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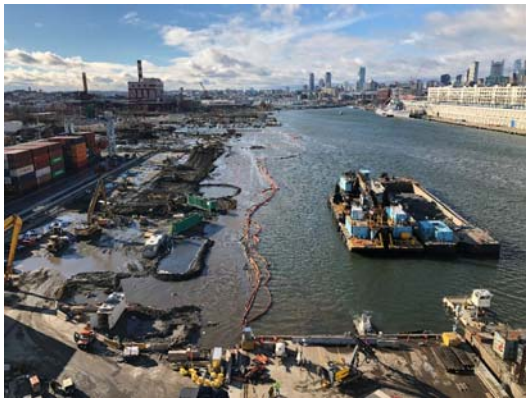
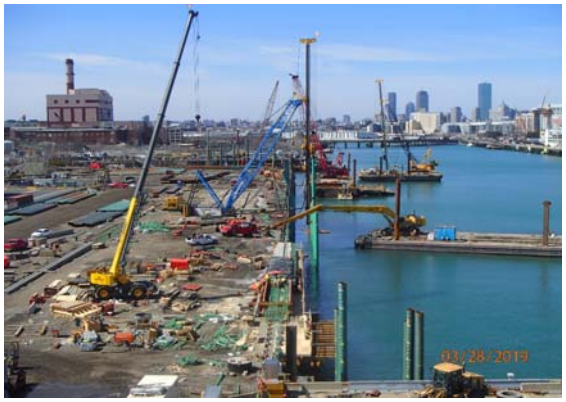
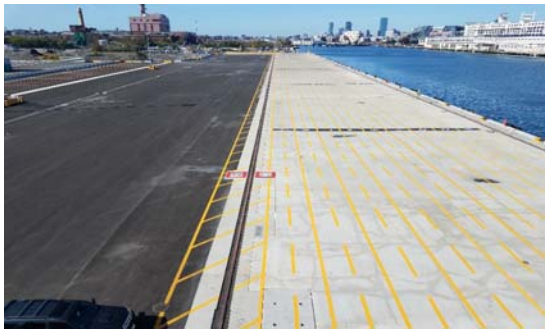
Port of Boston

Conley Terminal Modernization Program – New Berth 10 Construction

2021 Facilities Engineering Award



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June 1, 2021

Ms. Paula Gonzalez
American Association of Port Authorities
1201 Maryland Ave SW, Suite 860
Washington, D.C. 20024

Subject: **AAPA 2021 Facilities Engineering Awards**
Conley Terminal New Berth 10
Port of Boston, South Boston, MA

Dear Ms. Gonzalez,

On behalf of the Massachusetts Port Authority (Massport), I am pleased to submit the Conley Terminal New Berth 10 Project for the AAPA 2021 Facilities Engineering Award.

The Conley New Berth 10 project provides for the construction of a new 1,300 foot long deepwater berth, designed to support post-panamax vessels with draft up to -50 MLLW. Significant challenges were overcome in achieving the successful completion of this complexly phased project: the project had to be designed and constructed under the air-draft restrictions of the nearby Logan International Airport, the facility was sited along the shoreline of a contaminated former oil facility in an area of shallow bedrock, adjacent to a sensitive local residential community, and had to be constructed without impacting existing container operation at Conley Terminal and cruise operations at the Flynn Cruiseport Boston across the Reserved Channel.

The project was completed safely, on schedule (despite the project occurring during the height of the COVID-19 pandemic), below budget and with innovative design that adapted to the structural site conditions and air draft restrictions. In addition, from a resiliency and sustainability point of view, the project implemented a comprehensive soil reuse program that resulted in no export of soils while drastically reduced the import of soils necessary to complete the work.

With the successfully completion of the New Berth 10, Conley Container Terminal will be in a position to support the growth of the New England economy. I am happy to endorse this project for the prestigious AAPA 2021 Facilities Engineering Award.

