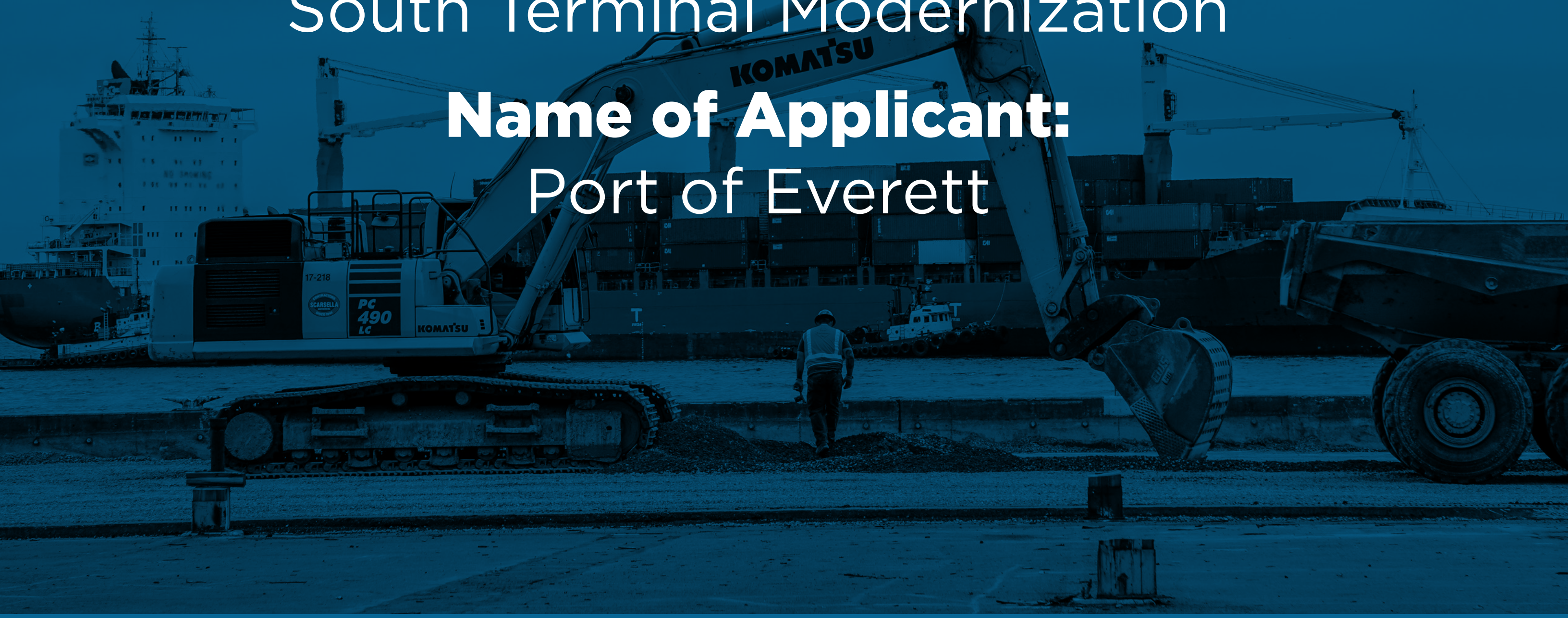
Title of Project:
South Terminal Modernization

Name of Applicant:
Port of Everett



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1. PROJECT DESCRIPTION

The Port of Everett's recently completed $57 million South Terminal Modernization project transformed an underutilized, nearly obsolete cargo handling facility into a modern-day, full-service cargo terminal. The project set out to strengthen and retrofit the 700-foot South Terminal Wharf — the largest of the Port's docks by land footprint — to accommodate industry demand bringing in larger ships and heavier cargo to Everett, including oversized aerospace containers for the new 777X.

The South Terminal dock was originally built in the 1970s by The Weyerhaeuser Company to support Everett's booming wood products era. The Port acquired the site in the 1980s to support log handling operations. In its former state, the dock could only accommodate 500 pounds per square foot (psf). This worked perfectly for log handling; however, modern cargo operations, such as the high-value and heavy cargo mix supported by the Port of Everett today, require a minimum of 1,000 psf.

