Pier D2 Dock Extension (Project) FY 2024
**Port Infrastructure Development Program (PIDP)**
Grant Request

**Submitted to:**
U.S. Department of Transportation-Maritime
Administration

**Submitted by:**
Alabama State Port Authority (ASPA)
250 North Water Street
Mobile, AL 36602

**May 10, 2024**

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# Executive Summary

*Table 1: Executive Summary*

| Current Status/ Baseline & Problem to be Addressed | Change to Baseline | Type of Impacts | Affected Population | Economic Benefits | Summary of Results |
|---|---|---|---|---|---|
| Port of Mobile adding Berth length, mooring dolphin and strengthening to permit more and heavier break bulk cargo to be handled by water instead of truck. | Improvements on the Port to facilitate more efficient loading, unloading and storage of steel imports and exports. | Economic, Environment/Quality of Life, Competitive. | Mobile, Alabama, and vicinity. | Monetized value of reduced highway use and subjective benefits relating to lifting the economy of the historically disadvantaged Port community. | Investment Cost $5.59m ($5.09m discounted), including $1.80m ($1.68m 2022 dollars) non-federal match for a 30% match. |
| Creates very significant safety and environmental benefits. | Reduces adverse impact of lengthy transfers of steel coils from dock to warehouse. | Accident reductions. Fuel consumption savings. Social benefits of reduced air emissions. | External and regional communities are affected by air emissions, accidents, and road use. | Monetized value of reduced accidents, fuel consumption, and emissions. | $1.95 m in these categories' undiscounted benefits ($1.63m discounted) (2022 dollars) |
| Creates significant travel time, operating expense, shipper savings, and highway maintenance benefits. | Port expects to eliminate truck drayage and shorten forklift transfers. | Improves traffic flow and reduces delays and maintenance. | Less highway wear, reduced travel time, and savings for existing users. | Monetized value of competitive benefits, reduced hwy. maintenance, net consumer benefit. | $10.61m in these categories' undiscounted benefits ($7.13m discounted)<br><br>Benefit/Cost Ratio of 1.99. |

**BCA Narrative**

# 1. Summary Project Description



*Figure 1: Existing Port Handling Positions*

## a. Summary of Problem to be Solved.

Most of the steel products produced at the state-of-the-art ArcelorMittal-Nippon Steel plant (35 miles upstream from the Port of Mobile at Calvert, AL) are produced from billets barged upriver from an unloading dock on Pinto Island in the Port of Mobile. Returning barges are then used to carry coil steel products downriver to the AST Steel Warehouse on Pier D, Berth 2 (Pier D2), as indicated with the blue arrow in Figure 1.

There is a gap between dock segments at the point indicated by the yellow arrow in Figure 1 that will be addressed by this capital project. This gap prevents the mooring of barges carrying steel coils from the Calvert plant to Pier D2, which is adjacent to the AST Steel Warehouse.

As a result, barges must be located approximately 1,900 feet upstream as space permits. About 10% of the time, they must be located at Pier 2 some 2.2 miles downstream due to congestion. This results in excessive forklift and truck travel in unloading barges along with consequent excessive machine operating and labor hours and significant truck traffic on the busy stretch of port access road between Pier 2 and AST Warehouse.

This inefficiency directly affects approximately one million annual tons of export steel, and this level of activity causes significant quality of life issues, including emissions, congestion, and accidents because of the longer-than-necessary paths for forklifts used to move the steel coils from barges to warehousing and for trucks needed to dray the heavy coils over port access roads from the distant barge unloading point at Pier 2.

Additionally, imported coiled and other steel products amounting to 200,000 tons are adversely affected by the delays imposed on ships loading at Pier D2. Frequently, these import ships are diverted to neighboring Pier C and sometimes to Pier 2. In either case additional emissions, congestion, and safety issues are imposed. If normal operations could be established at Pier D2, these ships could also be accommodated at Pier D2.

Finally, the mill at Calvert, AL, is installing an Electric Arc Furnace with an annual output of 1.65 million tons, which will allow it to make a wider variety of high tensile strength and other specialty steels aimed at the international markets and particularly the USMC Trade Agreement nations. If additional steel exports are generated over the next two years, they would be likely to flow through this same supply chain as discussed above, putting additional pressure on operations.

**Proposed Improvements:**

- Extend Pier D2 by 203 linear feet downstream,
- Extend the dredge prism to conform to the newly available length,
- Install/move sheet piling, Install wooden fenders, and
- Make a continuous mooring space fully conforming to existing dock.

Investments, including engineering, require a total of $6.159 million as budgeted or $5.59 million expressed in 2022 dollars. If this, matching funding in the amount of $1.85 million ($1.68 million in 2022 dollars) will be provided by non-federal matching investment.

Service life of dock and wharfage assets is expected to exceed the 20-year discounting period provided in USDOT Guidance for enhancement- and improvement-type projects[1].  In total, the discounted 20-year costs **including capital and maintenance** are $5.13 million, discounting at 3.1%. We assume a 50% residual value at the end of the 20-year discounting period.

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[1] USDOT, Office of the Secretary, "Benefit-Cost Analysis Guidance for Discretionary Grant Programs." December 2023.

# 2.   Demographically Quantifiable Benefits Discussion

## a.   Urban or Rural Designation?

The project location lies within Census Tact 12 and is considered Rural under the 2010 Census-designated urbanized area.

## b.   Demographic Qualifier: Poverty

The census track is also located within a Persistent Poverty Tract, as indicated in the U.S. Department of Transportation Grant Project Location Verification tool. The Port of Mobile is adjacent to multiple historically disadvantaged communities. The project is in the Federally designated CDZ Opportunity Zone: 01097001200, and Empowerment Zone for Census Tract 001203 as an Urban Renewal Community. According to EPA EJScreen, the population below poverty level for this tract is 367 of 3,354.

## c.   Demographic Qualifier: Economic Equity

The project location (Census Tract 12) and the surrounding community has a per capita income in 2021 was just $27,432, well below the national average of $70,480+. At the end of 2022, the unemployment rate for Alabama was 2.8%. However, in Mobile County the unemployment rate over the same period was 5.7% which is 2.3 points higher than the U.S. average of 3.4%. In general, the unemployment rate has been historically high in the region.

The Port of Mobile is a significant employment generator, including a substantial number of minority-held jobs. Over the last decade, Black employee hours for direct ASPA employees have averaged approximately 30% of total employee hours, compared with a Mobile County population that is approximately 36% Black. Black International Longshoremen's Association (ILA) employment on the container terminal or the rail intermodal facility is even stronger. Black employee hours in the container terminal and rail intermodal facilities averaged 41% of total employee hours, compared with a Mobile County population that is approximately 36% Black.

## d.   Demographic Qualifier: Ethnicity and Race

The City of Mobile, Alabama has a population that is 41.5% White and 52.5% Black, making up 97% of the population[2]. Other races include Asian (1.8%) and those who identify as some other race (0.9%). There is 2.6% of the population who are Hispanic or Latino.

