

Tacoma Pier 23 Renovation Design

Tacoma, Washington

Owner: US Army Reserves / USACE, Louisville District

Description: Pier 23 is located on the southeastern shore of Commencement Bay. Originally built around 1946, the pier serves to support the equipment, personnel, and operations of the 70th Regional Readiness command of the US Army Reserves. A concrete extension was added to the pier a few years later, making the pier approximately 1,216-feet long by 56-feet wide. The landward 606 feet of the pier consisted of timber construction and the outboard 610 feet of the pier consisted of concrete construction. INCA Engineers, Inc., A Tetra Tech Company (INCA) provided engineering during construction services and developed 23 construction drawings, 13 project specific specification sections, and a detailed MCACES construction cost estimate.

The existing timber portion of the pier was demolished and replaced with a new concrete pier for this project. The replacement pier was constructed of precast/prestressed concrete piles supporting cast-in-place (CIP) pile caps and precast deck panels. The new pier is approximately 600 feet long and lies between the existing concrete pier and the existing sheet pile bulkhead wall, which extends along the shore bank. The pier foundation system supports the vertical loads and lateral loads through a foundation system consisting of pile caps supported by vertical and battered piles, which transfer the load to the soil in friction and end bearing. Geotechnical reports provided the geotechnical design parameters for the foundations.

The pier superstructure supports the vertical loads through the concrete deck panels which are seated on the pile caps. Lateral loads, including seismic forces, soil pressure, ship impact, and mooring forces, are transmitted through the superstructure deck acting as a diaphragm to the batter piles.

The chosen fender system for the new pier uses prestressed concrete fender piles which are the most prevalent system in use, as noted in UFC 4-152-01. Square prestressed concrete fender piles have been tested and proven to have high-energy absorption fendering capabilities and greater strain energy at collapse than either timber or steel fender piling. The top of each is attached to a rubber fender unit that can deflect and absorb a large amount of energy without imparting high reactions.

A horizontal waler beam with diagonal restraint chains helps complete the fender system. The face of each square fender pile has a UHMW polyethylene rub strip to protect the vessel hulls while providing a low sliding coefficient of friction.

The utilities for the pier electrical, communications, potable water, and compressed air systems were upgraded. Utility trenches with removable concrete covers were built in to the new pier deck for easy accessibility. A continuous longitudinal drainage trench was built into the deck on the east and west side of the new pier to collect surface runoff and to carry it back to the oil-water separator on shore.

The removal of the contaminated slag and sediment along the shore areas required the existing bulkhead sheet pile retaining wall to be reinforced in certain areas and replaced in other areas. The temporary construction sheet pile wall 12-feet to the south of the new wall will remain in place and will be buried and covered with new asphalt paving in order to restore the area to its existing paving. The concrete cap and fencing on top of the new wall section will match the existing. The estimated construction cost for the entire project is \$24M.