This two-phase project involved a unique combination of live load deck capacity increase and crane rail addition to support heavy roll-on/roll-off (RO/RO) and containerized cargo operations at the dock, as well as support the Port's niche of moving breakbulk and project cargoes. Phase 1 broke ground in 2015 and focused on strengthening the northern most portion of the dock to create a 140-foot by 110-foot "heavylift pad" to support the Port's RO/RO operations and to accommodate the weight of the Port's mobile harbor cranes that otherwise couldn't be placed on the dock due to inadequate dock live load capacity. Completing this work allowed the Port to keep cargo operations moving while the team planned, engineered, permitted and secured financing to complete the second phase of the project to strengthen the remaining 560-feet of dock, relocate an existing warehouse, acquire and relocate two 100-foot-guage Post-Panamax container cranes from the Port of Los Angeles to the dock, and upgrade dock electrical to support future shorepower to allow ships to plug in and reduce emissions. Phase II broke ground in summer 2018, and at that time, was the largest maritime construction project taking place on the U.S. West Coast, and the largest maritime construction project to ever be undertaken in the Port of Everett's 100-year history. Earlier work also included on-dock rail upgrades, totaling $8 million to support the modernized facility. The project was completed in 2021 and has been in continuous use since.

The complexity of this project was not from any one individual element, but from combining these elements into a single project while also addressing the site's environmental constraints, project phasing and funding requirements associated with multiple grants/loans.

2. INTRODUCTION – PROJECT HIGHLIGHTS

The Port of Everett has traditionally been known in the shipping industry for handling of high-value, over-dimensional cargoes in support of the region's aerospace industry, as well as other large agriculture, military construction, forest product and energy sectors. The Port handles 100 percent of the oversized aerospace parts for The Boeing Everett Factory, including parts transported in oversized containers direct from Asia to Everett weekly. The new Boeing 777X production requires larger and heavier oversized containers, which now arrive on larger and longer vessels. Such changes made existing Port facilities less efficient. This demand from the Port's largest client, and the Port's desire to meet current and future industry demands while also diversifying cargo handling capabilities, led the Port to deliver the South Terminal Modernization project. The South Terminal Modernization project accomplished two main structural objectives:

- Increased the wharf live load capacity over the entire length of the wharf; and
- Added Post-Panamax container crane handling capability in the form of a retrofit to install 100-foot-gauge crane rail beams into the rehabilitated structure.

Although the Port's longest docks with the largest upland area, the South Terminal (see Figure 1) has been underutilized due to the limited wharf live load capacity and known structural repair needs. Significant project elements associated with the South Terminal Modernization project include the following:

- Retrofit installation to add waterside and landside crane rail beams capable of supporting container crane service loads of over 50 kips/foot;
- Double the live load capacity of the existing wharf deck to 1,000 psf;
- Under wharf repair of concrete pile caps to repair corner and soffit spalls, replace corroded reinforcing, and add cathodic protection;
- Relocation of an existing 39,600 square foot cargo transit shed off of the wharf to support newly installed on-terminal rail line;
- Electrical upgrades to power container cranes, and construction of electrical vaults and conduit to support both future mobile harbor crane outlets and vessel cold ironing to improve air quality; and,
- Acquisition, rehabilitation, and installation of two used 100-foot-gauge Post-Panamax container cranes.

Previous infrastructure projects to improve the South Terminal included $8 million in on-dock rail upgrades. These projects included extending rail spurs to the South Terminal dock and adding a new 3,300-lineal foot double rail siding along the eastern upland edge of the terminal, which parallels the BNSF mainline running adjacent to the terminal.

3. GOALS AND OBJECTIVES/BUSINESS PROBLEM

Preparing for trade of the future is the Port of Everett's standard. Over the past couple of decades, industry trends and demand has created a "big ship" shift where we are now seeing larger ships transporting more cargo. Much of this shift started before seaports were "big ship" ready. Seaports, just like the Port of Everett's, have been in a rush to modernize their facilities to accommodate the level or large ships that can be accommodated at their facility and fit their niche markets with the goal of keeping freight moving efficiently. As for the Port of Everett, this is especially critical as our facility represents the third largest container port in Washington State and is the second largest export customs district in the state (fifth on the U.S. West Coast) — representing $29 billion in annual export value.