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[2] ACS 2021 5-Year Estimates

### e.      How does the Port's Business Expansion Impact Equity Issues?

The results of EPAs Environmental Justice Screening Tool (EJSCREEN) show that Census Tract 12 has the following seven categories that meet the criteria that identify it as disadvantaged: Climate change, energy, health, legacy pollution, transportation, water and wastewater, and workforce development. ASPA understands that although there is no regional or state Climate Action Plan in place, EJ communities are more vulnerable and at risk when it comes to the impacts of pollution and climate change on their health and well-being. ASPA will use the DOT's Climate Action Plan as continuous guidance throughout construction. This project will reduce the long-term emissions compared to current operations.

A large part of the Port's labor force is drawn from those demographic groups most disadvantaged by today's technology-centric and education-focused economy.  To secure a good paying job as a trucker or operations worker typically does not require higher education in the form of a completed college or graduate degree. Thus, the Port's expansion provides an excellent source of employment for those populations frequently facing a lack of sustained employment and falling into poverty.

ASPA, for many years, has maintained a policy of equal opportunity hiring from the local population and, along with that, a policy of training and promoting from within on the basis of merit. The current demographics of ASPA's labor force demonstrate that commitment.

Upon completion of construction, the Port of Mobile will have additional capacity at its piers and roadway system to continue growing its economic impact by increasing incomes for those living in the surrounding APP and HDC communities. The largest impact on near—and mid-term jobs will be directly related to the project construction contract. Any long-term benefits will be related to the increased economic output of the related businesses in the community.

# 3. Methodology for Computing Monetized Benefits

We are measuring the public and competitive benefits of diverting truck-drayed steel coil traffic from the Port's privately maintained and busy access road to on-dock maneuvering, while simultaneously shortening the distance of on-dock maneuvers by placing the point where barges are unloaded immediately adjacent to the warehouse where coils are stored until shipment.

Typically, among quantitative inputs needed to create benefit estimates for environmental quality of life, sustainability, safety, and operating cost savings are:

- Reduced truck or forklift haulage expressed as:
  - Miles traveled, tons hauled, ton-miles hauled, labor hours, etc.
- Environmental and quality of life characteristics include:
  - Gallons of fuel consumed, contaminants produced, hours driven, congestion and safety effects, etc.

## a. How did we derive transport effects for this investment?

It may be helpful to take a walking tour of the facilities to demonstrate the criticality of this relatively small but important investment. Figure 2 shows the current layout of Pier D2 and the issues surrounding barge unloading. At present, a ship occupies the area nearest the warehouse, and the crane and forklifts unloading the barges coming downriver from the steel mill in Calvert must negotiate a long-distance run to the warehouse (blue lines) among vehicle traffic on the pier access road that is open to all forms of vehicular traffic. Arrows indicate the missing dock gap.
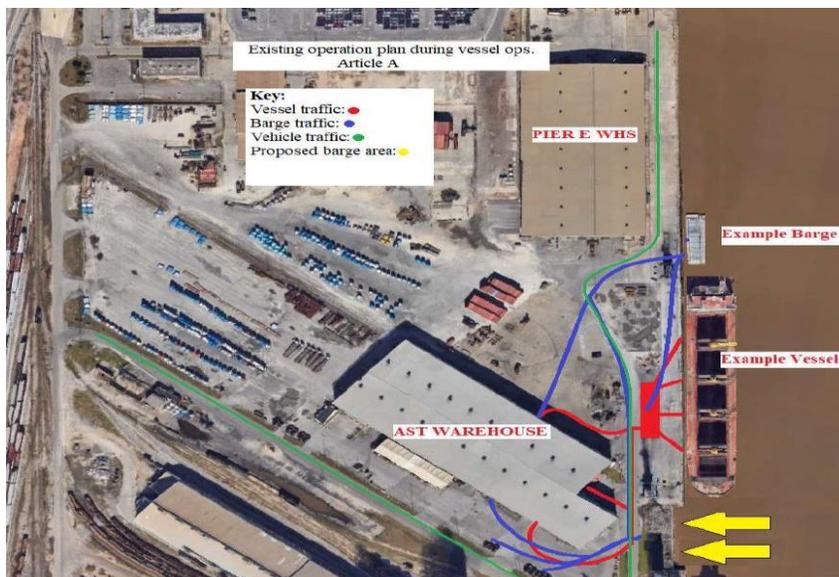


*Figure 2:Current Barge Unloading Work Scheme*

Moving away from Pier D2, we mentioned that traffic could be diverted to Pier 2 some 2.2 miles away. Not only is the distance a problem but the route includes several hairpin turns that are quite risky when executed with one or more coils positioned upright on your trailer and nine active railroad crossings. Figure 4 shows part of the lengthy and curvy route, and Figure 5 shows affected crossings.

## Project Improvements with new vessel and barge operations flows
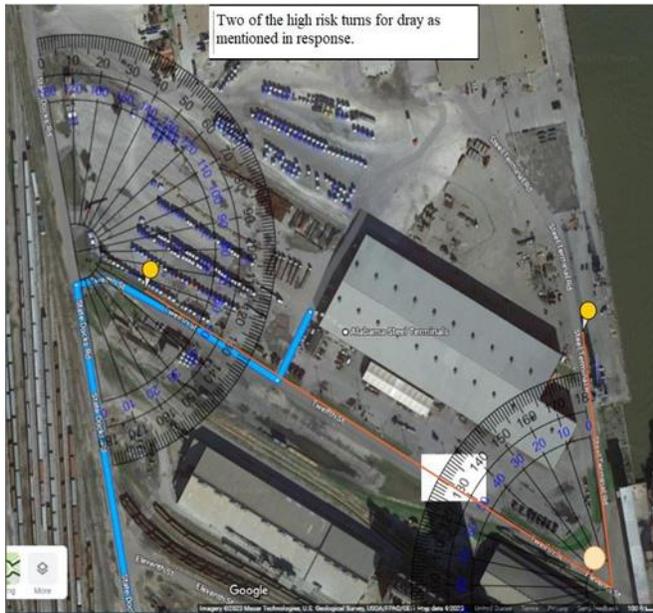


*Figure 3 Project Improvements with new vessel and barge operations flows*
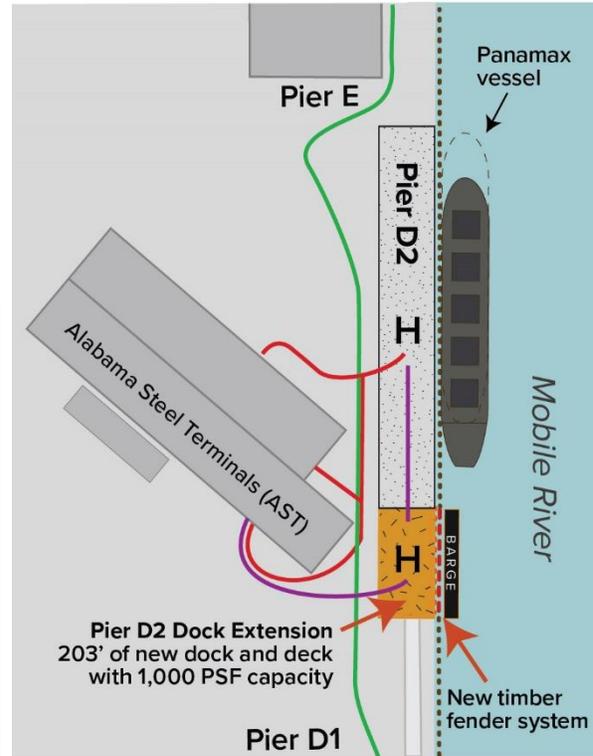
**LEGEND**
— Vessel traffic
— Barge traffic
— Steel Docks Road
▦ Dedicated Pier D2 berth space
H Mobile Harbor Crane



