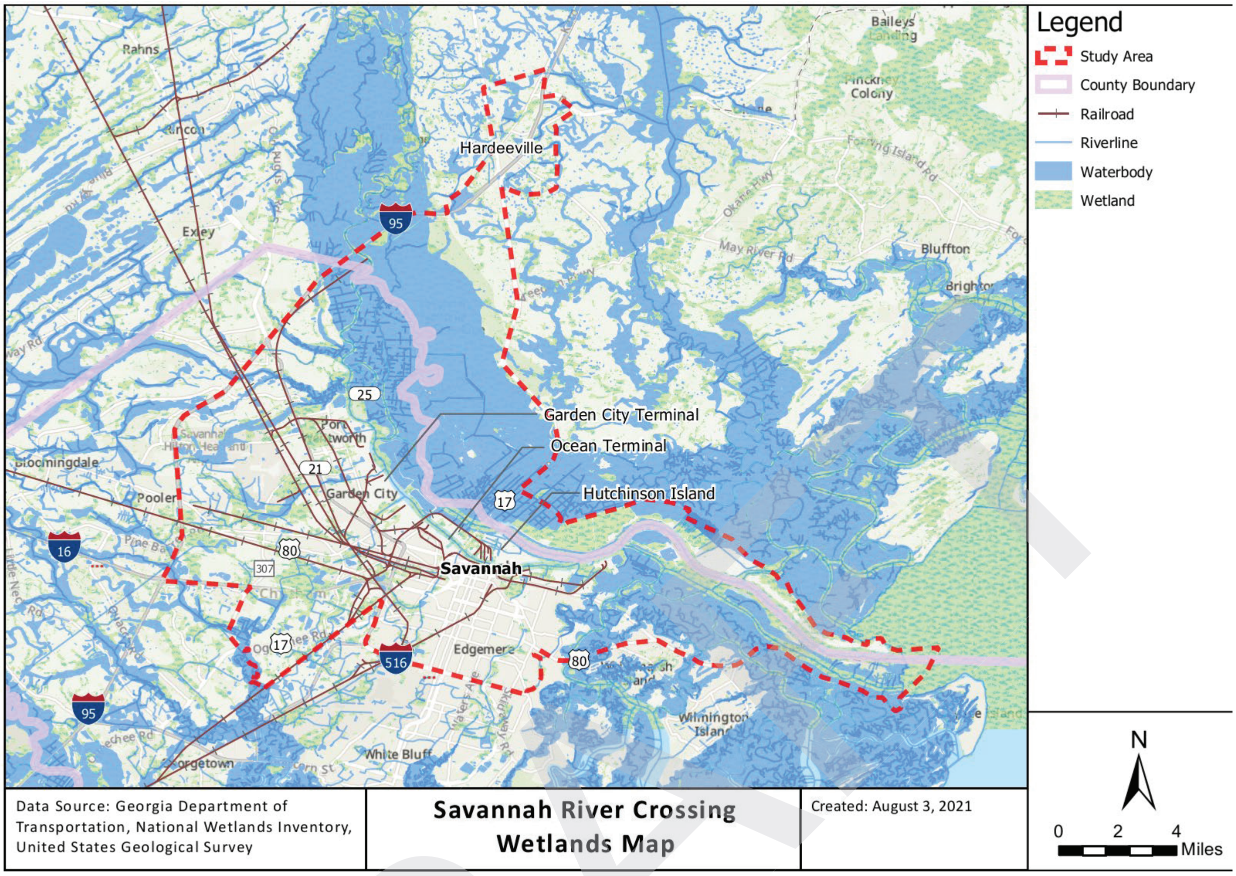


Figure 21. Wetlands and Water Bodies within Environmental Screening Area

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.

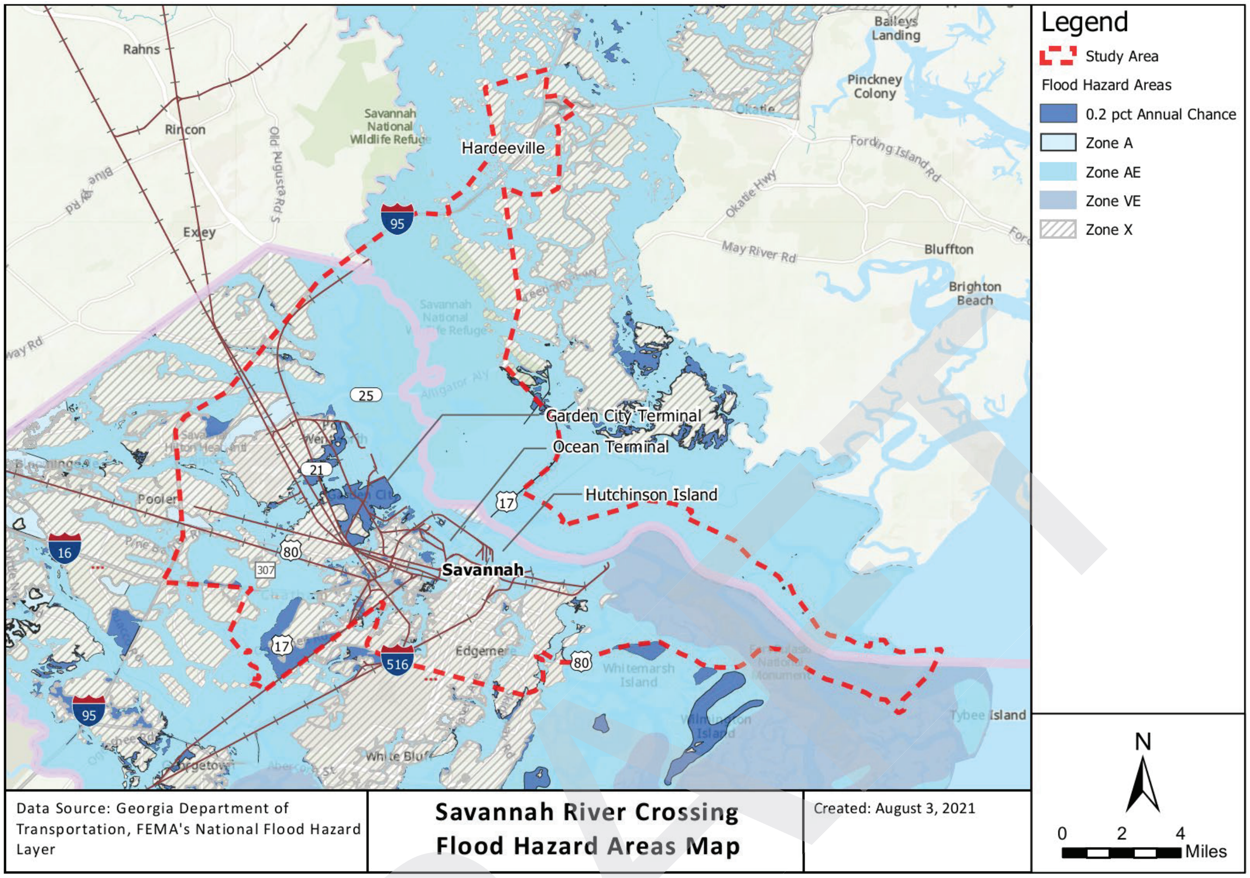


Figure 22. Flood Hazard Areas within Environmental Screening Area

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.

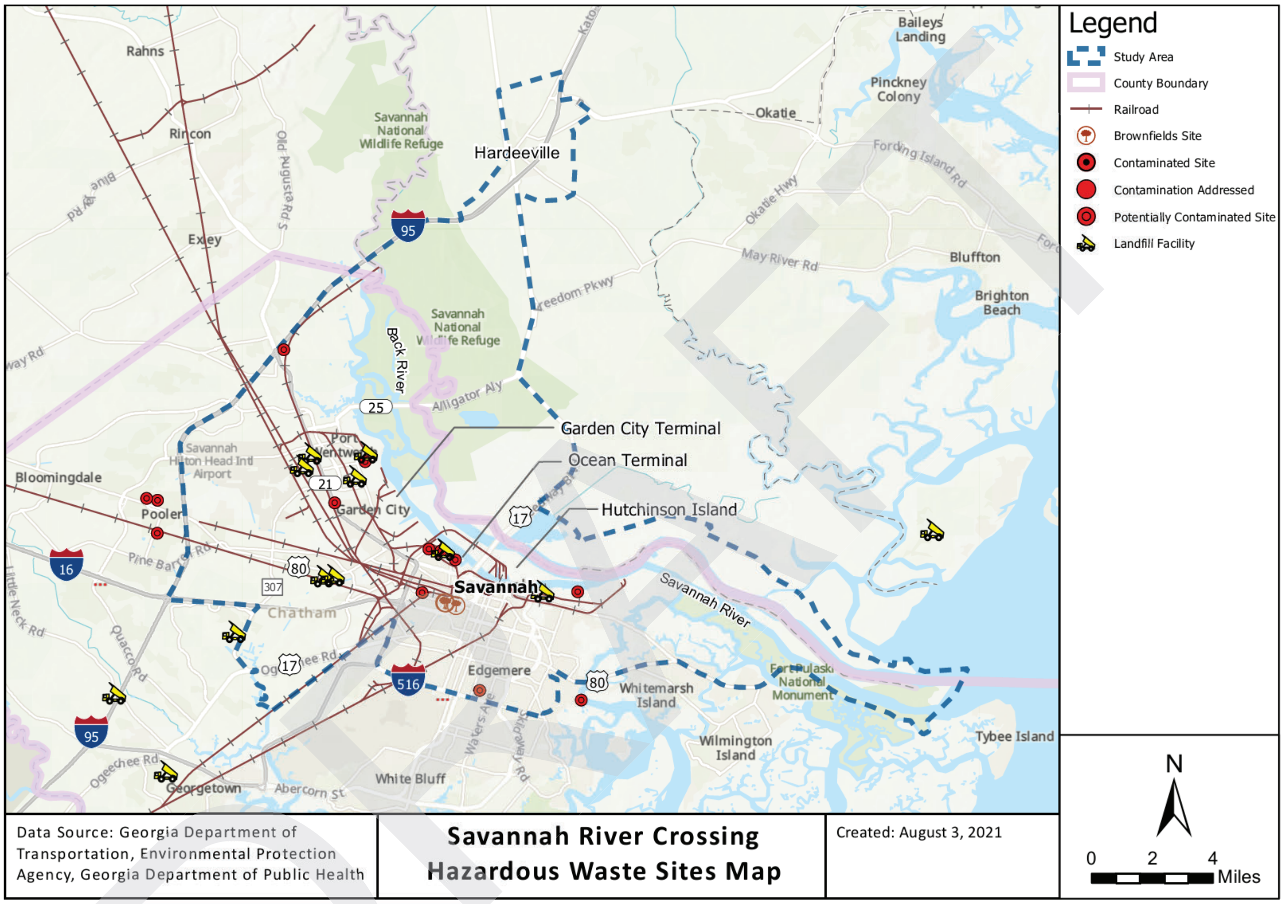


Figure 23. Hazardous Waste Sites within Environmental Screening Boundary

Thirteen gas stations and 547 underground storage tanks (USTs) were identified within the screening boundary, as shown in Figure 24.

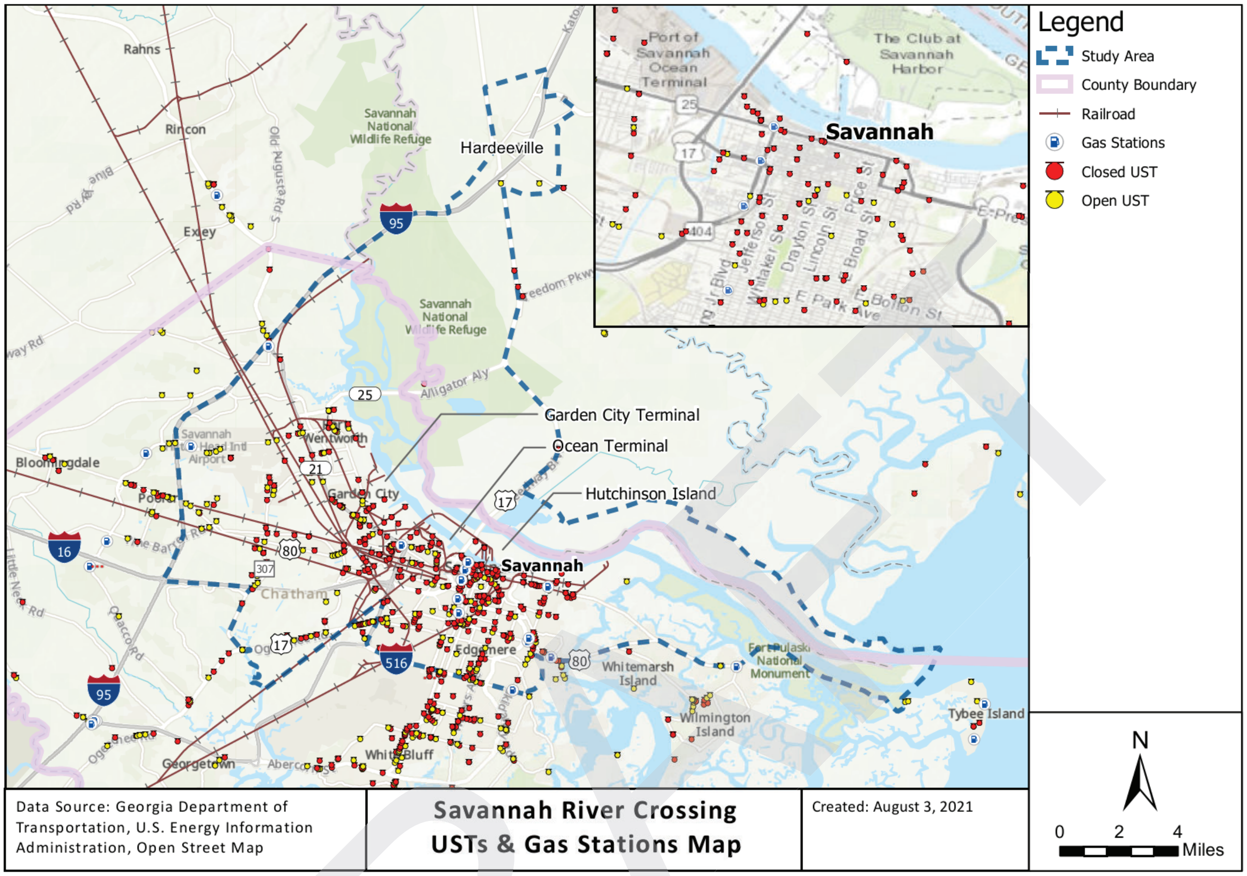


Figure 24. Gas Stations and Underground Storage Tanks within Environmental Screening Boundary

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

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.