Sincerely,
MASSACHUSETTS PORT AUTHORITY

Luciana Burdi, Intl. Assoc. AIA, CCM, MCPPO
Director of Capital Programs and Environmental Affairs

American Association of Port Authorities (AAPA)

2021 Facilities Engineering Awards

Conley Terminal Modernization Program
New Berth 10 Construction

June 1, 2021

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Project Description – Executive Summary

Conley Container Terminal is an important economic asset for the New England region, serving more than 2,500 businesses, including nearly 700 enterprises based in rural areas. To maintain its competitiveness, in 2014, the Massachusetts Port Authority (Massport) commenced the Conley Terminal Modernization Program, an $800 MM investment into the infrastructure of the Port of Boston. The Program included partnering with the US Army Corps of Engineers (USACE) on the dredging and deepening of the Boston Harbor, rehabilitation of two existing berths at Conley Terminal (Berths 11 and 12), expansion of Conley Terminal yard onto an adjacent property, the location of a former oil storage facility and construction of a new deep-water berth (New Berth 10 Construction).

The New Berth 10 was designed and constructed to:

- Provide 1,300 linear feet of berthing for vessels that draft up to -50 MLLW.
- Support the delivery and operation of three new low-profile ship-to-shore cranes.
- Service vessels that are up to 22 containers wide.

The project was completed 8 months before crane arrival and will finish under its $215M budget.

Massport was able to achieve these goals despite:

- Constructing and operating the new berth under air-draft restrictions of Logan International Airport,
- Constructing the new facility along the shoreline of a contaminated former oil facility,
- The presence of shallow bedrock,
- Operating adjacent to a sensitive local residential community, and
- The requirement that the project could not impact existing Maritime Operations.

Introduction - Conley Terminal

FIGURE 1: Paul W. Conley Container Terminal Aerial View

The Port of Boston is the oldest continuously active major port in the western Hemisphere. The Port of Boston handles more than 13 million metric tons of containerized and bulk cargo per year, and operations have been steadily growing. Port activities support approximately 50,000 jobs annually, contributing more than $4.6 billion to the local, regional and national economies. The 101-acre Paul W. Conley Container Terminal (Conley Terminal) in Boston, MA, operated by the Massachusetts Port Authority (Massport) is New England's only deep-water full service container terminal. Conley Terminal plays a significant role in the regional economy by moving roughly one-third of the New England cargo in and out of the market.

Conley Terminal has been facing several challenges that impact its ability to meet the needs of the rural and urban businesses that rely on its services. ***These challenges include: changes in the shipping industry, constraints to the existing port infrastructure and outdated terminal technology.*** In order to address these challenges, Massport commenced the Conley Terminal Modernization Program, an $800 MM investment into the infrastructure of the Port of Boston.

1.0 Goals and Objectives: The Conley Terminal Modernization Program

The $800 MM Program included partnering with USACE on the deepening of Boston Harbor, rehabilitation of two of the existing Berths at Conley Terminal (Berths 11 and 12), expansion of Conley Terminal onto an adjacent property, the location of a former oil storage facility, and construction of a new deep-water berth (New Berth 10 Construction). The Initiative includes the following:

Landside Projects Leveraged with Federal Funds (2016 FASTLANE Grant): These improvements, highlighted in yellow on **Figure 2**, include repairs and strengthening at Berth 11; backland and fender repairs at Berth 12, new refrigerated container storage racks; buildout of additional container storage yard, terminal technology and equipment upgrades that will expedite container processing and increase reliability for trucks transporting goods on the National Highway Freight Network; and new in-gate and exit-gate processing facilities. The overall program was estimated at $103 MM, and in 2016, Massport was awarded a $42 MM in Federal Funding through a FASTLANE Grant from the United States Maritime Administration (MARAD) of the US Department of Transportation (USDOT) to support these landside FASTLANE projects.