*Figure 4: High Risk Turns*



*Figure 5: Route Distance for Dray trucks to Pier C and Pier 2 from AST Warehouse at Pier D2*

The solution to the problem is straightforward. Refurbishing the 203 lineal feet of the dock allows the coil barges to be positioned immediately in front of the steel warehouse doors instead of a quarter of a mile distant. This reduces the distance that the forklifts travel by approximately 75% and, consequently, the amount of equipment required to maintain a safe tempo of work and the amount of work that can be performed at the dock on an annual basis.

## Effect on Exported Steel

The beneficial effects of this change on the approximately 1 million tons of steel products exported from Pier D2 are many:

- Reduces the distance traveled by the heavy forklifts (approximately 24 tons in loaded direction) along and across busy Steel Terminal Road and State Docks Road by 75%,
- This in turn reduces the possibility of personal and vehicular accidents,
- Reduces emissions because of fewer machines required for less distance, and
- Reduces roadway and dock surface wear and tear.

Because of overload conditions at Pier D2, barges must be diverted approximately 10% of the time to one of the Port's general cargo docks – usually Pier 2. The effects of eliminating the risky and inefficient dray of two 19-ton coils along State Docks Road 2.2 miles from Pier 2 are important:

- Eliminates the need for 10 dray trucks to operate continuously for five and a half hours per barge on busy State Docks Road,
- Eliminates the need to turn a heavily laden tractor-trailer around hairpin turns at the corner of State Docks Road and 12th Street and again at the entrance to the warehouse,
- Eliminates nine railroad grade crossings over busy railroad switching tracks, and
- Eliminates the need to remotely position three to four forklifts and a crane at Pier 2 for five and a half hours per barge.

## Effect on Imported Steel

Because of the slower tempo of work currently being realized at Pier D2, vessels carrying imported steel products cannot be accommodated there. This results in approximately 200,000 tons of imported products being offloaded from vessels at Pier C and drayed seven tenths of a mile to Pier D warehouse. There are two sources of savings here. First, the dray (two 12-ton coils per truck) is eliminated and replaced by forklift movements and second, the path for the

forklifts is 500 feet from alongside the ship to the warehouse, which compares favorably with the double handling that occurs if the coils are trucked from one place to another.

All these effects are quantified in Table 2 in terms of reduced miles traveled, reduced ton-miles generated, reduced machine hours operated, and reduced labor hours required for export operations, thus allowing the displaced 200,000 import tons to be accommodated more efficiently.