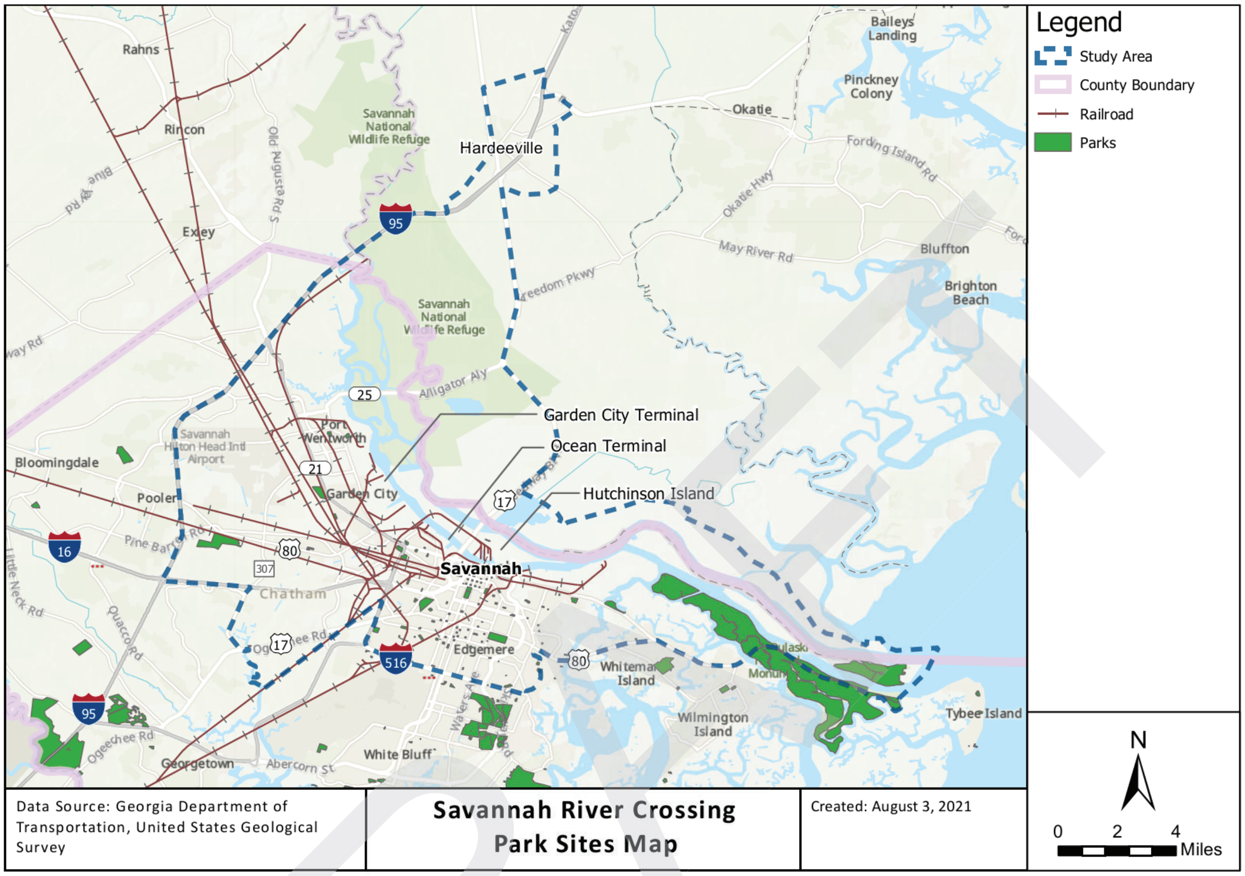


Figure 25. Parks within Environmental Screening Boundary

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.

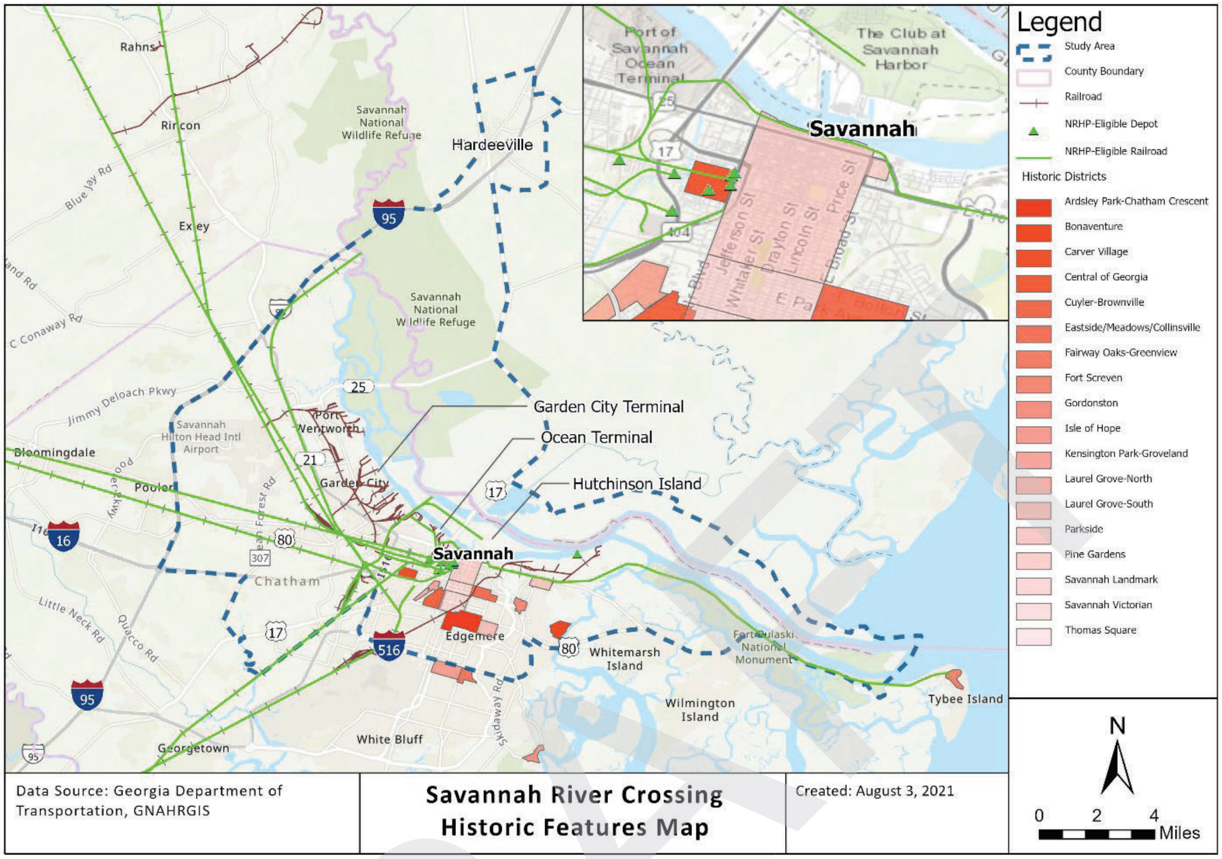


Figure 26. Historic Features within Environmental Screening Boundary

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.

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

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.

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 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 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.

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.

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%.

3.5.1.1.2 CORE MPO Travel Demand Model Volume

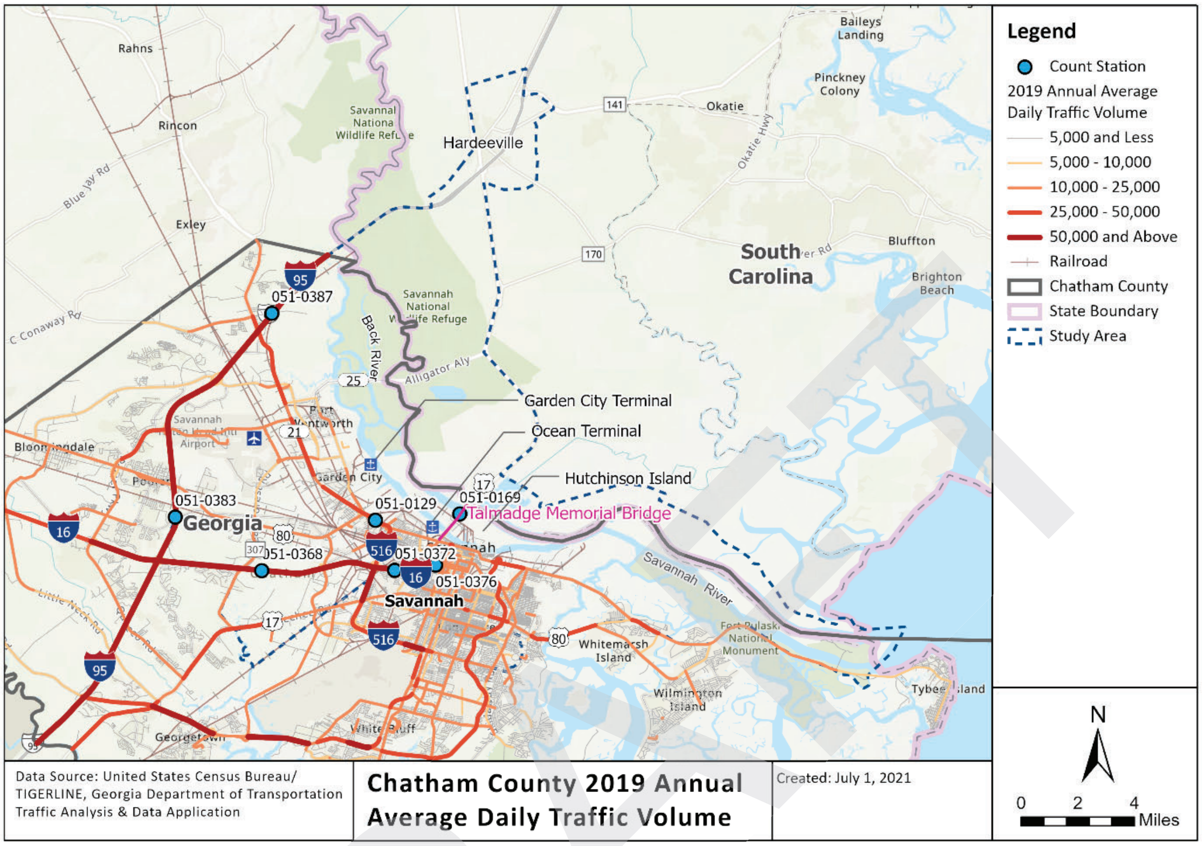


Figure 27. 2019 Annual Average Daily Traffic (AADT) Volume – TADA

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.