FIGURE 2: Existing and Plan Map

Waterside Projects Leveraged with Federal Funds (Boston Harbor Deep Draft Navigational Project): The Boston Harbor Deep Draft Navigational Project is a $350 MM investment in the deepening of the main shipping channel in Boston Harbor. The existing depth of -40 MLLW is being deepened to -47 MLLW, -51 MLLW in the Broad Sound North Entrance Channel area. Massport committed to construct two deep-water berths at Conley Terminal to a depth of -50 MLLW. To meet this commitment, Massport is strengthening and deepening the existing Berth 11 and constructing the New Berth 10.

FIGURE 3: New Berth 10 Project Location

FIGURE 4: Coastal Oil (1974)

New Berth Construction Leveraged with State Funds (New Berth 10): The New Berth 10 project involves the conversion of the shoreline of the former Coastal Oil Facility into a new, modern, deep-water berth capable of accommodating Post-Panamax vessels expected to call on the East Coast of the United States.

The Former Coastal Oil facility, located adjacent to Conley Terminal, operated for decades as a bulk oil storage facility on the Reserved Channel in Boston Harbor. Areas of concern at the facility included light non-aqueous phase liquid (LNAPL) on the surface of groundwater in multiple locations, contaminated fill which was both oil contaminated and characteristically hazardous, and a periodic sheen present at the waterline on the Reserved Channel.

The Berth 10 Construction project involves: installation of a new 1,200 foot long bulkhead along the shoreline, dredging approximately 330,000 cubic yards of material (and underwater rock blasting of approximately 10,000 cubic yards of rock) to achieve a target dredge depth of -50 MLLW, and construction of a pile supported deck. The backland area was improved with full-depth paving for container storage, installation of new utilities, installation of new Rubber Tired Gantry Crane runways, and new overhead lighting. The project also included procurement of three new low-profile ship-to-shore cranes and construction of a new substation and other new electrical infrastructure that can support the loads of the new cranes. The new pile supported deck is approximately 1,300 feet long by 108 feet wide, and is supported by 861 new 26" to

FIGURE 5: Bulkhead Installation at Coastal - 2018

30" diameter concrete filled steel pipe piles driven to bedrock (some of which were rock socketed into place). Pile spacing for the deck was 15 feet by 20 feet on center, while pile spacing for the Crane Rails were spaced 7.5 feet on center.

2.0 Discussion: New Berth 10 Construction

Background

Design and construction of the New Berth 10 involved multiple technical challenges:

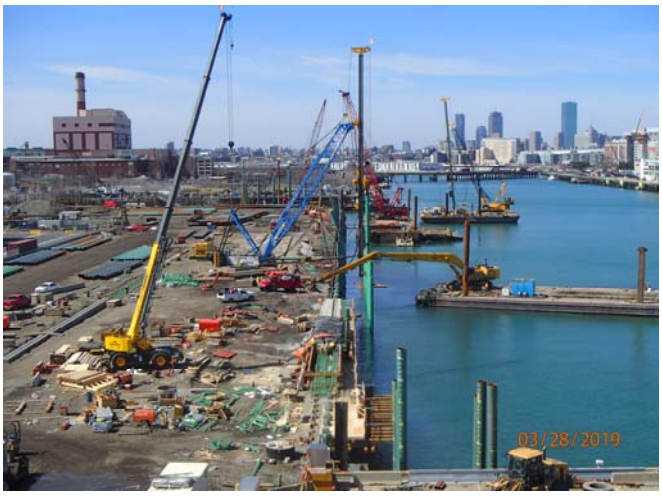

FIGURE 6: Berth 10 Construction

- Constructing and operating the new berth under air-draft restrictions of the nearby Logan International Airport,
- Constructing the new facility along the shoreline of a contaminated former oil facility,
- The presence of shallow bedrock,
- Operating adjacent to a sensitive local residential community, and
- The requirement that existing Maritime Operations could not be impacted.