*Figure 6 Barge positions*

## Table 2 Matrix of No Build and Build Scenarios and Cumulative Difference (Benefits)

Table of Data and Assumptions - Pier D Improvements for Steel Cargoes

| | | Present or No Build Scenario | | | | | | | Build Scenario | | | | | Cum. Annual Difference | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Data Element Name | Quantity 1 | Quantity 2 | Quantity 3 | Cum. Annual | Comments | Location | Data Element Name | Quantity 1 | Quantity 2 | Quantity 3 | Cum. Annual | Comments | | |
| Pier D | **Vessel Calls** | 60 | | | 60 | | Pier D | **Vessel Calls** | 60 | | | 60 | | - | |
| | **Barge Calls** | 440 | | | 440 | See diverted | | **Barge Calls** | 480 | | | 480 | None diverted | 40 | added at D |
| | Coils per Barge | | 106 | | 46,640 | | | Coils per Barge | | 106 | | 50,880 | | 4,240 | added at D |
| | Tons per Coil | | 19 | | | | | Tons per Coil | | 19 | | | | - | |
| | **Cumulatrive Tons** | | | | 886,160 | | | **Cumulatrive Tons** | | | | 966,720 | | 80,560 | added at D |
| | Feet to Warehouse | 900 | 2 | 1800 | 792,000 | | | Feet to Warehouse | 300 | 2 | 600 | 288,000 | | (504,000) | (efficiency at D) |
| | Miles to Warehouse | 0.17 | 2 | 0.34 | 15,900 | | | Miles to Warehouse | 0.06 | 2 | 0.11 | 5,782 | | (10,118) | (efficiency at D) |
| | Ton Miles to Warehouse | 0.17 | 2 | 4.94 | 230,550 | 5 T Forklift | | Ton Miles to Warehouse | 0.06 | 2 | 1.65 | 83,836 | 5 T Forklift | (146,714) | (efficiency at D) |
| | **Machine Hours per Barge** | | | | | | | **Machine Hours per Barge** | | | | | | | |
| | Crane | 3.5 | 1 | 3.5 | 1,540 | | | Crane | 3.5 | 1 | 3.5 | 1,680 | | 140 | offset |
| | Fork Lift | 3.5 | 3.5 | 12.25 | 5,390 | | | Fork Lift | 3.5 | 2 | 7 | 3,360 | | (2,030) | (efficiency at D) |
| | **Labor Hours per Barge** | | | | | | | **Labor Hours per Barge** | | | | | | | |
| | Crane Operator | 3.5 | 1 | 3.5 | 1,540 | | | Crane Operator | 3.5 | 1 | 3.5 | 1,680 | | 140 | offset |
| | Fork Lift Operator | 3.5 | 3.5 | 12.25 | 5,390 | | | Fork Lift Operator | 3.5 | 2 | 7 | 3,360 | | (2,030) | (efficiency at D) |
| | Dockhands | 3.5 | 2 | 7 | 3,080 | | | Dockhands | 3.5 | 2 | 7 | 3,360 | | 280 | |
| | Vessel Loading | Doesn't change | | | | | | Vessel Loading | Doesn't change | | | | | | |
| | | | | | | | | | | | | | | | |
| **Barges Diverted to Pier 2 Account Congestion at Pier D** | | | | | | | **Barges Diverted to Pier 2 Account Congestion at Pier D Restored to D2** | | | | | | | | |
| Pier 2 | Vessel Calls | 0 | | | 0 | | Pier 2 | Vessel Calls | 0 | | | 0 | | - | |
| | **Barge Calls** | 40 | | | 40 | Total 480 | | **Barge Calls** | 0 | | | 0 | | (40) | (to D) |
| | Coils per Barge | | 106 | | 4,240 | | | Coils per Barge | | 106 | | 0 | | (4,240) | (to D) |
| | Tons per Coil | | 19 | | | | | Tons per Coil | | 19 | | | | - | |
| | **Cumulatrive Tons** | | | | 80,560 | | | **Cumulatrive Tons** | | | | 0 | | (80,560) | (to D) |
| | Feet to Warehouse | 11,510 | 2 | 23,021 | 920,832 | | | Feet to Warehouse | 11,510 | 2 | 23,021 | 0 | | (920,832) | (net saved) |
| | Miles to Warehouse | 2.18 | 2 | 4.36 | 18,486 | | | Miles to Warehouse | 2.18 | 2 | 4.36 | 0 | | (18,486) | (net saved) |
| | Ton Miles to Warehouse | 2.18 | 2 | 85.02 | 360,485 | 1 Coil + Truck | | Ton Miles to Warehouse | 2.18 | 2 | 85.02 | 0 | | (360,485) | (net saved) |
| | **Machine Hours per Barge** | | | | | | | **Machine Hours per Barge** | | | | | | | |
| | Crane | 5.5 | 1 | 5.5 | 220 | | | Crane | 5.5 | 1 | 5.5 | 0 | | (220) | (net saved) |
| | Fork Lift | 5.5 | 3.5 | 19.25 | 770 | | | Fork Lift | 5.5 | 3.5 | 19.25 | 0 | | (770) | (net saved) |
| | Dray Truck | 5.5 | 10 | 55 | 2,200 | | | Dray Truck | 5.5 | 10 | 55 | 0 | | (2,200) | (net saved) |
| | **Labor Hours per Barge** | | | | | | | **Labor Hours per Barge** | | | | | | | |
| | Crane Operator | 5.5 | 1 | 5.5 | 220 | | | Crane Operator | 5.5 | 1 | 5.5 | 0 | | (220) | (net saved) |
| | Fork Lift Operator | 5.5 | 3.5 | 19.25 | 770 | | | Fork Lift Operator | 5.5 | 3.5 | 19.25 | 0 | | (770) | (net saved) |
| | Dockhands | 5.5 | 2 | 11 | 440 | | | Dockhands | 5.5 | 2 | 11 | 0 | | (440) | (net saved) |
| | Dray Truck | 5.5 | 10 | 55 | 2,200 | | | Dray Truck | 5.5 | 10 | 55 | 0 | | (2,200) | (net saved) |
| | Vessel Loading | Doesn't change | | | | | | Vessel Loading | Doesn't change | | | | | | |
| | | | | | | | | | | | | | | | |
| **Import Steel Products Diverted to Pier 2 or C Account Congestion at Pier D** | | | | | | | **Import Steel Products if Handled at Pier D** | | | | | | | | |
| Pier C or 2 | Vessel Calls | 40 | | | 40 | | Pier D | Vessel Calls | 40 | | | 40 | | 40 | to D |
| | Tons per Vessel | 5,000 | | | 5,000 | | | Tons per Vessel | 5,000 | | | 5,000 | | 5,000 | to D |
| | Coils per Vessel | | 417 | | 16,667 | | | Coils per Vessel | | 417 | | 16,667 | | 16,667 | to D |
| | Tons per Coil | | 12 | | | | | Tons per Coil | | 12 | | | | | |
| | **Cumulatrive Tons** | | | | 200,000 | | | **Cumulatrive Tons** | | | | 200,000 | | 200,000 | to D |
| | Feet to Warehouse | 3,696 | 2 | 7,392 | 295,680 | Pier C | | Feet to Warehouse | 500.00 | 2 | 1,000 | 40,000 | to Pier D | (255,680) | (net saved) |
| | Miles to Warehouse | 0.70 | 2 | 1.40 | 23,333 | | | Miles to Warehouse | 0.09 | 2 | 0.19 | 3,157 | | (20,177) | if transfer to D |
| | Ton Miles to Warehouse | 0.70 | 2 | 30.80 | 513,333 | 2 Coil + Truck | | Ton Miles to Warehouse | 0.09 | 2 | 2.08 | 34,722 | 5 T Forklift | (478,611) | if transfer to D |
| | **Machine Hours per Vessel** | | | | | | | **Machine Hours per Vessel** | | | | | | | |
| | Crane | 12 | 0 | 0 | - | Ship's Cranes | | Crane | 12 | 0 | 0 | - | Ship's Cranes | - | |
| | Fork Lift | 12 | 3.5 | 42 | 1,680 | | | Fork Lift | 12 | 2 | 24 | 960 | | (720) | if transfer to D |
| | Dray Truck | 12 | 10 | 120 | 4,800 | | | Dray Truck | 12 | 0 | 0 | - | | (4,800) | if transfer to D |
| | **Labor Hours per Vessel** | | | | | | | **Labor Hours per Vessel** | | | | | | | |
| | Crane Operator | 12 | 0 | 0 | - | Ship's Cranes | | Crane Operator | 12 | 0 | 0 | - | Ship's Cranes | - | |
| | Fork Lift Operator | 12 | 3.5 | 42 | 1,680 | | | Fork Lift Operator | 12 | 2 | 24 | 960 | | (720) | if transfer to D |
| | Dockhands | 12 | 2 | 24 | 960 | | | Dockhands | 12 | 2 | 24 | 960 | | - | |
| | Dray Truck | 12 | 10 | 120 | 4,800 | | | Dray Truck | 12 | 0 | 0 | - | | (4,800) | if transfer to D |
| | Vessel Loading | Doesn't apply | | | | Import | | Vessel Loading | Doesn't apply | | | | Import | | |

# 4.    Benefit-Cost Analysis

A quantitative benefit-cost analysis (BCA) was performed using available information about current truck drayage practices and current and proposed water operations, USDOT guidance, and supported by documentable costs and industry research data.

This BCA is not a comprehensive measure of the project's total potential economic impact as many likely regional benefits related to increased competitiveness of Mobile area and Alabama firms and products and their employment and multiplier effects are not used in this type of analysis[3].

Identifiable future years' costs and benefits have been projected, in constant 2022 dollars, for a period extending 20 years beyond construction. Per federal guidance, the monetized value of these quantified future benefits and costs are discounted to Present Value (PV) at a discount rate of 3.1%, except for carbon emissions savings, which are discounted at 2%.

*Table 3: Benefit Cost Summary*

| Total Project Cost including O&M and Match -- PV @ 7% | $5,129,310 |
|---|---|
| Quantified Benefits--PV @ 7%: | |
| Accident Reduction | $150,984 |
| Non-Carbon Emissions Reduction | $137,891 |
| Fuel Cost Savings | $1,023,196 |
| Social Cost of Carbon @ 3% | $316,834 |
| Additional Savings: | |
| Road Wear Savings | $78,013 |
| Operating Cost Savings | $872,239 |
| Travel Time Savings | $4,740,314 |
| Savings to Existing Users | $1,496,268 |

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[3] USDOT, Office of the Secretary, "Benefit-Cost Analysis Guidance for Discretionary Grant Programs. December 2023.

| | |
|---|---|
| Truck Externalities Cost | $312,866 |
| Total Quantified Benefits | 10,110,389 |
| Benefit Cost Ratio (BCR) | 1.99 |

# 5.   Project Benefits

Quantified project benefits are estimated through 2045, 20 years after the project is fully functioning.  Benefits are projected using constant, 2022 dollars discounted at 3.1%, except for carbon emissions damage, which, per federal guidelines, is discounted at 2%. Abbreviated summaries of analysis methods and authorities are presented below. The BCA Matrix spreadsheet is provided in the Appendix and an unlocked Excel workbook containing all calculations will be provided with the grant application.