The South Terminal Modernization project was vital in meeting these goals and objectives, and in preserving the overall functionality of our international trade facilities, specifically in their essential support to the local aerospace industry. As aforementioned, the Port of Everett's trade facilities are a key logistics link and an extension of local aerospace manufacturing, accommodating 100-percent of the oversized aerospace components for the 747, 767, 777 and 777X airplane production lines, as well as providing a backup facility to support the 787. The Port of Everett, City of Everett, Snohomish County, State of Washington and The Boeing Company came together to sign the 2008 Project Olympus Agreement to keep airplane production strong in Washington State and Snohomish County. According to the agreement South Terminal represents a critical improvement for use by The Boeing Company and other suppliers to support "just-in-time" delivery to the Boeing Everett Plant. The infrastructure deficiency precipitates the need for this investment. This agreement foresaw the need to modernize the South Terminal in the future to meet critical delivery schedules for Boeing and other aerospace suppliers as the aerospace industrial cluster in the region expanded over the next 20 to 30 years to meet global demand. Project Olympus refers to The Boeing Company's project for the siting of the manufacturing facilities for the 7E7. The agreement also provides Boeing preferential use of Everett's seaport facilities and identified the need for facility improvements to meet the future requirements of the oversized aerospace parts. Following this, the Port of Everett Commission, working through a full public process, adopted the Port's 2008 Marine Terminal Master Plan (MTMP) which laid out the business case and need for future improvements at South Terminal.

4. DISCUSSION

4.1 BACKGROUND

The South Terminal Modernization project and other components of the overall Seaport Modernization Initiative were developed to implement portions of the Port's 2008 MTMP. The MTMP desired to build upon the success the Port has had in attracting niche container and breakbulk cargoes. It chose to focus attention on the traditionally underutilized South Terminal, while maintaining current operations at adjacent shipping terminals without significant change. Relevant aspects of the MTMP included structural upgrades and expansion of the South Terminal Wharf, the addition of two new 100-foot-gauge container cranes and a second mobile harbor crane, deepening the South Terminal Wharf to accommodate Panamax and Post-Panamax vessels, and the addition of yard tracks for on-terminal rail discharge and loading.

The South Terminal Modernization project accomplished several of these goals, while the structure was designed to be compatible with future plans to deepen the berth and extend the wharf.

4.2 OBJECTIVES AND METHODOLOGY

ACQUISITION, DELIVERY AND INSTLALL OF POST PANAMAX CRANES

A key component of the South Terminal Modernization was the acquisition, installation and retrofit of two, 100-foot-gauge Post-Panamax container cranes. The Port acquired the two used gantry cranes from EverPort Terminal at the Port of Los Angeles on surplus for $1 each; transport costs came in at nearly

$6 million. In comparison, purchasing the cranes new would have cost the Port an estimated $20 million before transport costs, which made this an innovative and cost-effective approach to meet the needs of the modernized terminal.

The two cranes — weighing in at 2.4 million pounds a piece and measuring 360 feet long by 120 feet wide — arrived in Port in June 2019. They were transported fully intact with intricate sea bracing to ensure the structural integrity of the equipment. It took 10 days to load the two cranes and another 11 days for them to arrive in Everett. The Foss Maritime tug, Michele Foss, transported the cranes via barge the size of an NFL football field, logging 1,177 nautical miles from LA to Everett, encountering 12-foot seas and 50-knot winds along the way. (It was supposed to be a seven-day journey, but inclement weather and high seas delayed the trip.) Upon arrival in Everett, the elaborate sea-bracing that supported the cranes in transport was removed while on the barge, and the cranes were then off-loaded one day at a time at optimal tides so the barge would reach the wharf. The cranes were rolled over the existing strengthened portion of the dock. Each crane took approximately three hours to roll from barge to wharf while jacked up on a 320-tire hydraulic dolly. The cranes were staged in the Port's east yard while they underwent retrofitting and upgrade work until their final move to the Port's upgraded South Terminal in 2020.

UPGRADE TO ADD NEW CRANE RAILS FOR CONTAINER CRANES

In order to accommodate two used container cranes, crane rail beams and appurtenances were added along the full length of the wharf. The new crane beams (Figure 2) are supported on 24-inch diameter steel pipe piles — 160 holes were cut through the dock and over 6.5 miles of piling were driven (Figure 3). The waterside beam is approximately 7 feet tall by 9 feet wide and includes numerous large electrical vaults for container crane power, vessel shore power and mobile harbor crane plug-in. The landside crane beam was almost 5 feet wide by 7 feet tall. Both the north and south ends of the wharf included removable bull-rail segments and removable bollards to accommodate vessel ramps for RO/RO operations. Retrofit installation of crane rail beams requires extensive select demolition involving careful chipping of concrete to protect steel reinforcement to remain and create a clean surface suitable for reattachment or re-incorporation into the new structure.