Massport was able to address these challenges in the following ways:

- Avoiding air draft impacts to Boston Logan International Airport by both siting Berth 10 to the west of existing berths at Conley Terminal, in higher airspace, and by staggering crane heights.
- Designing environmental remediation measures to control oil seeps and sheens from oil contamination.

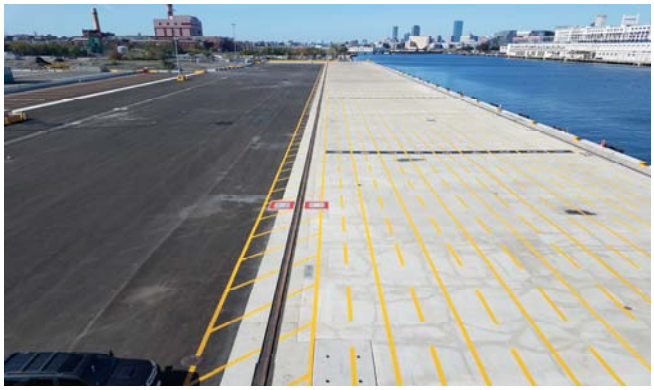

FIGURE 7: Completed Berth 10

- Designing and implementing measures to address shallow bedrock including: mechanical rock removal, an underwater rock blasting program, and a rock socketing process for a portion of the 861 waterside piles.
- Implementing a community outreach program that involved multiple meetings with local residents, local stakeholders, local businesses, and first responders.
- Contractual restrictions to minimize impacts to existing terminal operations.

Objectives and Methodology

Avoiding Air Draft Impacts From Logan International Airport

Conley Terminal is located directly across from and under the flight path of two of the main runways of Logan International Airport (4L/22R and 4R/22L). FAA regulations limit the height of obstructions within the flight paths of runways for airports.

FIGURE 8: New Cranes During Manufacturing

As part of the New Berth 10 project, low-profile ship-to-shore cranes were designed and procured. Low profile ship-to-shore container cranes (LPCs) are vital to Conley Container Terminal. LPCs servicing ultra-large container vessels are significantly heavier and more complex than conventional A-frame cranes (AFCs), and presented a myriad of challenges for Massport's crane and wharf designers. The most significant difference between LPCs and AFCs is that the LPC boom is a truss that cantilevers over the ship and shuttles horizontally rather than rotating vertically, resulting in much larger wheel loads on the landside and waterside rails (the distribution of which shifts, depending on whether the boom is extended or retracted).

It is this extra weight, the associated additional ballast needed to balance the crane, and the way the weight shifts from side to side depending on boom position that creates significant challenges associated with gantry travel, most particularly with braking activity. For this project, a specially designed braking system was created by the designers to differentially apply the brake system depending on the boom position and the direction of motion and speed of the crane.