## a.   Accident Reduction

Safety benefits are calculated based on the estimated number of accidents that will be eliminated or avoided because of the Project. The accident data used for the analysis are based on experienced rates for National highways as found in Traffic Safety Facts Annual Report Tables published by the National Highway Transportation and Safety Administration.[4] Such rates were applied to avoided truck vehicle miles traveled to generate direct avoided accident cost related to reduced truck mileage. An undiscounted sample of these calculations is shown below.

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[4] Traffic Safety Facts Annual Report Tables

*Table 4: Accident Savings (partial capture of full table)*

| ACCIDENT SAVINGS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Operational Year # | Truck 100MVMT Avoided | People Killed | People Injured | PDO | Killed Cost | Injured Cost | PDO Cost |
| | | | 1.34 | 79.00 | 125.00 | $ 11,800,000 | $ 213,900 | $ 4,800 |
| | | | 100MVMT | 100MVMT | 100MVMT | Per Accident | Per Accident | Per Accident |
| | | | | | | | $136,806/Inj. | |
| 2026 | 1 | 0.0004 | 0.00 | 0.03 | 0.05 | $ 6,067 | $ 4,907 | $ 251 |
| 2027 | 2 | 0.0004 | 0.00 | 0.03 | 0.05 | $ 6,067 | $ 4,907 | $ 251 |
| 2028 | 3 | 0.0004 | 0.00 | 0.03 | 0.05 | $ 6,067 | $ 4,907 | $ 251 |
| 2029 | 4 | 0.0004 | 0.00 | 0.03 | 0.05 | $ 6,067 | $ 4,907 | $ 251 |

## b.    Fuel Consumption and Emissions Reduction

Fuel consumption drives both fuel saving and emissions effects to the extent that hundreds of lengthy dray truck trips are diverted to shorter on-dock forklift movements, which are more fuel efficient. This is contrasted with the same calculations for a heavy-duty diesel truck which in this service moves approximately 19 tons 6.2 miles per gallon of diesel.[5]

*Table 5: Fuel Savings*

| Year | Truck-Miles Saved | Reduced Truck Hours | Truck Fuel Avoided (Gallons) | Forklift Miles Saved | Forklift Hours Saved | Forklift Fuel Saved |
|---|---|---|---|---|---|---|
| | | | | | | |
| 2026 | 41,820 | 7,000 | 6,745 | 6,962 | 3,520 | 12,320 |
| 2027 | 41,820 | 7,000 | 6,745 | 6,962 | 3,520 | 12,320 |
| 2028 | 41,820 | 7,000 | 6,745 | 6,962 | 3,520 | 12,320 |
| 2029 | 41,820 | 7,000 | 6,745 | 6,962 | 3,520 | 12,320 |
| 2030 | 41,820 | 7,000 | 6,745 | 6,962 | 3,520 | 12,320 |

The savings resulting from decreased truck drayage are complemented through fuel savings by forklifts. Fuel cost savings are based on prices of $3.99 per gallon[6] for mid-grade highway diesel for both truck and forklifts.  A sample of undiscounted calculations is shown below.

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[5] https://www.bts.gov/content/combination-truck-fuel-consumption-and-travel
[6] https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_nus_w.htm.

*Table 6: Fuel Savings Calculation (partial capture undiscounted)*

| FUEL COST SAVINGS | | | | | |
|---|---|---|---|---|---|
| Year | Reduced Truck Consumption | Value: Reduced Truck Consumption | Reduced Forklift Consumption | Value: Reduced Forklift Consumption | Fuel Savings |
| | Gallons | $ 4.027 | Gallons | $ 4.027 | |
| 2026 | 6,745 | $ 27,163 | 12,320 | $ 49,613 | $ 76,775 |
| 2027 | 6,745 | $ 27,163 | 12,320 | $ 49,613 | $ 76,775 |
| 2028 | 6,745 | $ 27,163 | 12,320 | $ 49,613 | $ 76,775 |
| 2029 | 6,745 | $ 27,163 | 12,320 | $ 49,613 | $ 76,775 |
| 2030 | 6,745 | $ 27,163 | 12,320 | $ 49,613 | $ 76,775 |

Emissions reductions are estimated for carbon and for non-carbon emissions. For the purposes of calculating fuel consumption and emissions benefits, heavy-duty combination (tractor-trailer) drayage trucks are assumed.

- Export Coils: For on-dock operations we assumed that forklift operations would be truncated from 1,900 feet as presently to roughly 300 feet per coil.  Mileage and ton-mile savings for truck to on-dock substitutions are calculated based on the assumption that <u>one</u> coil averaging 19 tons in weight is driven 2.18 miles from Pier 2 to AST warehouse. We assume 100% "deadhead" or empty-return movements for this dray movement.

- Import Steel: Work time and mileage savings for truck to on-dock substitutions are calculated based on the assumption steel products averaging 24 tons per truckload (2 coils) are driven 0.7 miles from Pier C to the AST warehouse on adjoining Pier D. Here again, 100% "deadhead" or empty-return movements are assumed for this equipment. In the more efficient case, the ship simply docks at Pier D2, the dray is eliminated entirely, and some additional forklift work is substituted.

- Carbon emissions are estimated based on estimated reduction of fuel consumption using an assumed 1.6 KG of $CO_2$ per mile for heavy trucks.

*Table 7: Authorities for Emissions Quantities for Truck and Forklift.*

| Factors Applied to Emissions Analysis | | | | | |
|---|---|---|---|---|---|
| Truck fuel consumption rate (diesel) | | 0.689 | gallons/hour | https://truckingresearch.org/research/results/ATRITRBOpCosts.pdf | |
| $CO_2$ G per mile (heavy truck) | | 1667.746 | grams | https://www.epa.gov/sites/default/files/2018-03/documents/emission-factors_mar_2018_0.pdf | |
| MPG: Combination trucks (2020) | | 6.2 | | https://www.bts.gov/content/combination-truck-fuel-consumption-and-travel | |
| Avg. Miles/Day | | 164.2 | | https://www.fhwa.dot.gov/policyinformation/statistics/2020/pdf/vm1.pdf | |
| SOx | | 3.97 | lbs/1,000 gallons | https://cfpub.epa.gov/webfire/SearchEmissionFactor/factorSearch2.cfm | |
| Nox Heavy-Duty Vehicles | | 4.169 | grams/mile | https://www.bts.gov/archive/publications/national_transportation_statistics/table_04_43 | |
| PM2.5 Heavy-Duty Vehicles | | 0.106 | grams/mile | https://www.bts.gov/archive/publications/national_transportation_statistics/table_04_43 | |
| SOx | | 1,802 | grams/1,000 gallons | | |
| | | | | | |
| Fuel Cost: | Diesel/Highway | $ 3.990 | | https://www.dat.com/trendlines | |

- Unit costs for the social cost of carbon per year as presented in the 2023 BCA Guidance Table A-6, are applied to net savings in metric tons to calculate carbon-based emissions avoided.[7]

- Non-carbon emission quantities were estimated based on EPA metrics. The appropriate unit price for each type of emission was sourced from USDOT's BCA Guidance.