Crane rails were set with the waterside crane beam rail at an elevation 6 inches higher than the landside rail to minimize regrading the upland terminal yard, while new trench drains were installed near the landside rail to maintain existing rainwater collection conditions.

The Port had initially planned to procure used container cranes from the Port of Seattle that required approximately 30 to 35 kips/foot loading for the rails. However, during initial planning the design team recognized that there was a relatively small construction cost premium based on pile and beam size to construct the crane rail beams to support an operating crane load of approximately 50 kips/foot. Designing to this increased demand provided the Port much greater flexibility to procure the vast majority of used 100-foot-gauge container cranes available on the West Coast. The Port acquired two container cranes for the site from the Port of Los Angeles, which arrived in 2019. This timeline required setting up the wharf upgrade contract with a phasing milestone to allow delivery of the cranes across the north half of the wharf approximately six months prior to overall substantial completion.

The projects contract documents left open the possibility of driving piles with either upland or marine equipment. Utilizing lighter steel piles (opposed to concrete piles) maximized the potential bidding pool of contractors by not requiring large marine equipment. The selected contractor elected to utilize an on-dock upland crane to perform pile driving, along with a second crane to simultaneously support demolition and other construction activities (Figure 3.) Using two upland cranes enabled the sequencing of multiple construction activities in a tight work area.

INCREASING WHARF LIVE LOAD CAPACITY

Crane rail upgrade projects have become more common to accommodate dramatic increases in vessel and container crane sizes over the last 15 years. The South Terminal Modernization project included substantial demolition required for new crane rails (at wharf face and bulkhead), and significant retrofit construction between the new crane rails to add intermediate bents to double the live load capacity of the entire wharf footprint. As previously noted, the South Terminal Wharf was originally constructed in the late 1970s to accommodate a live load capacity of 500 psf for handling forest products. In 2015, as part of Phase 1 of the South Terminal Modernization, the Port upgraded the northern-most 140 feet of wharf, creating a "heavylift pad" to provide a minimum footprint of increased deck capacity.

Extending the live load capacity upgrade over the remaining 560 feet of wharf was covered in Phase II of the project. New pile caps were installed at the mid-point between existing 20-foot wharf bents, requiring cutting of pile access holes in existing pre-cast deck panels and forming new concrete pile caps beneath the precast panels of the wharf structure. The new pile caps were approximately 4 feet deep and 3.5 feet wide and were supported with 18-inch steel pipe piles as shown in Figures 2 and 3. To achieve the 1,000 psf live loading criteria, the existing pile caps were also strengthened by adding additional concrete above the caps in the ballasted portion of the deck.

RETROFIT MARINE STRUCTURAL DESIGN CRITERIA

The existing concrete structure did not meet current seismic design standards and it would be cost prohibitive (and not feasible) to install the ground improvements beneath the wharf required to upgrade the structure to current standards. A comparative analysis was performed as opposed to a typical three-tiered Performance Based Design. The comparative wharf lateral analysis approach evaluated seismic performance of the wharf before and after construction, including slope stability, inertial response, and combined inertial/kinematic performance. Comparative analysis utilized methodologies from *ASCE 61-14: Seismic Design of Piers and Wharves* and required agency education to streamline the permitting review since city review staff were not familiar with wharf design methodologies. Innovative Fast Lagrangian Analysis of Continua (FLAC) modeling techniques, requiring iterative structural/geotechnical design interaction, were utilized to evaluate alternating existing concrete and new intermediate steel pile bents in a two-dimensional FLAC model.

Structural analysis was generally performed with the two objectives described below:

- The first objective was to summarize the anticipated overall seismic performance of both the existing and upgraded wharf configurations with respect to maintaining life safety. The objective was to determine the approximate level of ground shaking (including 72, 94, 144, 224 and 475-year return periods) that the structure can withstand prior to jeopardizing life safety.

- The second objective was to ensure a "do no harm" approach and illustrate that the upgraded wharf performs equally well or better than the existing wharf configuration. Analysis was performed to illustrate that despite adding mass to the existing structure (due to new crane beams/pile caps, as well as new container crane dead loads), the overall performance of the upgraded structure would not be worse than the existing configuration.