Environmental Remediation

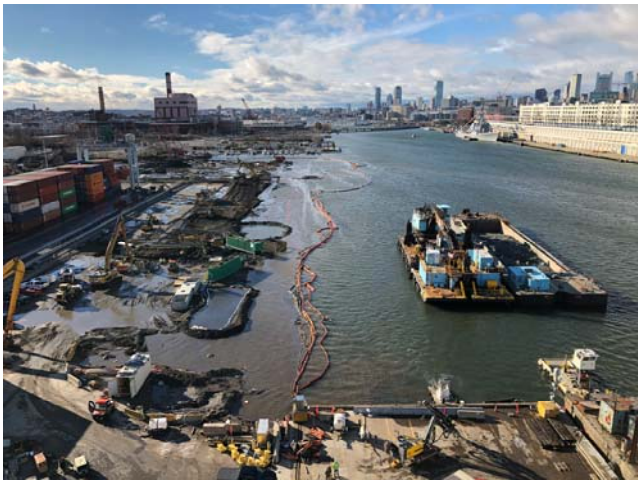

FIGURE 9: Site Containment Measures

The New Berth 10 was constructed on a facility contaminated with historic oil releases into the subsurface. Construction of the New Berth 10 helped to permanently isolate and remediate the oil contamination by installing a new king pile bulkhead, excavating/dredging contaminated soil and sediment on the waterside of the bulkhead, utilizing in-situ concrete stabilization to fix contamination in soil, improve the soil geotechnically, and to create an impermeable barrier along the shoreline, and filling an existing cove located landside of the bulkhead with the contaminated material. However, during that work, oil seeps and sheens were a constant threat, particularly during certain high tides, when almost the entire site could be flooded. A series of oil containment booms and oil absorbent booms were anchored in place around the shoreline. The result was that releases of oil into the larger harbor area were controlled during the 24-month duration of the project.

FIGURE 10: In-Situ Soil Stabilization

Measures to Address Shallow Bedrock

In order to be able to accommodate the next generation of Post-Panamax vessels, a target dredge depth of -50 MLLW was set during the deign process. The geotechnical investigation during the design phase of the project revealed extensive shallow bedrock that would have to be incorporated into the design to reach that dredge depth. To address this issue, piles along the water line were rock-socketed into the rock, a mechanical rock removal program was implemented within 50 feet of an existing structure, and an underwater blasting program was implemented for rock located within the dredge footprint. Blasting mitigation measures included down-hole vibration monitors, limits on charge sizes and peak particle accelerations, scare charges, a fish startle system, marine mammal and fish observers, and pre-construction and post-construction documentation of existing structures.

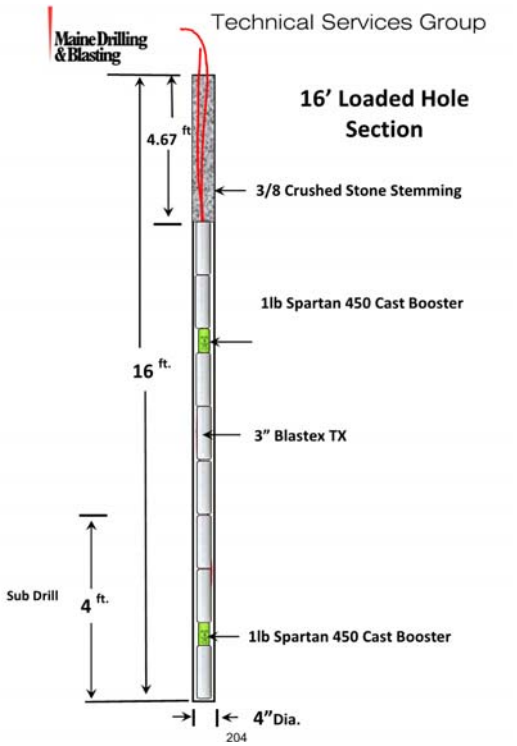

FIGURE 11: Blast Hole Design

Community Outreach

Due to the large and complicated nature of the project, and due to Massport's place in the public eye due the proximity of Conley Terminal to the nearby South Boston residential community, a significant community outreach program was critical to project success. Outreach included numerous community meetings to discuss the scope of the project, as