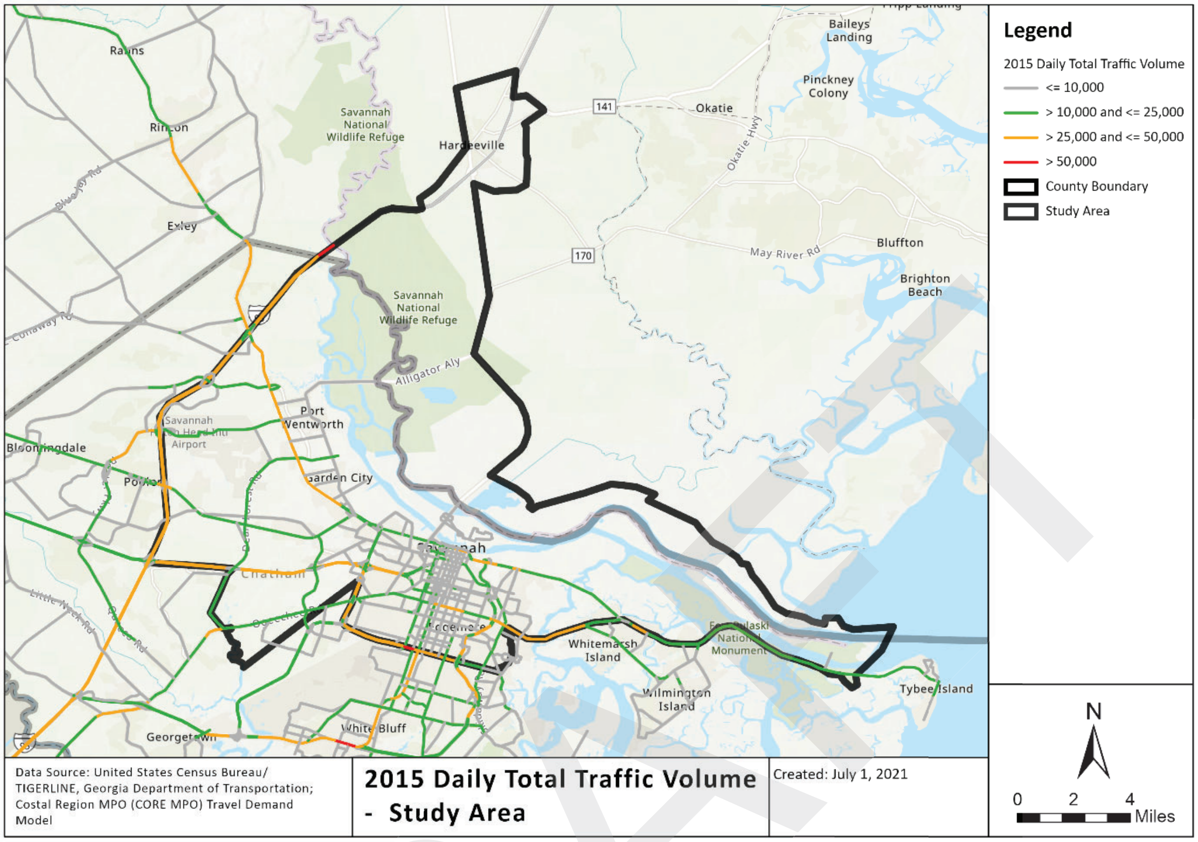


Figure 28. 2015 Daily Total Traffic Volume – CORE MPO Travel Demand Model

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.

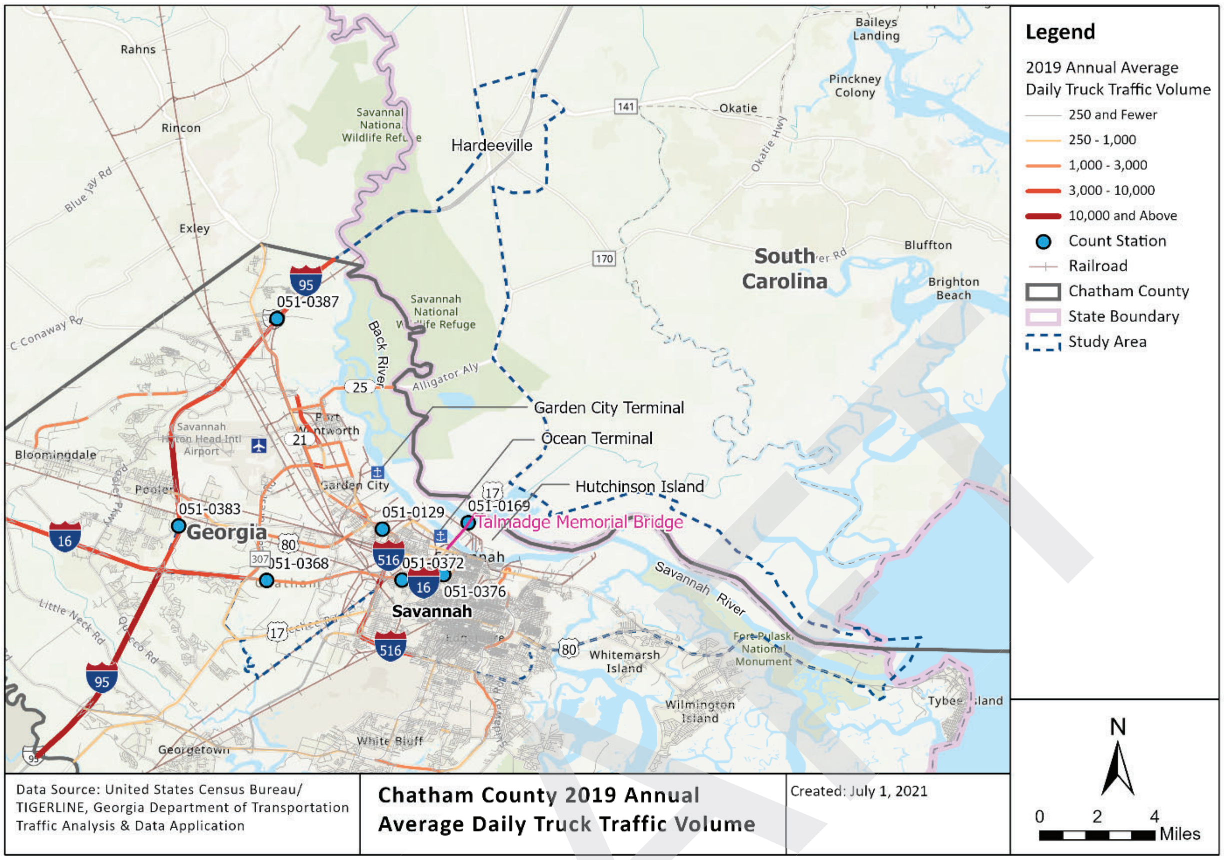


Figure 29. 2019 Annual Average Daily Truck Traffic Volume

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

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

Savannah/Hilton Head International Airport, segments of US 80, and segments of East DeRenne Avenue, which connects I-516 and Truman Parkway.

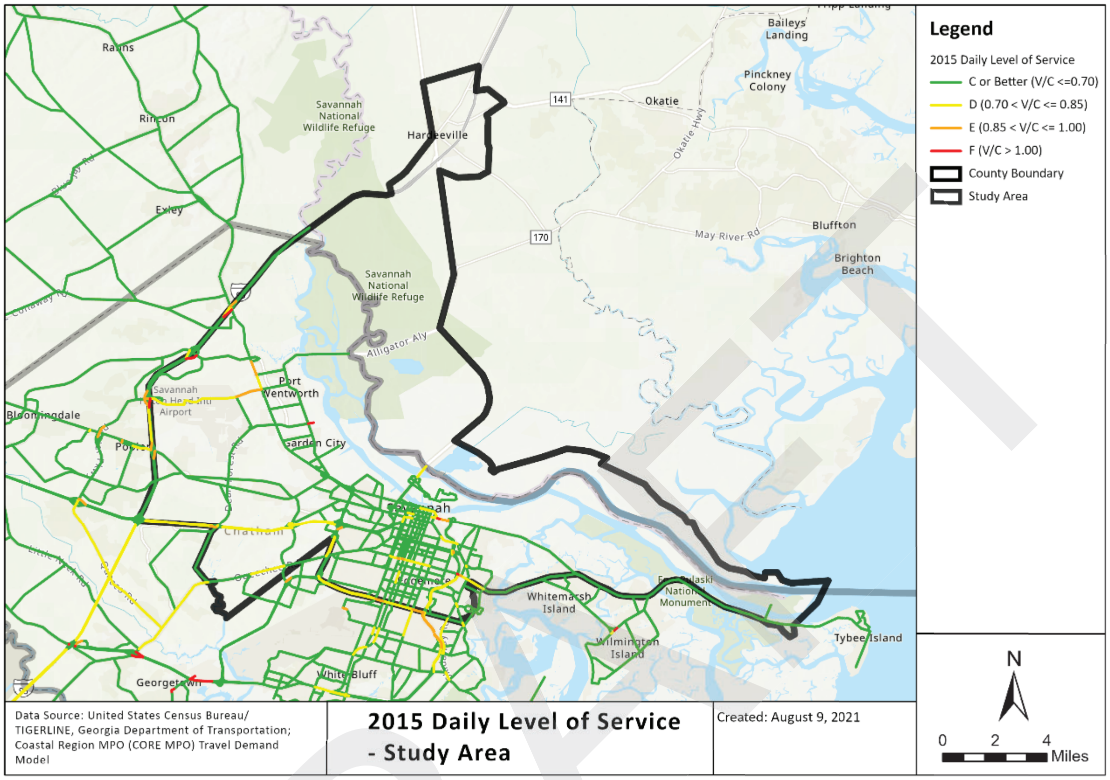
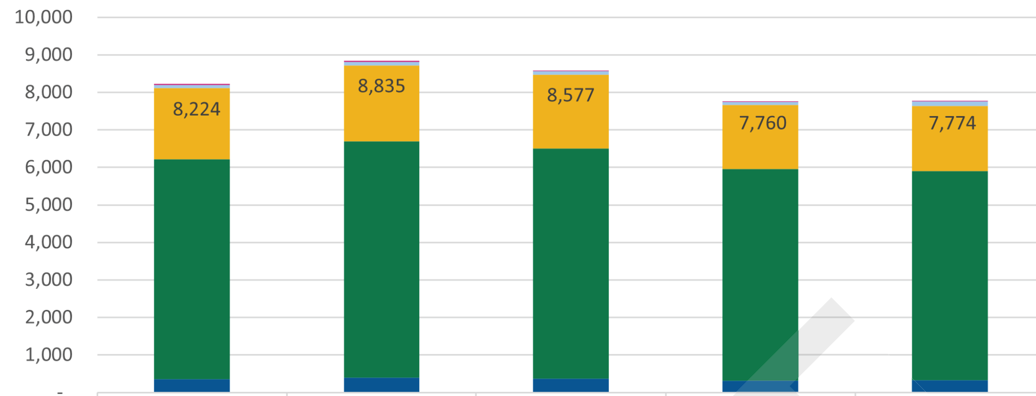


Figure 30. 2015 Daily Level of Service – CORE MPO Travel Demand Model

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.



	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.

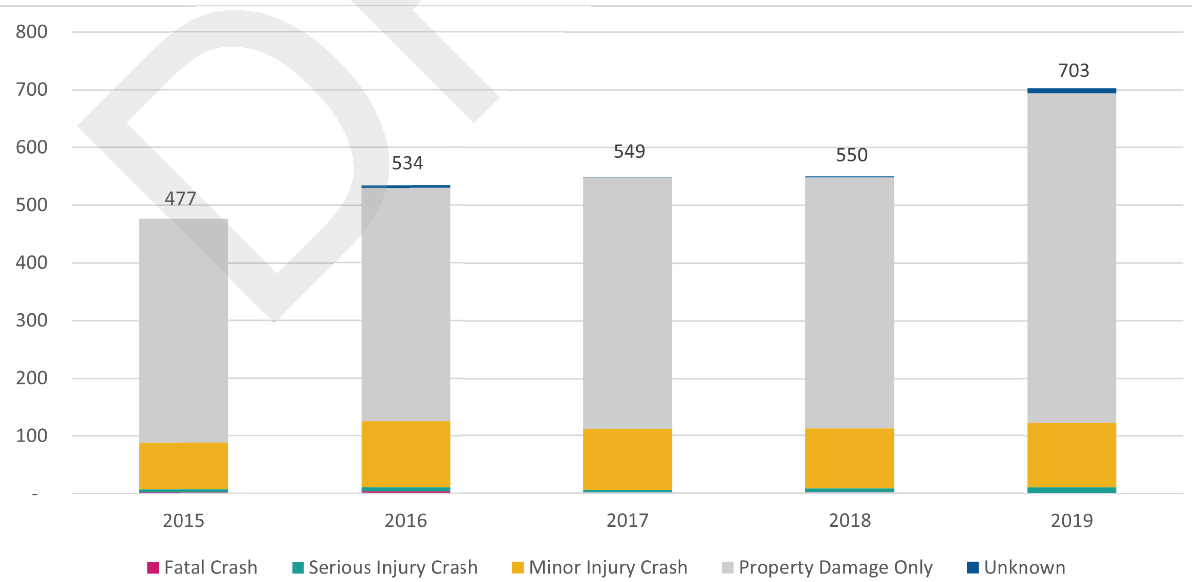


Figure 32. 2015-2019 Commercial Vehicle Crashes by Severity in the Study Area

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%

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%

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.