Analysis showed the current structure was sufficient for a 72-year return period seismic event. Therefore, subsequent seismic analysis focused on the difference in response between the current configuration and the upgraded configuration for 72-year through 224-year return period ground motions. Structural analysis illustrated an increased life safety event level from a 72-year to 144-year return period. The analysis also revealed that all factors of safety increased for the upgraded configuration for limit-equilibrium slope stability.

Another challenge of the design was the fact that initial geotechnical explorations revealed significant differences between the north and south ends of the 700-foot-long wharf in terms of the presence of soil units with liquefaction potential (for 72, 144 and 475-year Hazard Levels). The initial northern-most boring showed significant liquefiable layers that did not appear in the southern explorations. This led the project to perform additional borings to reduce uncertainty and better determine the extents of the liquefiable soil units of concern between the original boring locations. Approximations of these soil units with high liquefaction potential (ESU 5 and ESU6) are highlighted in the generalized geotechnical cross-section provided in Figure 4. The ESU 5 layer was classified as very soft, very sandy silt and ESU6 was loose to medium dense silty sand.

UNDER DOCK PILE CAP REPAIR

Conditions assessments on the nearly 45-year-old wharf in 2009 had revealed that the under wharf concrete pile caps had sections of significant deterioration along the lower corners and soffit. Since the South Terminal Modernization was going to require under dock scaffolding for workers to access the new pile cap bents (to install formwork/reinforcing), there was financial value in performing the repairs to the existing pile caps during the work. The design team carried out a detailed inspection of the existing piles and associated concrete superstructure over the length of the wharf, including Level I and Level II inspection as outlined in the *ASCE Manuals and Reports on Engineering Practice No. 130 (MOP 130); Waterfront Facilities Inspection and Assessment*. Generally, the condition of the existing concrete piles for the wharf were good; however, the condition of the concrete pile caps beneath the wharf showed extensive longitudinal/horizontal corrosion cracking, areas of spalling, exposed reinforcing steel, rust bleeding and cracking with efflorescence.

Repair focused on the deteriorated areas of concrete on the bottom of the existing pile cap soffits, with work including removing and disposing of all deteriorated and unsound concrete, cleaning rust and scale from exposed reinforcement, potential replacement of reinforcing bars, installation of cathodic anodes, and replacing removed concrete using cementitious repair mortar (Figure 5).

Detailed photograph logs were created for all surfaces of the pile caps during the inspections. Then structural engineers created plans for anticipated repair areas based on field observations. To accommodate inherent uncertainty in estimating actual deterioration/repair quantities during design, the bid documents were set up with unit prices to quantify volume of concrete removed/replaced (in cubic feet) and weight of new replaced reinforcement and couplings (in pounds). The bid quantities included in the bid form were increased above those repair areas calculated during design, to account for the likelihood that actual limits of unsound concrete and deteriorated reinforcement observed in the field would be greater. The contractor was required to mark the anticipated repair limits in the field and then determine actual repair perimeters by hammer sounding for subsurface delamination or unsound concrete.

ELECTRIFICATION & AIR QUALITY

The project also included electrification elements based on environmental benefits associated with air quality. Besides electrical power required for two 4 kV container cranes, the wharf was outfitted with conduits/vaults for future mobile harbor crane outlets and vessel shorepower. This required a new 15 kV electrical service from Snohomish County Public Utility District (SnoPUD). SnoPUD had an existing power pole and vault located just outside the South Terminal, as well as spare conduit capacity routed beneath the existing rail lines and into the terminal. The utility provided a 15kV switch and metering equipment that would be located just inside the terminal, while the Port was responsible for a separate adjacent switch to demark transition to Port service. The Port service continued via ductbanks across the terminal to the wharf substation area, located near the south end of the upgraded South Terminal Wharf.

The Port ductbanks were routed across the terminal and constructed in a unique single row, 6-conduit-wide configuration (rather than stacking 4-inch-diameter conduits within the encased ductbank) to minimize excavation depths. From past upland construction, the Port was aware that demolition debris from many of the former Weyerhaeuser buildings had been left in place and buried when the site was filled to become a log handling yard. By limiting the ductbank excavation to less than 42 inches deep, the contractor was able to avoid the majority of buried concrete debris that was difficult to remove.