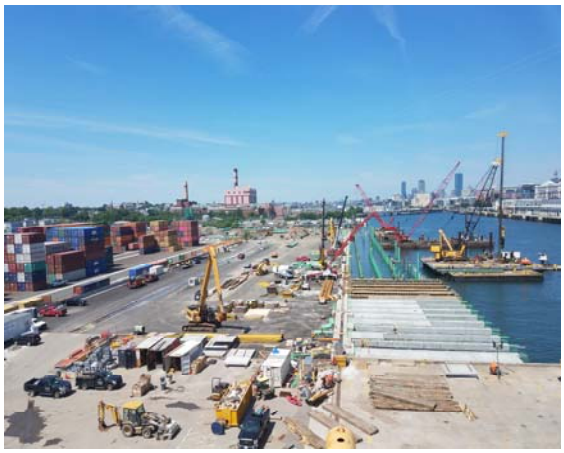

FIGURE 12: Deck Construction

well as more specific meetings with stakeholders, public safety officials, first responders, local environmental organizations, environmental regulators, and local companies to discuss the specifics of the blasting program. During the project, Massport collected air monitoring and noise monitoring data to address community concerns regarding potential air and noise pollution from the work. During the blasting program, Massport's contractor sent out daily email alerts to all interested parties informing everyone of the daily time of the blast. In addition, warning sirens informed the public of blasting times, and signs and marine details restricted marine traffic out of the blast area to ensure public safety. The overall community outreach program was a huge success, as the project had very few comments or complaints.

Contractual Restrictions to Minimize Impacts to Terminal Operations

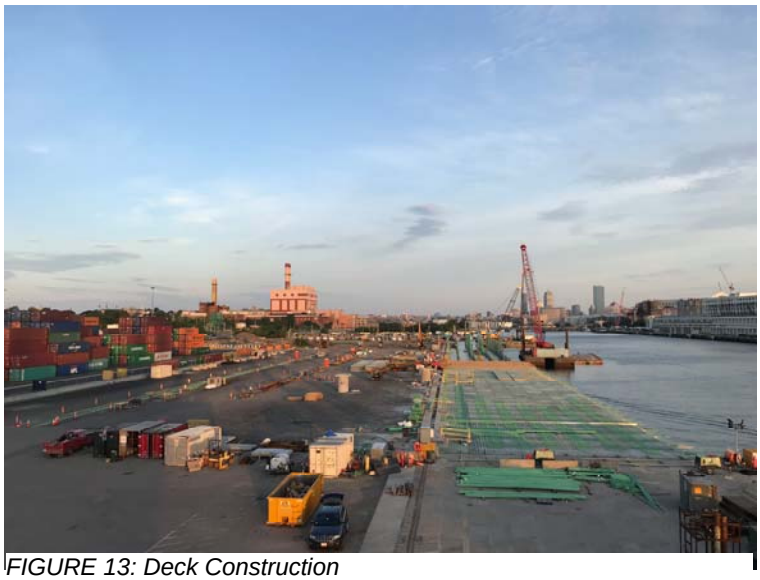

FIGURE 13: Deck Construction

One of the primary concerns of Maritime Operations when conducting such a large project at an active terminal was the risk that the project could impact ongoing container and/or cruise operations. As a result, numerous restrictions were included in the construction bid documents, including project phasing, staging, land-based and water-based deliveries of materials and equipment, to ensure minimal impacts to Conley container vessel operations and Black Falcon Cruise Terminal's cruise operations. When construction was actually ongoing, the project could then lift those restrictions as allowed by Maritime Operations, to facilitate construction where possible. As a result, there were no complaints from Maritime Operations regarding impacts to their operations during construction.

Hardware/Software Used

Conley Terminal is located along the Reserved Channel in Boston Harbor. This Channel is heavily used by both Conley Container Terminal (for container vessels) and the Black Falcon Cruise Terminal (for cruise vessels), Boston's only cruise terminal. To study the navigational impacts of the construction of the new Berth 10, Massport commissioned the creation of a full-bridge maritime simulation of Boston Harbor at the nearby Maritime Simulation Institute in Newport, Rhode Island. With the assistance of the Boston Harbor Pilots and the Boston Pilots, Massport was able to simulate real-time conditions for arriving and departing vessels and to see how the cruise and container traffic interacted in various wind, tidal, and daytime/nighttime conditions.

FIGURE 14: View Inside Simulator

FIGURE 15: Simulated Vessel At Berth 10

Project Cost

The total project budget for the New Berth 10 project is $215 million, which provides for design, permitting, berth construction and crane procurement, and Massport will finish under budget. The construction of the New Berth 10, as well as the supporting electrical infrastructure, was completed over eight months before the arrival of the new ship-to-shore cranes, the three new ship-to-shore cranes are complete, and are currently at sea, with a delivery date of late June, 2021.