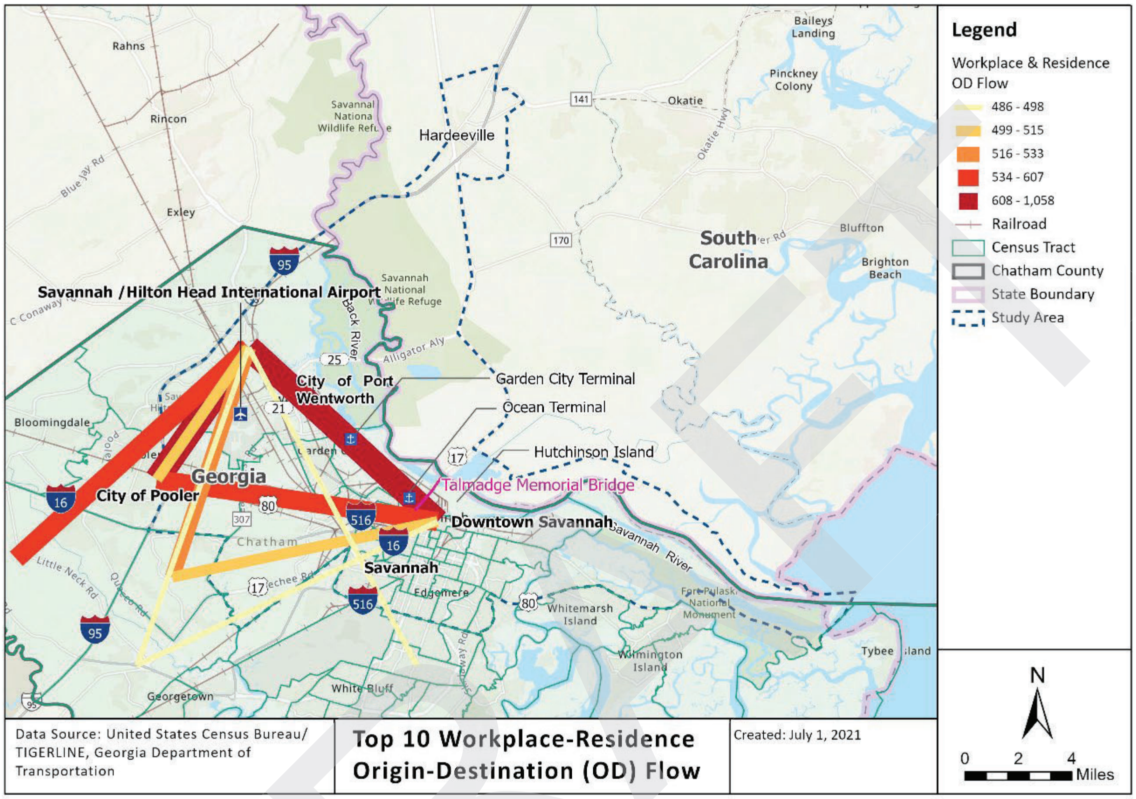


Figure 33. Top 10 Workplace and Residence Origin-Destination (OD) Flow

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.

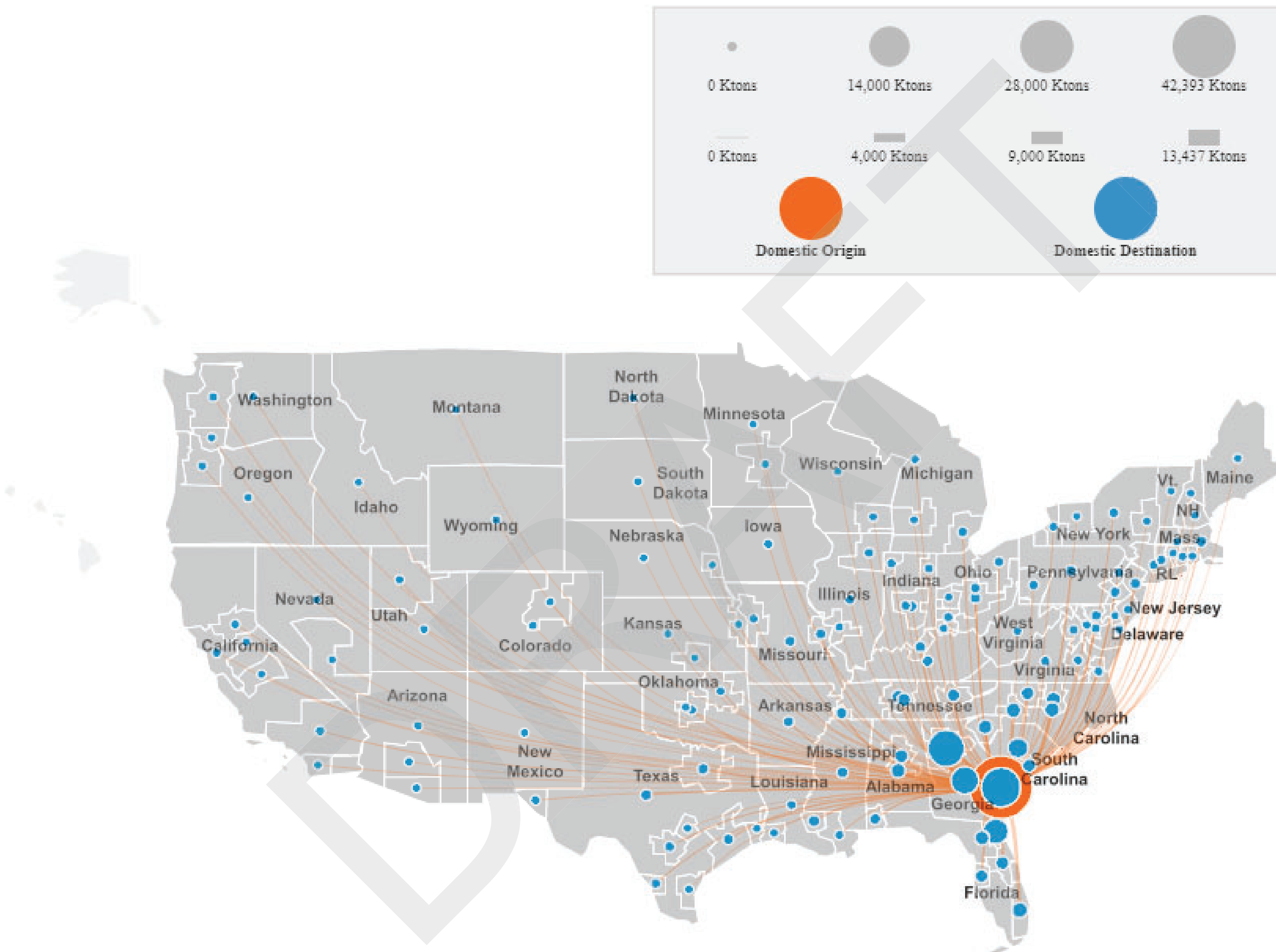


Figure 34. Total Freight Flows by Tons from Savannah Area in 2017

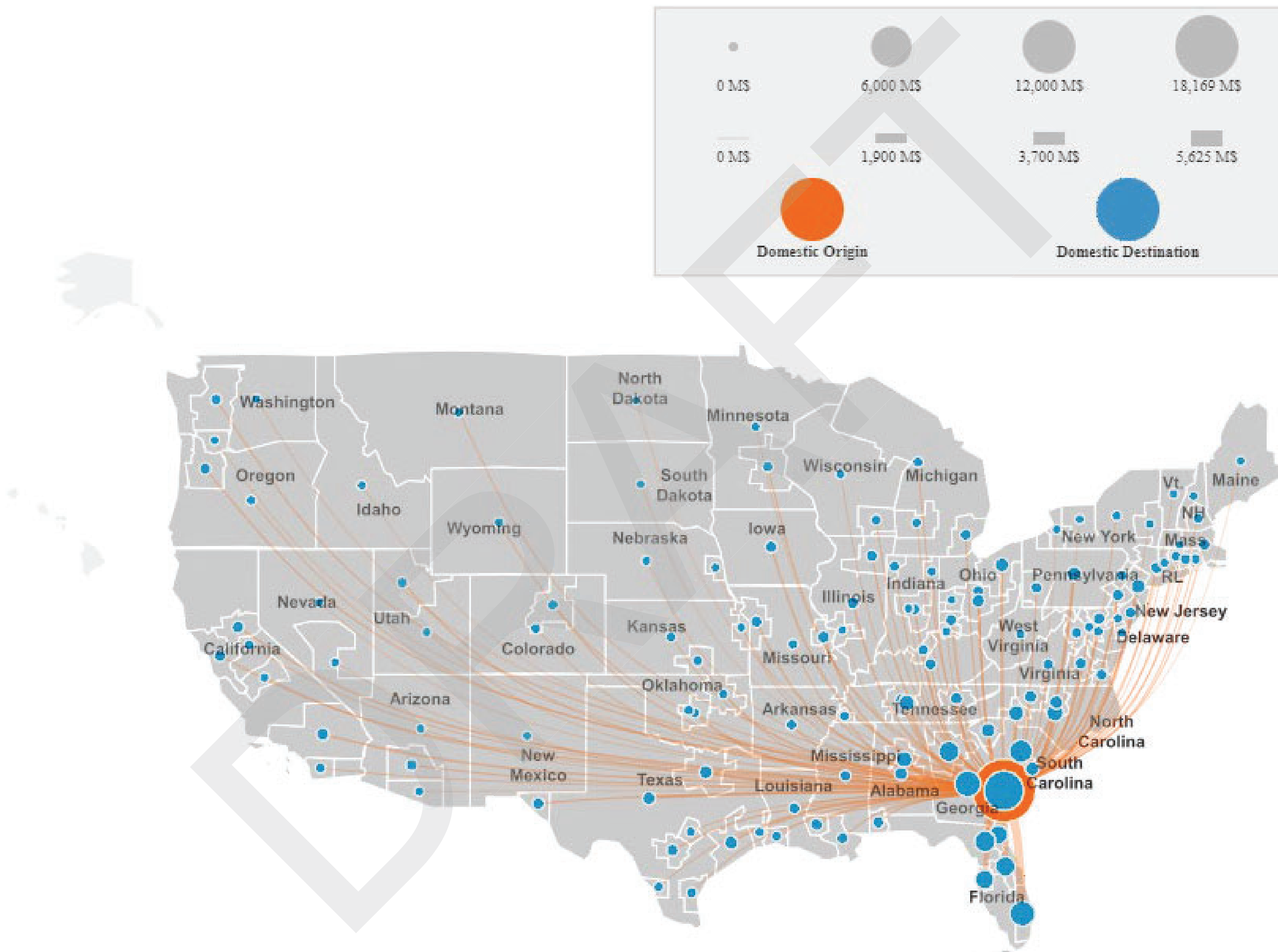


Figure 35. Total Freight Flows by Values (M$) from Savannah Area in 2017

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.

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%

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.

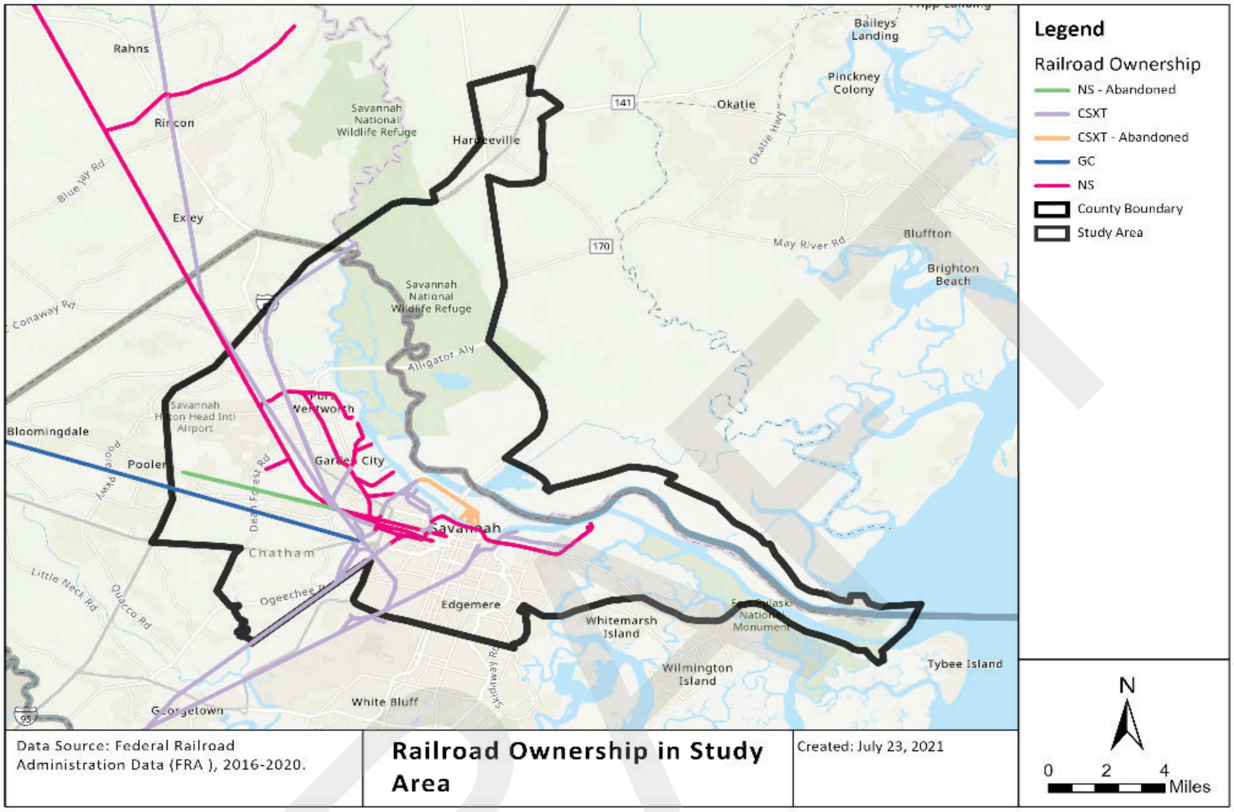


Figure 36. Railroad Ownership

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.