The wharf substation occupies a footprint area of approximately 35 feet by 45 feet. The substation includes transformers (both 4 kV and 480V), crane power switchgear and other protective equipment including neutral grounding resistors and isolating load break switches. When balancing grant requirements and priorities of the overall program, it was elected to defer installation of the equipment/cabling for existing mobile harbor cranes and future vessel shorepower. Area was set aside within the wharf substation footprint for future installation of switchgear for those services, while only empty conduits required for that work were installed to the wharf (including casting conduits and vaults into the concrete wharf structure).

TIMBER TRANSIT SHED BUILDING RELOCATION

One unique element of the overall program was the need to move an existing timber cargo transit shed that was built in the 1970s by Weyerhaeuser for log handling. The 39,600 square foot covered shed had under roof footprint dimensions of 264 feet by 150 feet. The shed was supported by timber columns and had long been used by the Port for maintenance of terminal container handling equipment as well as additional covered storage. The foundation for the shed's west wall was the wharf bulkhead, with a 25-foot roof overhang extending over the existing wharf footprint. The building had to be removed to install the landside crane rail beam for the South Terminal Modernization project.

The original program planned to demolish the existing shed and construct a new building structure to house these terminal maintenance functions. The design team initially performed a programming and alternative analysis study that included replacement options ranging from a new pre-fabricated metal building to an open canvas hoop building structure. The process highlighted that the Seaport Modernization budget was likely only able to support construction of a new enclosed building of approximately 20 to 25 percent the size of the existing transit shed footprint. The preferred alternative became to relocate the existing transit shed to a new location approximately 1,200 linear feet to the northeast, adjacent to a recently installed on-terminal railroad track (Figure 6). The selected new footprint allowed the shed roof overhang to be located over the rail to facilitate dry covered material transfer from rail cars.

The Port advertised for a procurement contract for large move contractors to relocate the shed building. The move contractor cut the timber columns from the footings and provided horizontal W12 steel structural beams with 70-ton off-road hydraulic dollies (Figure 7). Diagonal bracing for the columns was utilized to maintain the structural integrity of the timber structure during the move, until it could be permanently placed in its final location. The building move contract included a temporary staging requirement to remove the building out of the Modernization contract work area before the new building footprint site was prepared (see Figure 6).

A separate Cargo Transit Shed site preparation contract was advertised that included concrete foundations for the relocated structure, timber shear walls and superstructure upgrades, relocation of a modular restroom building, new electrical service, relocation of an existing 8-inch watermain (from beneath the proposed building footprint), refurbishment of the existing fire protection sprinkler system and a new sanitary sewer lift station/forcemain. Once the foundations were prepared, coordination between the two separate contracts required the building move Contractor to position the building over the new footprint and lower it onto the concrete plinths (Figure 7). New structural upgrade work required to meet current building codes included the following:

- Additional shear walls;
- Raised concrete plinths at each column (to provide minimum vertical clearance over the adjacent rail track and further protect timber columns for forklift/equipment impact);
- Roof purlin connection reinforcement upgrades to accommodate current wind uplift requirements; and

- Concrete tie-beams between individual column footings due to site soil geotechnical classification per International Building Code (IBC) requirements.

4.3 HARDWARE/SOFTWARE USED

The finite element analysis program SAP 2000 was utilized in structural design for the wharf upgrade to perform non-linear performance based seismic analysis and design. In addition, time history analysis was performed in PLAXIS to account for lateral under-wharf slope movement and its subsequent impact on the wharf upgrades, L-Pile was utilized to analyze geotechnical pile performance and X-Tract was utilized to evaluate non-linear structural pile ductility.

4.4 PROJECT COST

The two-phase project came in just over $57 million. It was supported by dozens of businesses, educational institutions and public agencies in our region, and was made possible and a big portion of project cost offset thanks to $22 million in various Department of Transportation grants and loans, including the federal TIGER and FAST LANE grant programs championed by Snohomish County's federal delegation, and the Railroad Rehabilitation & Improvement Financing (RRIF) loan program.

4.5 PERFORMANCE MEASURES

The wharf upgrades were designed to double the live load carrying capacity of the facility while also providing for the use of mobile harbor cranes. Crane rails were added with sufficient capacity to facilitate the use of a variety of used or new container cranes typically utilized for this type of berth, while also allowing room for expansion in the future. The wharf upgrades were designed for future compatibility with berth deepening, including seismic performance criteria that the wharf in the upgraded and deepened configuration would perform equal to or better than the original wharf.