*Table 8: Summary of Fuel Savings and Emissions Reduction (Undiscounted)*

| | Fuel Consumption (gallons) | Carbon Tonnes | NOx Tonnes | PM Tonnes | SOX Tonnes |
|---|---|---|---|---|---|
| **Total savings over 20 years** | 381,302 | 1,512 | 4.07 | .015 | .687 |
| **Average annual savings** | 19,065 | 76 | 0.20 | 0.103 | .034 |
| **Average Annual Value of Fuel Consumption/ Emissions Savings** | $76,070 | $20,746 | $3,823 | $4,682 | $1,756 |

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[7] Social Cost of Carbon has been discounted at a 3% cost of capital, per USDOT's BCA Guidance, which has been used here.

Table 8 reflects an estimated combined Export and Import Steel cumulative reduction of fuel use of 381,302 gallons from 2026 onward. Total forecasted fuel savings and emissions reductions are summarized in the following table.

### c.    Road Wear Savings

Trucks impart significantly more wear on highway pavement and bridges than do autos. When truck traffic is shifted to water this wear is eliminated and counted as a public benefit. "The Full Cost of Intercity Highway Transportation," by David Levinson and David Gillen[8], an article that appeared in the Journal *Transport and Environment* in 1997, computed the long-run marginal cost of highway infrastructure.

We inflated the equivalent cost per mile for combination trucks to 2022 using federal gross domestic product deflator data. Levinson and Gillen came to a value of 13.2 cents per vehicle mile travelled on a composite basis. One could argue all of this drayage is on urban or semi-urban roadways and apply an even larger number based on current metrics. Since the roads are built to purpose, we concluded a 50/50 urban rural split was appropriate.

The table below also presents an alternative long-run marginal or fully costed road wear alternative cost of 13.9 cents per mile, which we used in this analysis. The reasoning is that State Docks Road and other service roads used by draymen within the Port are maintained by the Port Authority on its budget which must pay the full cost of keeping the roadways in a state of good repair.

*Table 9: Costs Authorities Used for Road Wear*

| https://www.fhwa.dot.gov/policy/hcas/addendum.cfm | | | |
|---|---|---|---|
| From Table 13. "2000 Pavement, Congestion, Crash, and Noise Costs | | | |
| for Illustrative Vehicles Under Specific Conditions." | | | |
| | | Cents Per VMT | Weighting |
| 60kip 5-axle SU Truck Rural Intersta | | 3.3 | 50% |
| 60kip 5-axle SU Truck Urban Interst | | 10.5 | 50% |
| Weighted Average | | 8.66 | |
| Inflation 2000 to 2022 | | 1.6010 | |
| 2022 Value | | 13.87 | |

### d.    Roadway Congestion/Operating Cost Savings/Travel Time Savings/External Truck Savings

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[8] https://doi.org/10.1016/S1361-9209(97)00037-0.

Vehicle operating cost savings for trucks were computed using per-mile figures from Table A-5 of USDOT's BCA Guidance. However, the component attributable to **Fuel was subtracted** to avoid double counting fuel. Travel time savings were computed using Table A-3 of the BCA Guidance. Per-hour values for commercial truck drivers were applied to truck operations and forklift operations in the analysis. DOT's BCA Guidance provides unit costs per vehicle mile traveled for external congestion, and noise. Net benefits from reduced external effects were computed for dray trucks. We assumed no *externalities* congestion, noise, or safety expense for forklift movements.

*Table 10: Operating, Travel Time, and Truck Externalities Authorities*

| Vehicle Operating Cost per Mile Guidance A-4 | $1.32 | Fuel Adjustment | -0.641 | $0.679 |
|---|---|---|---|---|
| Commercial Truck Operator Time Value/Hr. | $33.50 | | | $33.50 |
| Externalities Values per VMT: | | | | |
| Congestion | $0.22 | | | $0.22 |
| Noise | $0.02 | | | $0.02 |

## e.    Operating Cost Reduction (Competitiveness Benefits)

According to USDOT's BCA Guidance, "*The primary benefits from a proposed project will typically arise in the "market" for the transportation facility or service that the project would improve and would be experienced directly by its users*." In this case the operating cost reduction by eliminating the cost of drayage is also beneficial to the competitiveness of the export steel.

It is generally conceded that water is more economical for the shipper than truck transport if water can be employed for the same purposes. In this case, one scenario is that water transport is



2.2 miles longer in the No-Build case and the geometrically higher cost of trucking the goods back 2.2 miles to the warehouse would be eliminated.
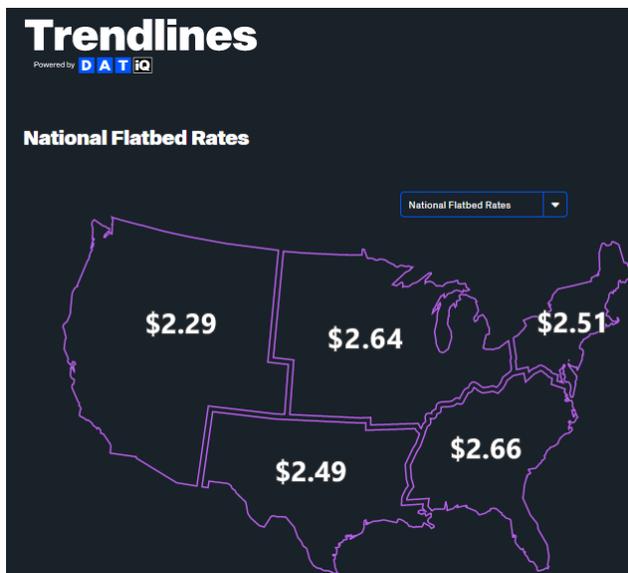
As the draymen truckers are independent operators not affiliated with the Port or Warehouse, to calculate the beneficial competitive effects for shippers and end users, we used the cost imputed for the drayage that was eliminated. This is calculated at the rate of $2.66-per-mile flatbed truck rate for the Southeast times 4.4 miles per dray, including empty backhaul, which is highlighted in Figure 7.

*Figure 7: Consumer cost savings authorities*
Source: DAT analytics April 16, 2023.

# 6.    Project Investment Costs

Project investment costs are arrayed in Table 11, show the project elements, sequence, and year of expenditure. It is anticipated that the Port will pay all project costs associated with permitting and engineering as a matching expenditure.

Capital recovery years or service life amortization years are also shown.

The BCA assumes the project investment phase will largely be executed from 2024 to 2026, while maintaining present operational continuity. and will be complete with benefits beginning in 2026.

## a.    Operations & Maintenance Costs:

The project is expected to generate discounted average $3,401 annual **incremental** maintenance costs for miscellaneous maintenance and annual dredging above those already associated with present operations.