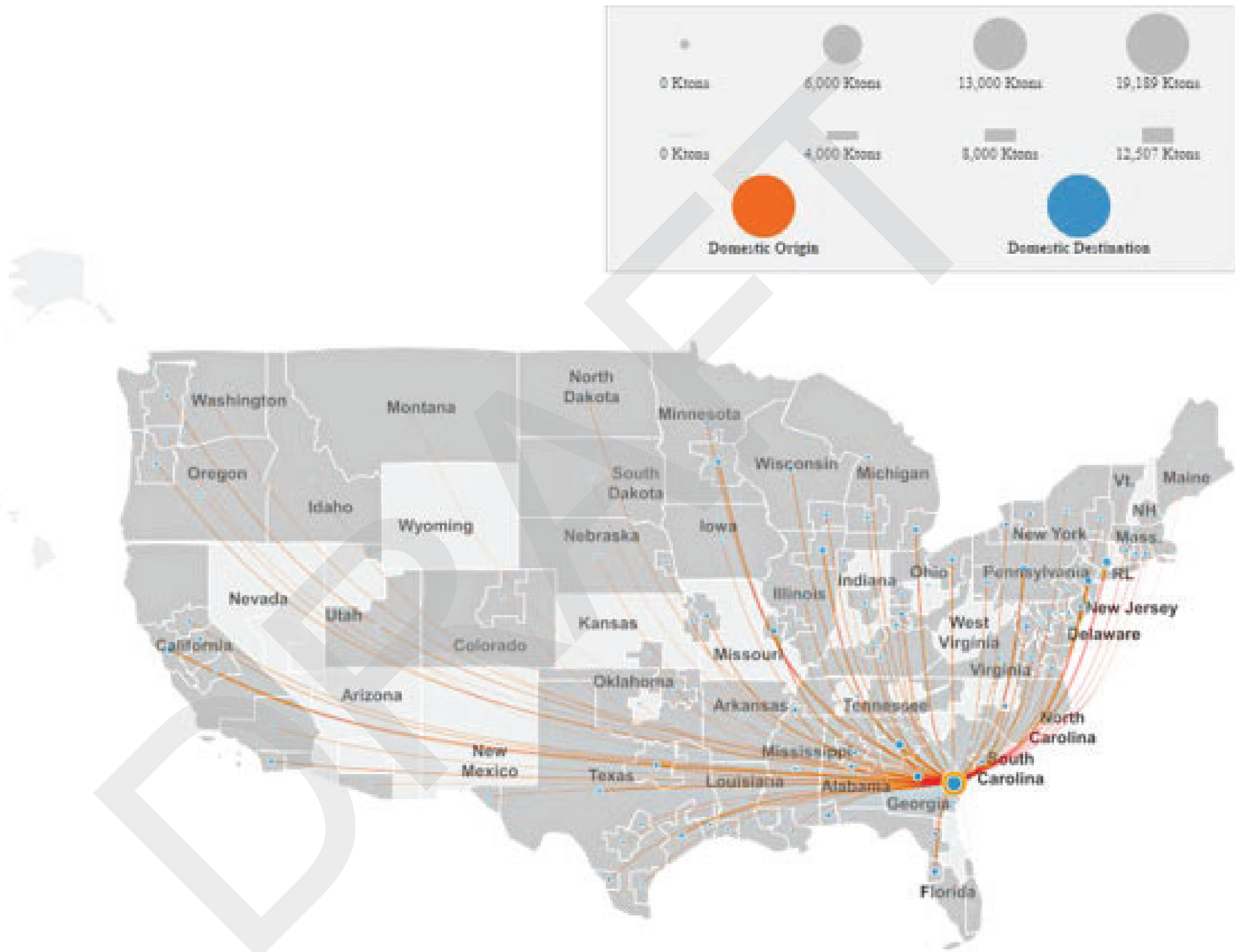


Figure 37. Total Rail Flows by Tons from Savannah Area in 2017

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.

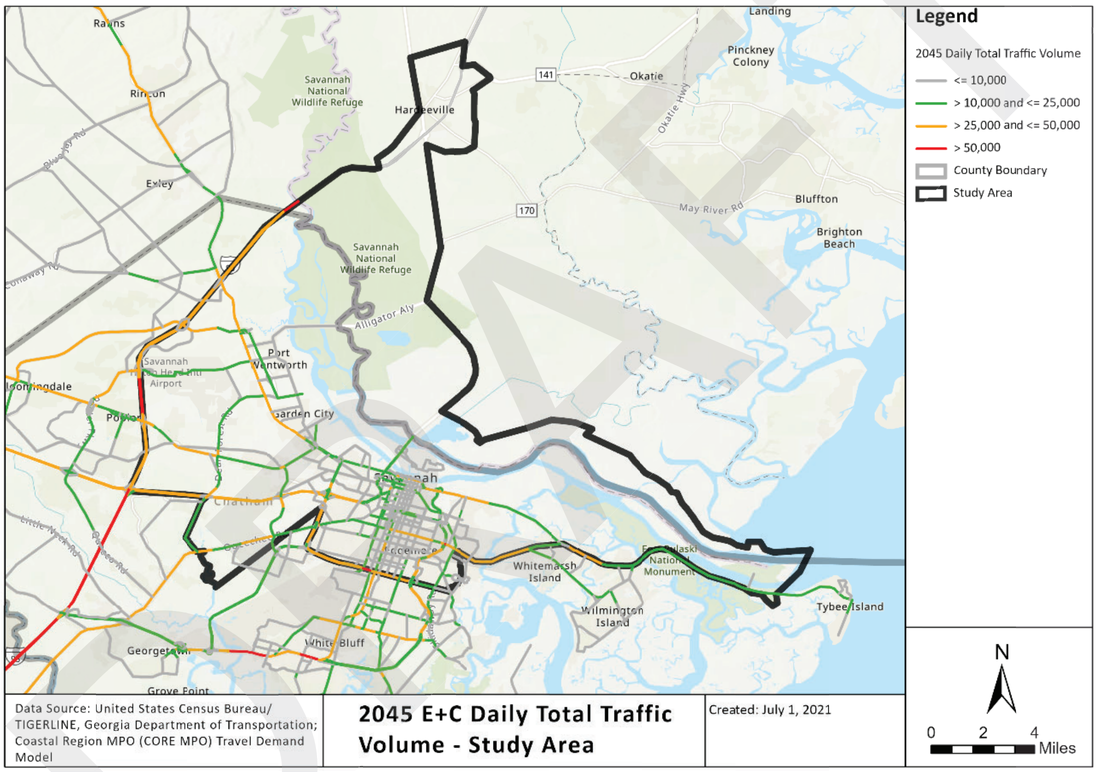


Figure 38. 2045 E+C Daily Total Traffic Volume - CORE MPO Travel Demand Model

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%

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.

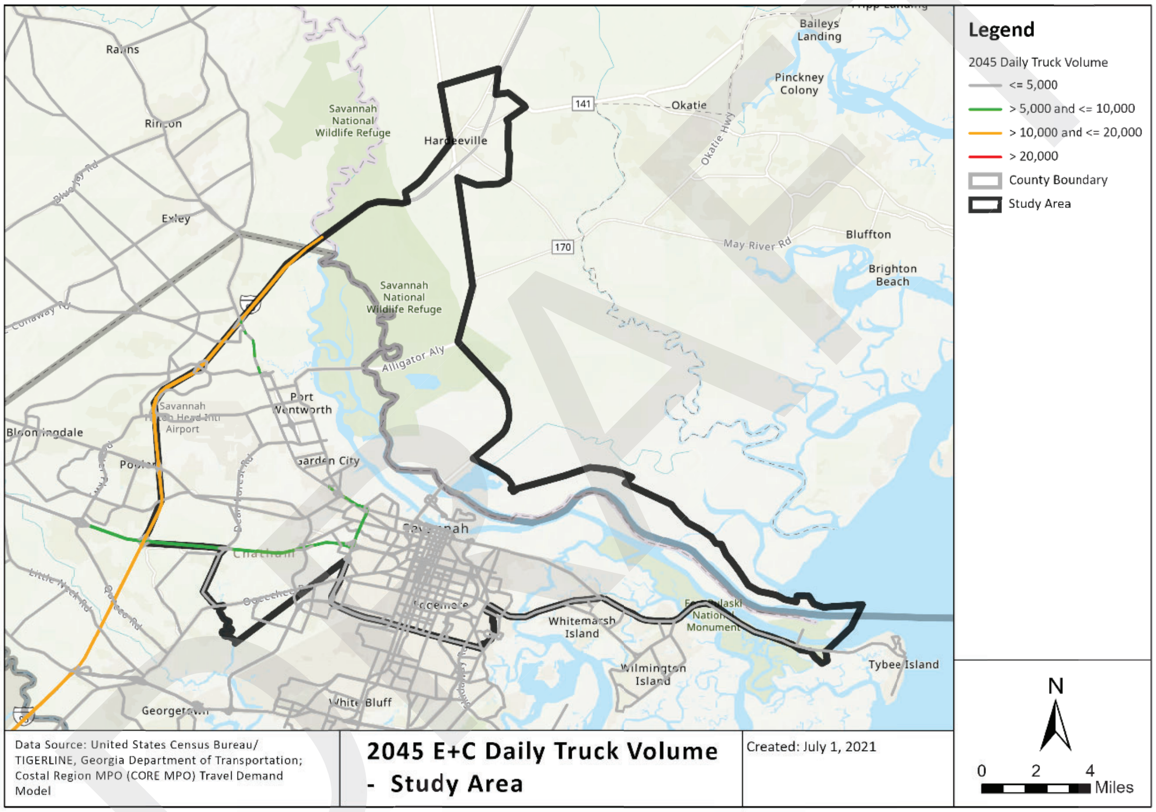


Figure 39. 2045 E+C Daily Truck Volume – CORE MPO Travel Demand Model

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.

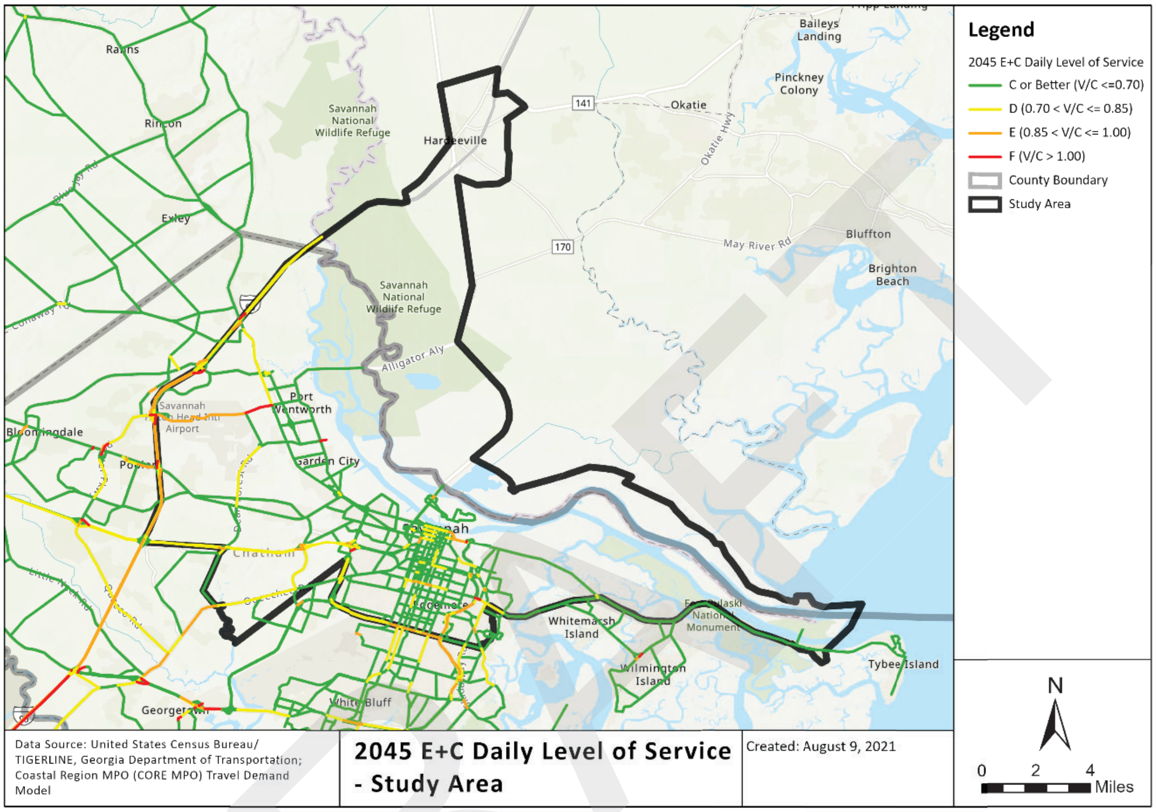


Figure 40. 2045 E+C Daily Level of Service – CORE MPO Travel Demand Model

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.