Infrastructure was installed for future "cold ironing" of modern vessels with ship to shore power, as well as vaults for electrification of the Port's existing mobile harbor cranes. Overall stormwater treatment was improved on the upgraded facility such that a portion of stormwater on the new facility would be actively treated with media-based treatment, whereas the existing facility only implemented oil-water separators.

Significant under dock wharf repairs were performed on the concrete pile caps to extend the service life of the structure, making the investment in the new pile caps and crane beams worthwhile.

4.6 HOW THE PROJECT FULFILLS AWARD CRITERIA

ENGINEERING INNOVATION

A comparative seismic performance approach implementing the newly released ASCE 61-14 Seismic Design of Piers and Wharves was taken utilizing state-of-the-art analysis software and non-linear displacement-based seismic design philosophies. Under dock pile cap repair included a combination of removal/replacement of damaged concrete/reinforcing, as well as fiber reinforced polymer (FRP) wrap to minimize demolition limits in other areas.

MEANS OF CONTRACTING

Contracting for the wharf upgrade was via the traditional low bid design-bid-build delivery method. The contracts were structured to facilitate Buy American requirements triggered by Federal MARAD grant funding for the project. The contracts were timed to coordinate with grant disbursements and to satisfy grant requirements. Ultimately the project consisted of six separate contracts for the Seaport Terminal Modernization project. Separate procurement of a heavy-move contractor for the cargo transit shed relocation allowed design/permitting/construction of the site preparation for the new footprint location to continue while the building move contract was executed.

SPEED OF CONSTRUCTION

The project required substantial coordination between the Port, design team, and contractor to perform repair activities beneath the deck, install new piles, install new pile caps and install new crane beams, while also minimizing the number of in-water construction work windows required to complete pile driving (in-water work allowed between July and February). The Port's inspectors and design team were on site daily to perform inspection and address questions, especially while demolition and rebuild were ongoing for the repair work. In addition, the Port procured cranes from the Port of Los Angeles, which were offloaded across the wharf during construction activities and temporarily stowed upland so that crane retrofit and commissioning could occur simultaneously with completing the wharf upgrades. Utilizing multiple upland cranes enabled the Port to perform and sequence multiple construction activities in a relatively tight work area within the wharf footprint.

BUDGET SUCCESS

Rather than demolish the existing 39,600 square foot cargo transit shed located behind the wharf (conflicting with proposed new retrofit landside crane rail) and rebuild a new maintenance facility for container handling equipment maintenance, the existing warehouse structure was relocated further upland to support both its existing maintenance function as well as providing covered on-terminal rail loading/offloading under the existing roof overhang. Without the relocation of the existing shed, the Port's project budget would have only been able to replace 20 percent of its original warehousing capacity. Also, as mentioned earlier in the submittal, being able to source two surplus cranes that met the equipment need for the site saved the Port nearly $20 million in budget need for this project, versus a few million to retrofit the crane rail engineering and the software for crane operations.

EXEPTIONAL MEASURES

The project is located within the former Weyerhaeuser Everett Mill A MTCA cleanup site. The property is owned by the Port but listed on the Washington State Department of Ecology's list of contaminated sites and is currently under an Agreed Order through the MTCA cleanup process. Due to the ongoing cleanup process, the Port also had extensive soil and groundwater data related to the upland terminal area. For the upland terminal grading and utility installation, the contract documents included requirements and best management practices (BMPs) related to soil and groundwater management. Excavated soil management required testing/characterization prior to off-site disposal for any material that could not be reused on site. Provisions were provided for replacement of geotechnically unsuitable wood waste if encountered during excavation, as well as dewatering for deeper vault installation.

5. CONCLUSION

The Port of Everett Seaport Modernization project required balancing and prioritizing a large number of overall goals, including adding new container crane capability while continuing to diversify the Port's capabilities to support more niche breakbulk cargoes. During planning and design, various program elements were considered independently, and the anticipated costs inputted back into the overall Seaport Modernization budget to prioritize work relative to the Port's overall goals. Project elements were packaged into multiple construction contracts to accommodate efficient delivery of different construction and project components, capital budget sequencing, grant reimbursement requirements, and environmental/permitting constraints.