## b.    Service Life:

In service, as contemplated here, docks have very long service lives, more than 20 years, and require only incidental maintenance and dredging. Notwithstanding, per the Guidance, a service life of 20 years is assumed here for this improvement of an existing asset.

*Table 11: Summary of Proposed Investments and O&M Expense (undiscounted 2022 dollars)*

**Build Pier D2 Extension and 20 year Maintenance Plan**

| | | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Capital Recovery Year | Budget | -4 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Discounting Year | Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| NPV of $1.00 | CapEx | 1 | 0.970 | 0.941 | 0.912 | 0.885 | 0.858 | 0.833 | 0.808 | 0.783 | 0.760 | 0.737 | 0.715 | 0.693 | 0.672 | 0.652 | 0.633 | 0.614 | 0.595 | 0.577 | 0.560 | 0.543 | 0.527 | 0.511 | 0.496 |
| Fiscal Year | Dollars | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 |
| E&P and Capiital Expenditure: | No Deflator | 9.3% | | | | | | | | | | | | | | | | | | | | | | | |
|   Engineering | 409,850 | 371,734 | | 185,867 | 185,867 | | | | | | | | | | | | | | | | | | | | |
|   Demolition | 172,500 | 156,458 | | | 156,458 | | | | | | | | | | | | | | | | | | | | |
|   Relocate Existing Ret. Wall | 908,500 | 824,010 | | | 824,010 | | | | | | | | | | | | | | | | | | | | |
|   New Structure | 3,967,500 | 3,598,523 | | | 3,598,523 | | | | | | | | | | | | | | | | | | | | |
|   Fender and Mooring | 701,500 | 636,261 | | | | 636,261 | | | | | | | | | | | | | | | | | | | |
|   Total CapEx plus E&P | 6,159,850 | 5,586,984 | - | 185,867 | 4,764,856 | 636,261 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *NPV of Initial CapEx Dollars* | | 5,085,820 | - | 174,858 | 4,347,843 | 563,119 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Dredging | | | | | | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| Dock Inspection | | | | | | | | | | 15,000 | | | | | 15,000 | | | | | 15,000 | | | | | |
| Underwater Inspection | | | | | | | | | | | | 15,000 | | | | | 15,000 | | | | | 15,000 | | | |
| Fender Replacement | | | | | | | | | | | | | | | | | | | | - | | | | | |
| Pavement Maintenance | | | | | | | | | | | | | | | 10,000 | | | | | 10,000 | | | | | |
| Annual Maintenace | | | | Build Case | | 10,000 | 10,000 | 10,000 | 10,000 | 25,000 | 10,000 | 25,000 | 10,000 | 10,000 | 35,000 | 10,000 | 25,000 | 10,000 | 10,000 | 35,000 | 10,000 | 25,000 | 10,000 | 10,000 | 10,000 |
| *Annual Mx. Deflated by 9.3% to 2022 $* | | | | | | 9,070 | 9,070 | 9,070 | 9,070 | 22,675 | 9,070 | 22,675 | 9,070 | 9,070 | 31,745 | 9,070 | 22,675 | 9,070 | 9,070 | 31,745 | 9,070 | 22,675 | 9,070 | 9,070 | 9,070 |
| **No Build or Base Case 20 year maintenance plan** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dredging | | | | | | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| Bank Stabilization Inspections | | | | | | | | | | 15,000 | | | | | 15,000 | | | | | 15,000 | | | | | 10,000 |
| Annual Maintenace | | | | Alternate No Build Case | | 10,000 | 10,000 | 10,000 | 10,000 | 25,000 | 10,000 | 10,000 | 10,000 | 10,000 | 25,000 | 10,000 | 10,000 | 10,000 | 10,000 | 25,000 | 10,000 | 10,000 | 10,000 | 10,000 | 20,000 |
| *Annual Mx. Deflated by 9.3% to 2022 $* | | | | Average | Total | 9,070 | 9,070 | 9,070 | 9,070 | 22,675 | 9,070 | 9,070 | 9,070 | 9,070 | 22,675 | 9,070 | 9,070 | 9,070 | 9,070 | 22,675 | 9,070 | 9,070 | 9,070 | 9,070 | 18,140 |
|   *Mx. Difference due to Project Total and by Year in 2022 Dollars* | | | | 3,401.25 | 68,025 | - | - | - | - | - | - | 13,605 | - | - | 9,070 | - | 13,605 | - | - | 9,070 | - | 13,605 | - | - | 9,070 |
| **Proposed Residual Value - 40 Year Life** | | 5,586,984 | | 20 Years Remaining | 2,793,492 | | | | | | | | | | | | | | | | | | | | |

# 7. Appendix. BCA Spreadsheet

Summary tables of undiscounted and discounted cash flows from investments, maintenance, and net benefits are reproduced below. Please note that user cost savings resulting from truck transport cost reductions are included as competitiveness benefits because they are directly relatable to the exported steel coils.

**Summary/BCA Matrix**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Undiscounted 2022 Project Costs | Discounted Project Costs | Undiscounted Value of User Benefits in Base Year Dollars | | | | | | | 1 | | |
| Project Year | Calendar Year | Site Work/Annual Maintenance | To Yr. of Exp. | Road Wear Savings | External Truck Cost Savings | Operating Cost Savings | Travel Time Savings | Fuel Cost Savings | Social Cost of Carbon Savings | Non-Carbon Emission Savings | Accident Savings | Competitiveness Savings to Existing Users | Increased Maintenance |
| | 2023 | $ - | | | | | | | | | | | |
| | 2024 | $ (185,867) | $ (174,858) | | | | | | | | | | |
| Constr. | 2025 | $ (4,764,856) | $ (4,347,843) | | | | | | | | | | |
| 1 | 2026 | $ (636,261) | $ (563,119) | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 18,502 | $ 9,949 | $ 11,225 | $ 111,240 | $ - |
| 2 | 2027 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 18,874 | $ 10,134 | $ 11,225 | $ 111,240 | $ - |
| 3 | 2028 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 19,113 | $ 10,299 | $ 11,225 | $ 111,240 | $ - |
| 4 | 2029 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 18,573 | $ 10,135 | $ 11,225 | $ 111,240 | $ - |
| 5 | 2030 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 18,945 | $ 10,227 | $ 11,225 | $ 111,240 | $ - |
| 6 | 2031 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 19,183 | $ 10,299 | $ 11,225 | $ 111,240 | $ - |
| 7 | 2032 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 19,480 | $ 10,299 | $ 11,225 | $ 111,240 | $ (13,605) |
| 8 | 2033 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 19,858 | $ 10,299 | $ 11,225 | $ 111,240 | $ - |
| 9 | 2034 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 20,091 | $ 10,299 | $ 11,225 | $ 111,240 | $ - |
| 10 | 2035 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 20,463 | $ 10,299 | $ 11,225 | $ 111,240 | $ (9,070) |
| 11 | 2036 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 20,766 | $ 10,299 | $ 11,225 | $ 111,240 | $ - |
| 12 | 2037 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 21,074 | $ 10,299 | $ 11,225 | $ 111,240 | $ (13,605) |
| 13 | 2038 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 21,370 | $ 10,299 | $ 11,225 | $ 111,240 | $ - |
| 14 | 2039 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 21,743 | $ 10,299 | $ 11,225 | $ 111,240 | $ - |
| 15 | 2040 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 21,981 | $ 10,299 | $ 11,225 | $ 111,240 | $ (9,070) |
| 16 | 2041 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 22,284 | $ 10,299 | $ 11,225 | $ 111,240 | $ - |
| 17 | 2042 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 22,662 | $ 10,299 | $ 11,225 | $ 111,240 | $ (13,605) |
| 18 | 2043 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 22,964 | $ 10,299 | $ 11,225 | $ 111,240 | $ - |
| 19 | 2044 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 23,342 | $ 10,299 | $ 11,225 | $ 111,240 | $ - |
| 20 | 2045 | $ - | $ - | $ 5,800 | $ 23,260 | $ 38,040 | $ 352,420 | $ 76,070 | $ 23,645 | $ 10,299 | $ 11,225 | $ 111,240 | $ 2,784,422 |
| Total | | $ (5,586,984) | $ (5,085,820) | $ 115,999 | $ 465,203 | $ 760,808 | $ 7,048,400 | $ 1,521,396 | $ 414,913 | $ 205,233 | $ 224,498 | $ 2,224,810 | $ 2,725,467 |
| | | | | | | | | | | | Total Undiscounted Benefits | | $ 15,706,727 |