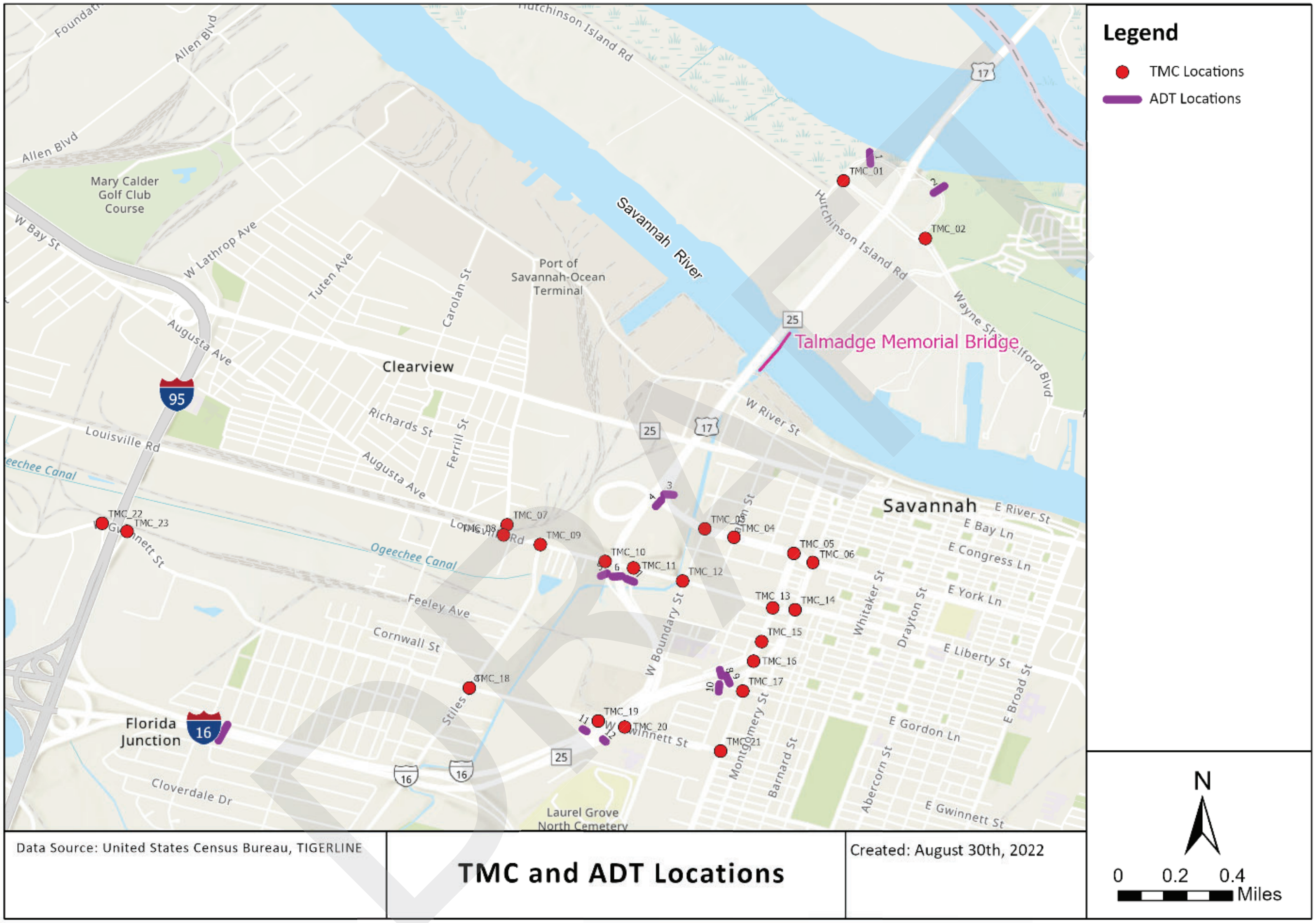


Figure 41. TMC and ADT Locations for Traffic Counts Collection

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.

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

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.

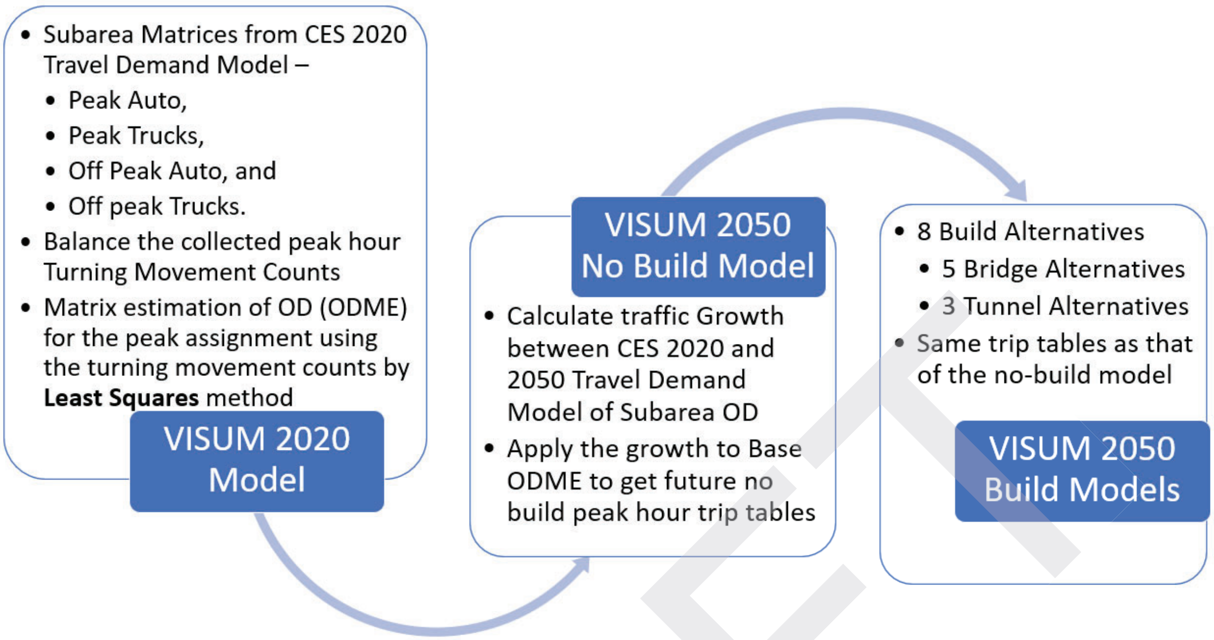


Figure 42. Flow Chart of the VISUM Model Development and Alternative Evaluation

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 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

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

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	✓					✓		✓	✓			✓		✓

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.

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

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.

Alternative Category 1
Tunnel

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.

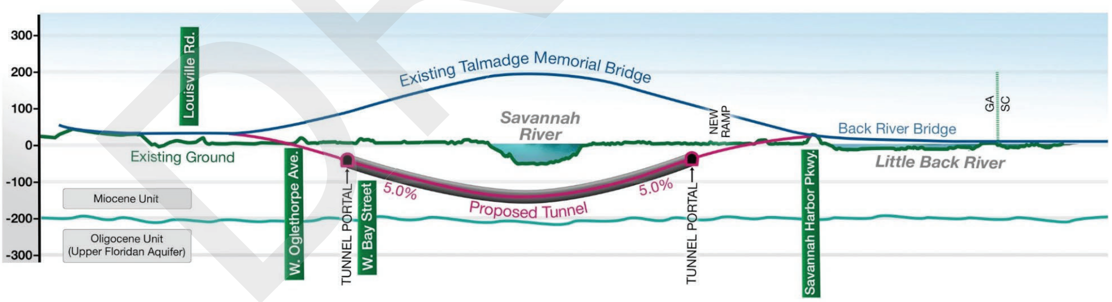
Tunnels require many life-safety considerations such as ventilation, fire suppression, emergency access and egress, and lighting. The tunnel would require an on-site operations building and has long-term operation and maintenance costs.

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

Alternative Category 1
Tunnel

SUMMARY SAVANNAH RIVER CROSSING FEASIBILITY STUDY

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

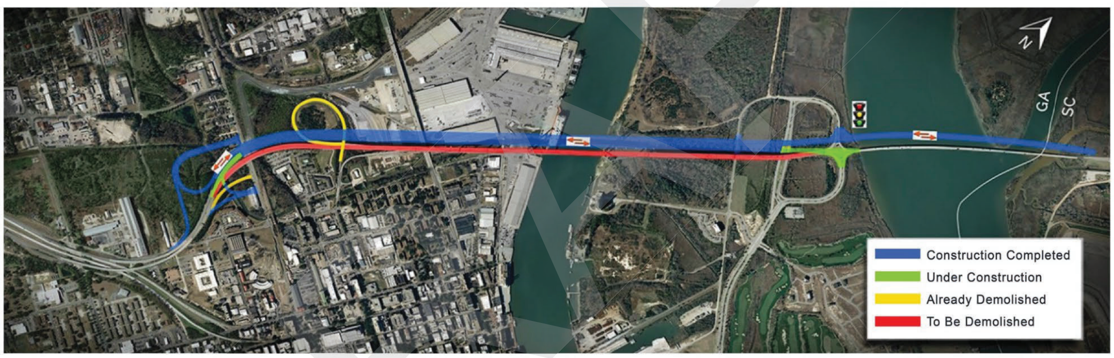
Eliminates future concerns about clearance for ships. Impacts to navigation will be minimal as tunnel construction will be under the riverbed. Demolition of the existing bridge will be the only potential for impacts.

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

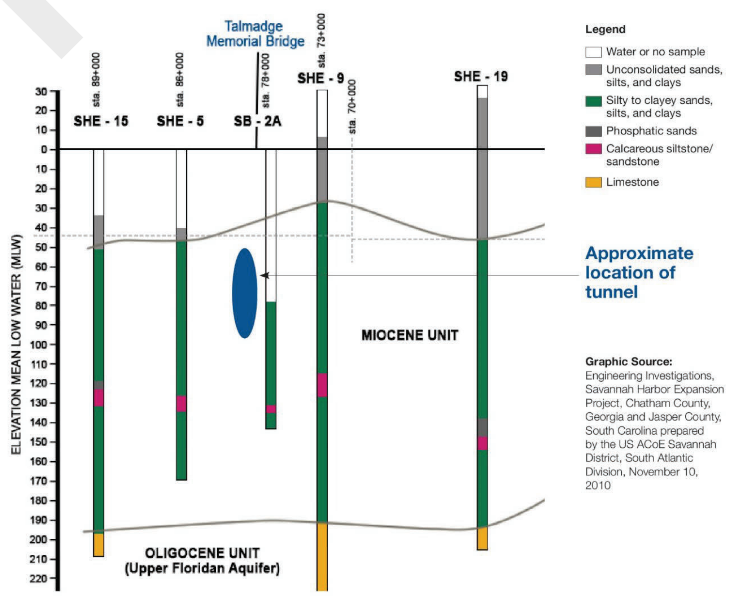
Impacts to natural, environmental, and cultural resources are likely for this alternative.

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.



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.

Alternative Category 2

New Bridge: Same Location

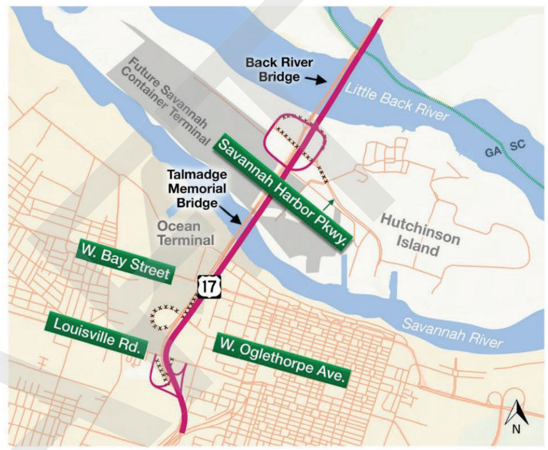
SUMMARY SAVANNAH RIVER CROSSING FEASIBILITY STUDY

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.