FIGURE 16: Cranes Prepared for Departure

Performance Measures

- **Budget:** $215 million – the project will finish below the budget.
- **Schedule:** Finished work on the berth 8 months before arrival of cranes.
- **Safety:** Only 3 minor injuries (cuts/scratches and abrasions/bruises) and zero COVID cases throughout 24 months of heavy construction.
- **Diversity & Inclusion Initiative:** Average actual 15.2% involvement of Minority Owned Business Enterprises (MBE) and Women Owned Business Enterprises (WBE) in construction, greatly exceeded the 6% goal set for the project. Similarly, 5.9% MBE/WBE involvement in design/oversight also exceeded the 5.0% goal.

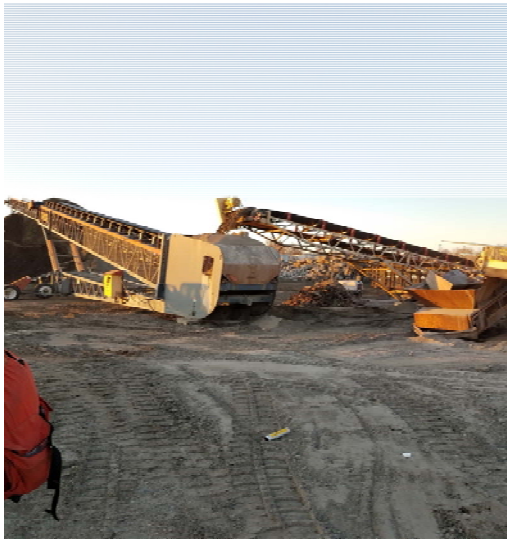

FIGURE 17: Soil Processing Operation

3.0 How the Project Fulfills the Award Criteria

The Conley Terminal Modernization Program is an $800 MM investment into the infrastructure of the Port of Boston. The Program includes partnering with the US Army Corps of Engineers (USACE) on the dredging and deepening of the Boston Harbor, rehabilitation of two existing berths at Conley Terminal (Berths 11 and 12), expansion of Conley Terminal yard onto an adjacent property, the location of a former oil storage facility and construction of a new deep-water berth (New Berth 10 Construction).

FIGURE 18: New Ship to Shore Cranes

The New Berth 10 provides 1,300 linear feet of berthing for vessels that draft up to -50 MLLW and will service vessels that are up to 22 containers wide. The project was completed 8 months before crane arrival and will finish under its budget.

2021 AAPA Facilities Engineering Awards

AAPA Award Criteria	New Berth 10 Construction
Engineering Innovation	• **Avoided** air draft impacts to Logan international Airport. • **Designed** containment measures to control sheens and seeps from oil contamination of former Oil Storage facility. • **Designed** measures to address shallow bedrock, including mechanical rock removal, underwater rock blasting, and rock socketing for piles. • **Designed** low-profile cranes to service up to 22-wide 14,000 TEU ships while staying under Logan Air Draft constraints.
Means of Contracting	• **Phased** bidding process to segregate contractor expertise. • **Utilized** contractual restrictions to prevent impacts to Operations.
Speed of Construction	• **Finished** project 8 months ahead of crane arrival **despite COVID impacts**. • **Set** aggressive milestones for contractors to stay on schedule.
Budget Success	• **Finished** under project budget of $215 million.
Exceptional Measures	• **Implemented** community outreach program that involved multiple meetings with local residents, local stakeholders, local businesses and first responders. • **Used** In-Situ Stabilization to remediate and reuse soil onsite. • **No** export of soils due to comprehensive soil reuse program. • **Only** 3 minor injuries (scratches and abrasions/bruises) and zero COVID Cases throughout 24 months of heavy construction.