ALABAMA STATE PORT AUTHORITY
BCA Narrative

**Summary Discounted**

| | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 3.1% discounted Value of User Benefits in Base Year (2021) Dollars | | | | | | | | | | Social Cost of |
| | 3.1% Discount Factor to 2022 | Road Wear Savings | External Truck Cost Savings | Operating Cost Savings | Travel Time Savings | Fuel Cost Savings | Non-Carbon Emission Savings | Accident Savings | Competitiveness Savings to Existing Users | Increased Maintenance | 2% Discount Factor to 2022 | Carbon Savings @3% |
| | 0.94 | | | | | | | | | | | |
| | 0.91 | | | | | | | | | | | |
| | 0.89 | $ 5,133 | $ 20,586 | $ 33,667 | $ 311,908 | $ 67,325 | $ 8,805 | $ 9,935 | $ 98,453 | $ - | 0.92 | $ 17,093 |
| | 0.86 | $ 4,979 | $ 19,967 | $ 32,655 | $ 302,529 | $ 65,301 | $ 8,699 | $ 9,636 | $ 95,493 | $ - | 0.91 | $ 17,095 |
| | 0.83 | $ 4,829 | $ 19,367 | $ 31,673 | $ 293,433 | $ 63,337 | $ 8,575 | $ 9,346 | $ 92,621 | $ - | 0.89 | $ 16,972 |
| | 0.81 | $ 4,684 | $ 18,785 | $ 30,721 | $ 284,610 | $ 61,433 | $ 8,185 | $ 9,065 | $ 89,836 | $ - | 0.87 | $ 16,169 |
| | 0.78 | $ 4,543 | $ 18,220 | $ 29,797 | $ 276,052 | $ 59,586 | $ 8,011 | $ 8,793 | $ 87,135 | $ - | 0.85 | $ 16,169 |
| | 0.76 | $ 4,407 | $ 17,672 | $ 28,901 | $ 267,752 | $ 57,794 | $ 7,825 | $ 8,528 | $ 84,515 | $ - | 0.84 | $ 16,052 |
| | 0.74 | $ 4,274 | $ 17,141 | $ 28,032 | $ 259,701 | $ 56,056 | $ 7,590 | $ 8,272 | $ 81,974 | $ (10,026) | 0.82 | $ 15,980 |
| | 0.71 | $ 4,146 | $ 16,625 | $ 27,189 | $ 251,892 | $ 54,371 | $ 7,361 | $ 8,023 | $ 79,509 | $ - | 0.80 | $ 15,971 |
| | 0.69 | $ 4,021 | $ 16,125 | $ 26,372 | $ 244,319 | $ 52,736 | $ 7,140 | $ 7,782 | $ 77,119 | $ - | 0.79 | $ 15,842 |
| | 0.67 | $ 3,900 | $ 15,640 | $ 25,579 | $ 236,972 | $ 51,150 | $ 6,925 | $ 7,548 | $ 74,800 | $ (6,099) | 0.77 | $ 15,819 |
| | 0.65 | $ 3,783 | $ 15,170 | $ 24,810 | $ 229,847 | $ 49,612 | $ 6,717 | $ 7,321 | $ 72,551 | $ - | 0.76 | $ 15,738 |
| | 0.63 | $ 3,669 | $ 14,714 | $ 24,064 | $ 222,936 | $ 48,121 | $ 6,515 | $ 7,101 | $ 70,369 | $ (8,606) | 0.74 | $ 15,658 |
| | 0.61 | $ 3,559 | $ 14,272 | $ 23,340 | $ 216,233 | $ 46,674 | $ 6,319 | $ 6,887 | $ 68,253 | $ - | 0.73 | $ 15,567 |
| | 0.60 | $ 3,452 | $ 13,843 | $ 22,639 | $ 209,731 | $ 45,270 | $ 6,129 | $ 6,680 | $ 66,201 | $ - | 0.71 | $ 15,528 |
| | 0.58 | $ 3,348 | $ 13,426 | $ 21,958 | $ 203,425 | $ 43,909 | $ 5,945 | $ 6,479 | $ 64,211 | $ (5,235) | 0.70 | $ 15,390 |
| | 0.56 | $ 3,247 | $ 13,023 | $ 21,298 | $ 197,309 | $ 42,589 | $ 5,766 | $ 6,284 | $ 62,280 | $ - | 0.69 | $ 15,296 |
| | 0.54 | $ 3,150 | $ 12,631 | $ 20,657 | $ 191,376 | $ 41,308 | $ 5,593 | $ 6,096 | $ 60,407 | $ (7,388) | 0.67 | $ 15,251 |
| | 0.53 | $ 3,055 | $ 12,251 | $ 20,036 | $ 185,622 | $ 40,066 | $ 5,425 | $ 5,912 | $ 58,591 | $ - | 0.66 | $ 15,151 |
| | 0.51 | $ 2,963 | $ 11,883 | $ 19,434 | $ 180,040 | $ 38,862 | $ 5,262 | $ 5,734 | $ 56,829 | $ - | 0.65 | $ 15,099 |
| | 0.50 | $ 2,874 | $ 11,526 | $ 18,849 | $ 174,627 | $ 37,693 | $ 5,103 | $ 5,562 | $ 55,121 | 1,379,703 | 0.63 | $ 14,994 |
| | | $ 78,013 | $ 312,866 | $ 511,672 | $ 4,740,314 | $ 1,023,196 | $ 137,891 | $ 150,984 | $ 1,496,268 | $ 1,342,349 | | $ 316,834 |
| | | | | | | | | TotalDiscounted Benefits @3.1% (Except for Carbon@2%) | | | | $ 10,110,389 |
| | | | | | | | | Benefit-Cost Ratio | | | | 1.99 |