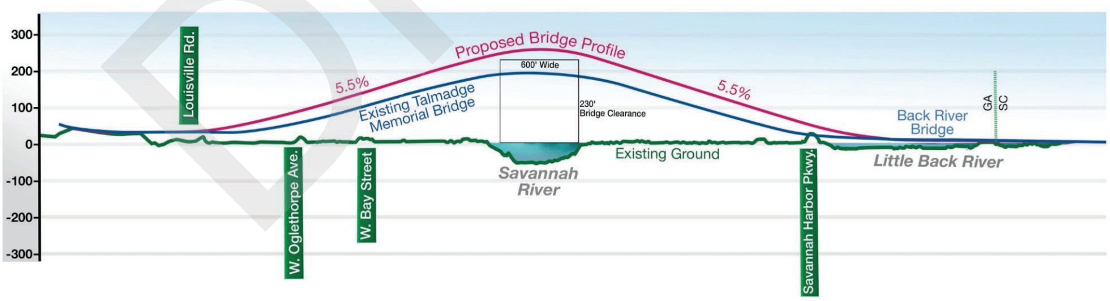
Upstream (West) Alignment

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.

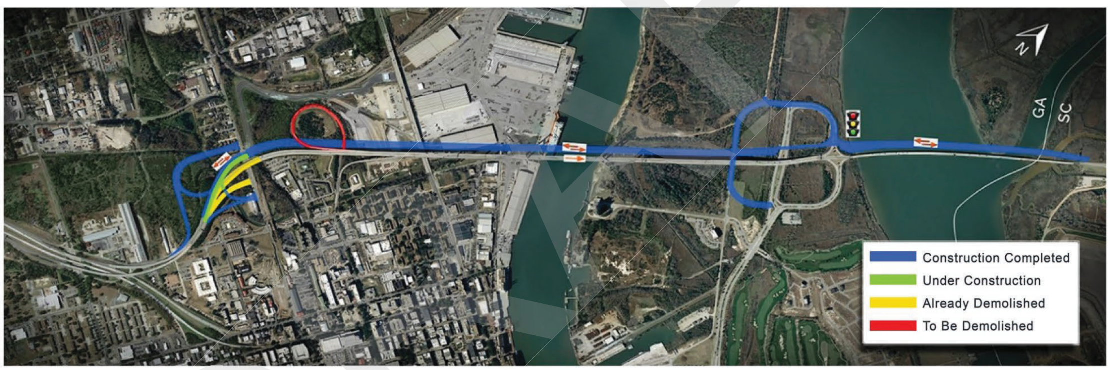
Vehicular Traffic
Can be constructed while maintaining traffic on the existing bridge and road network. Some staging of traffic will be needed, as there would be periods of time in which the lanes will be reduced to 1 in each direction and downtown access will be diverted to detours on I-16, Martin Luther 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

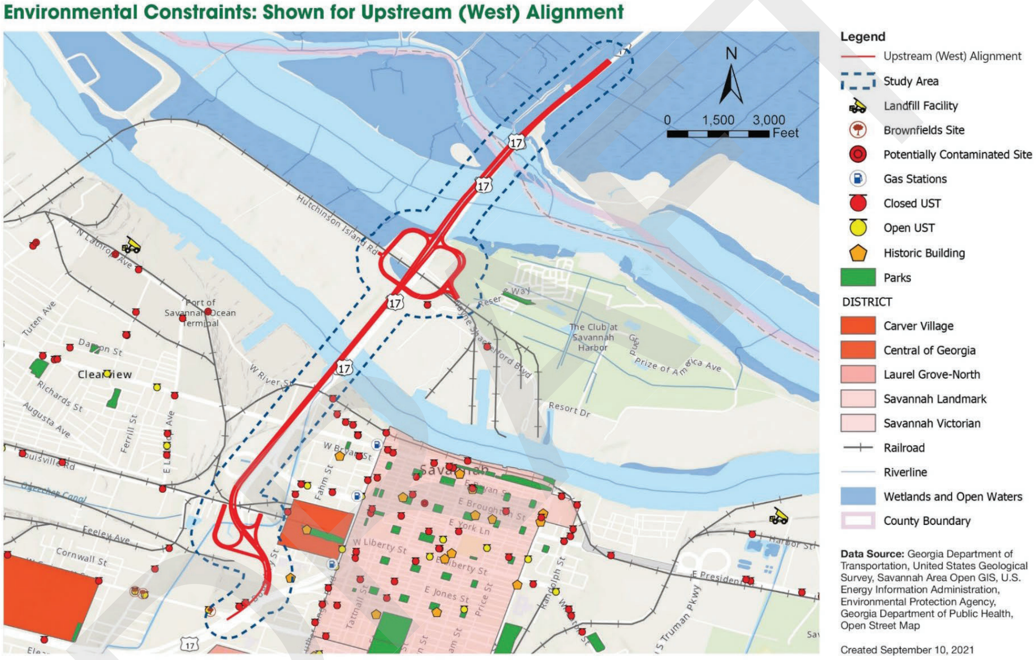
Environmental, Community, & Safety Impacts

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



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.

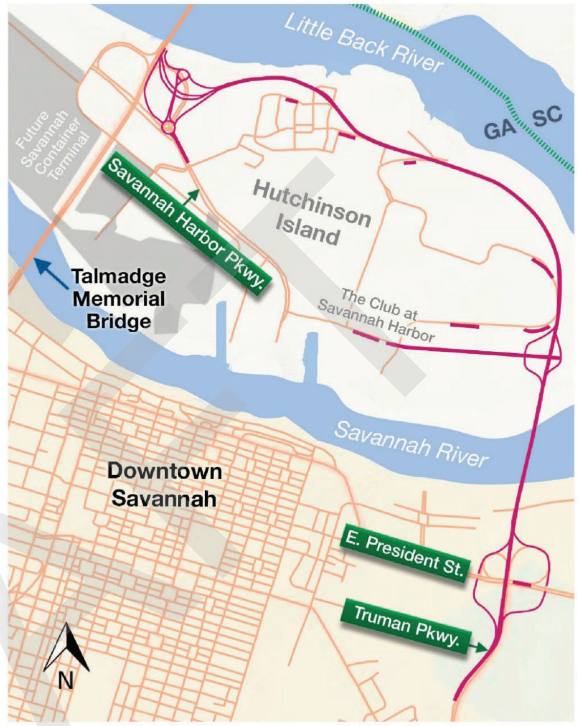
Alternative Category 3

New Bridge: Truman Parkway Extension

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.

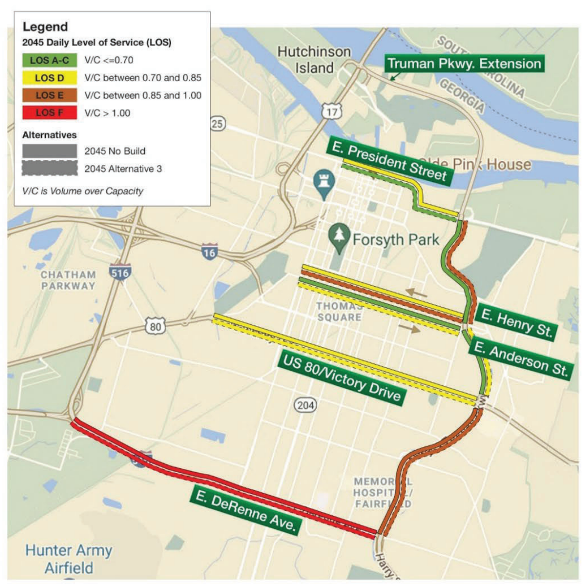
Vessel Traffic

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

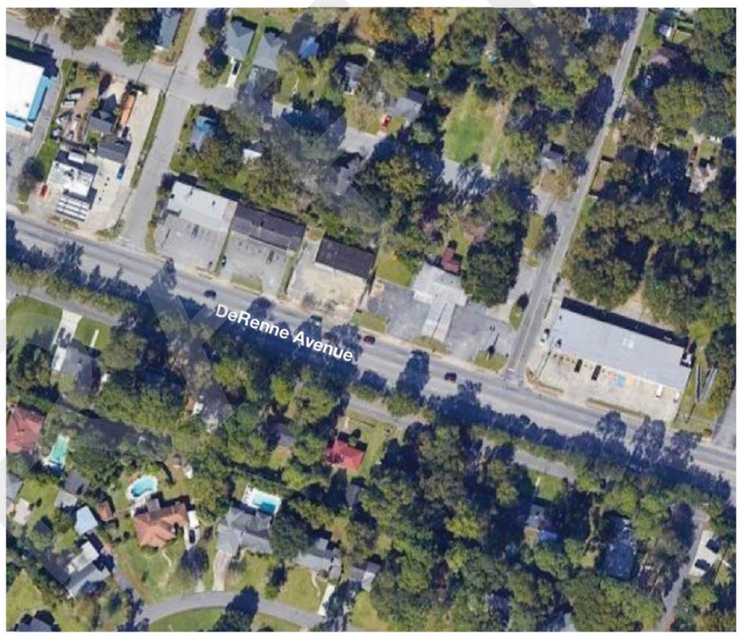
2022-2027
Environmental Documentation, Right-of-Way Acquisition, Pre-Let Development, Design-Build Procurement

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

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.

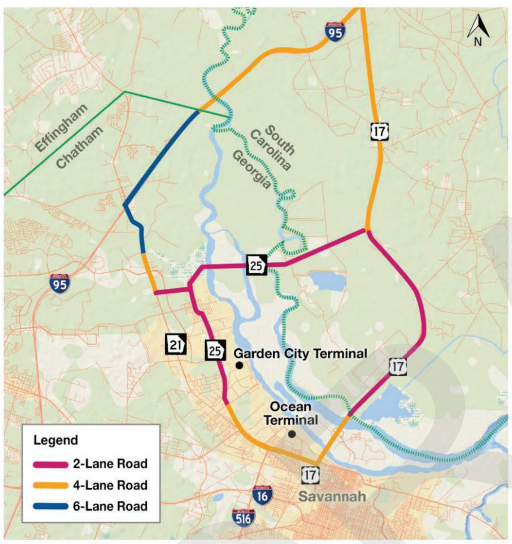
Conceptual Design

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.

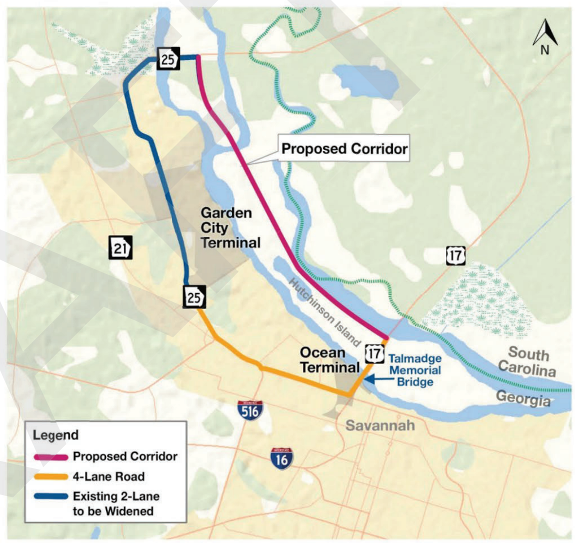
Timeline for Implementation

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

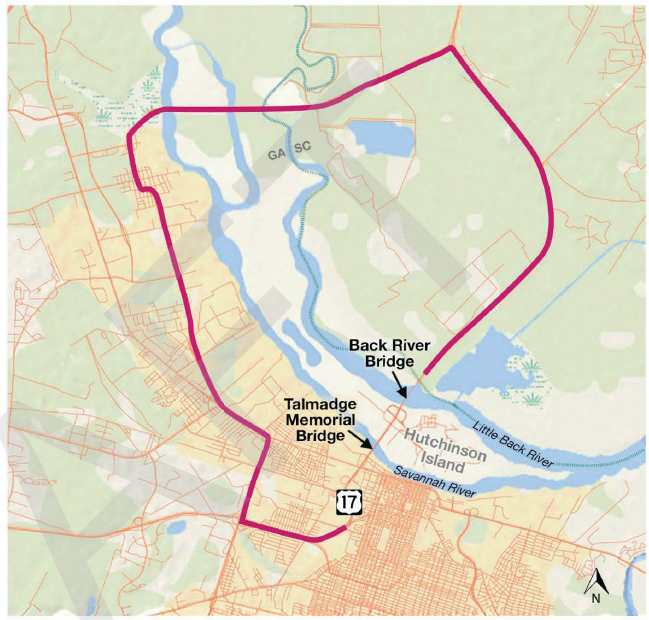
Transportation & Mobility Impacts

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.

Potential Detour Route



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.

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.

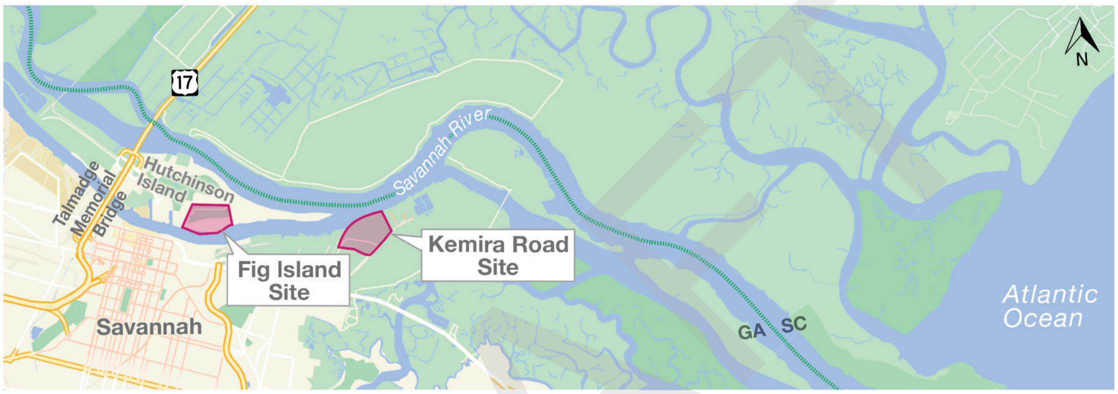
Alternative Category 6

Downriver Port Facilities

SUMMARY SAVANNAH RIVER CROSSING FEASIBILITY STUDY

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.

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.

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.

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.

Feasible Alternative

New Crossover Bridge

Alternative Overview

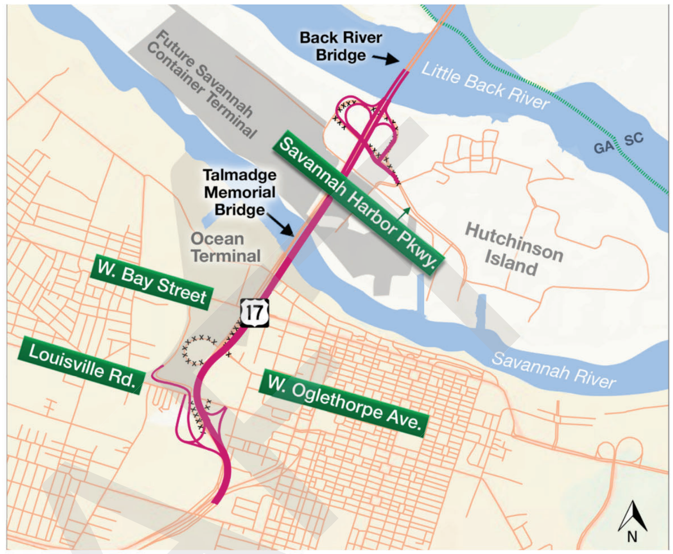
This alternative proposes a crossover bridge that combines the previously studied upstream and downstream bridge alternatives.

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.

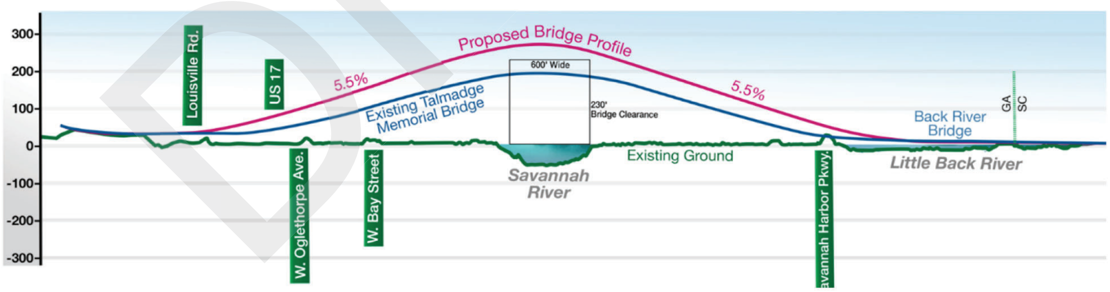
The assumed clearance envelope for the new bridge is 600 feet wide and 230 feet above Mean High Water (MHW). This results in a profile approximately 56 higher than the existing bridge.

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

Feasible Alternative

New Crossover Bridge

SUMMARY SAVANNAH RIVER CROSSING FEASIBILITY STUDY

Transportation & Mobility Impacts

The crossover bridge alternative has moderate impact to vehicular or vessel traffic during construction.

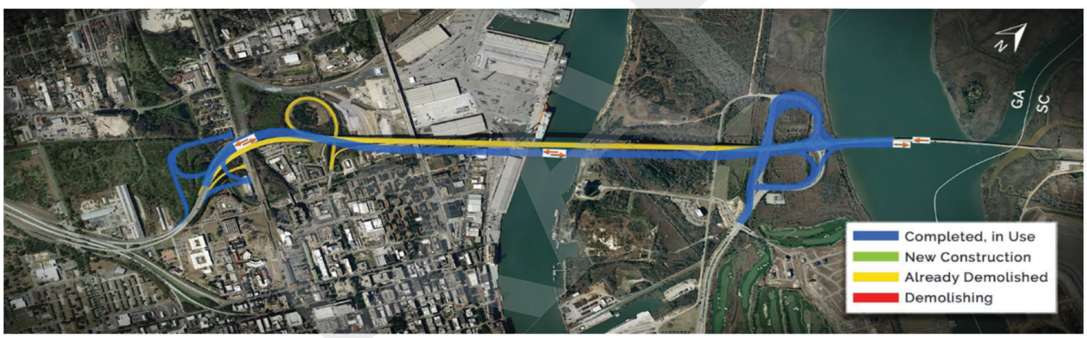
Vehicular Traffic
Can be constructed while maintaining traffic on the existing bridge and road network. Some staging of traffic will be needed, with periods of time that the lanes will be reduced to 1 in each direction and downtown access would be diverted to detours on I-16, Martin Luther King Jr. Boulevard, 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

Alternative Overview

This tunnel alternative is similar to the previously studied Alternative 1.

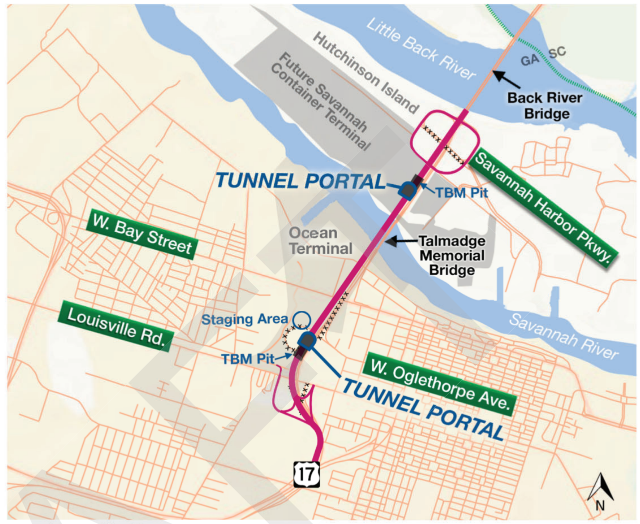
Refinements include a different vertical profile, relocated portal locations to minimize long-term operational impacts on GPA facilities, and a slight modification to curve the alignment toward the Back River Bridge in the Hutchinson Island area.

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.

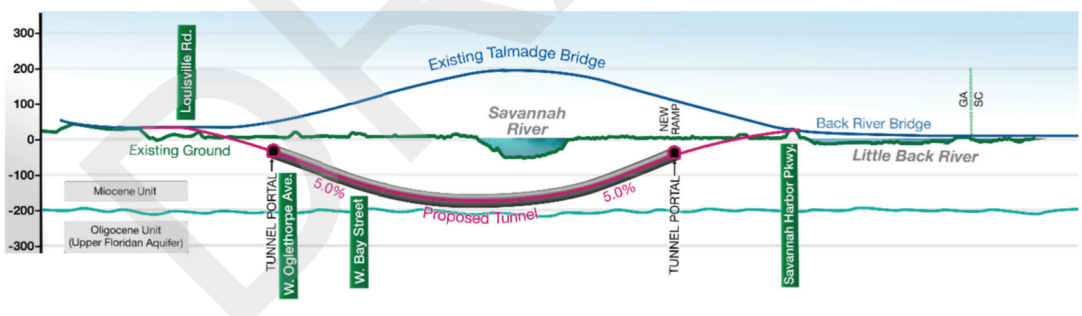
The existing bridge will be removed after construction of the new tunnel.



*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

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

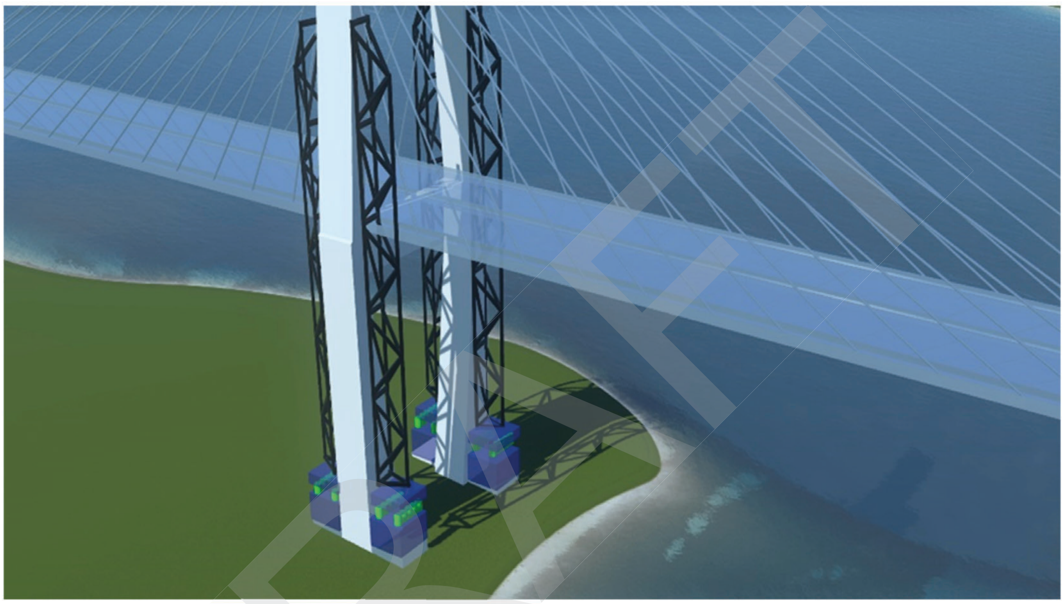
**Cost reported in current dollars. Includes allowance for PE, ROW; Final Design and Construction Oversight under a Design-Build Procurement Scenario. Also includes 40% contingency.*

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.

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.

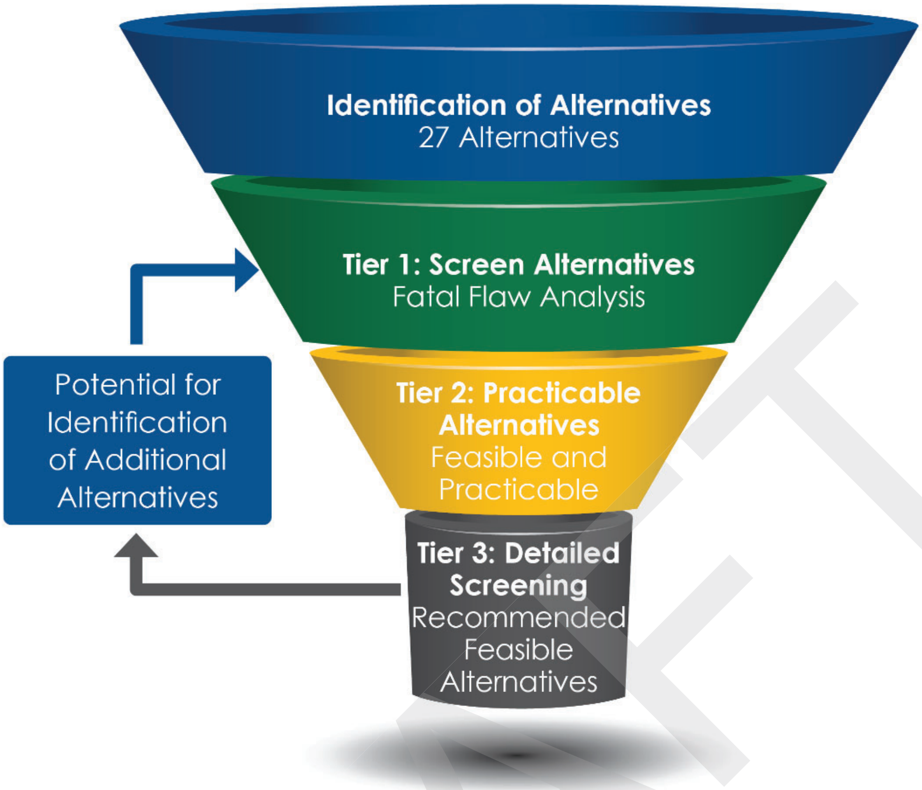


Figure 43. Alternatives Evaluation Approach

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?

- 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.

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

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.

APPENDIX

2839 Paces Ferry Road

#900

Atlanta, Georgia 30339

Tel 770 431 8666

Fax 770 435 2666

www.arcadis.com