

## *Floating Double-Deck Pier*

### **Technology Description**

Naval Facilities Engineering Command (NAVFAC) has developed the Floating Double-Deck Pier (FDDP), a new generation of berthing pier that offers a cost-effective and sustainable alternative to traditional pile supported piers. The design uses standardized modules manufactured at one location to create an easily reconfigurable and re-locatable pier that provides the lowest life cycle cost for Navy piers. The FDDP is ideal for all legacy and envisioned classes of U.S. Navy ships except CVN's and submarines.



The FDDP is designed using high strength light weight concrete that has been validated through service life modeling to provide 100-years of service life with no major structural repairs.

### **Value to the Warfighter**

Maintaining constant tidal level with respect to a berthed ship, the top deck of this floating pier serves as a convenient extension of the ship's decks for exclusive operations by the ship's crew. All hospital service equipment and utility hardware are located in the lower deck of the pier, where shore personnel can easily reconfigure it for any unplanned service without encumbering critical operations on the top deck.



A constant tidal level greatly simplifies cargo and supply transfer, mooring line handling, vessel fendering, and cable/hose routing between pier and ship. No dockside labor is needed for tending brows, mooring lines, and utility cables after berthing, as required for traditional piers.

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## **Economics of the Technology**

The FDDP provides \$48M in cost avoidance compared to a single deck fixed pier and \$51.4M in cost avoidance when compared to a double deck fixed pier. These values are based on a life-cycle cost analysis for 100-year total facility ownership cost of a FDDP as compared to both a single deck fixed pier and a double deck fixed pier for Naval Base San Diego. A modular floating design with long service life for the FDDP, also assures that the FDDP can be economically relocated to accommodate changing fleet needs and ship-basing options.

## **Technology Transition Documentation**

The final Report for the Floating Double-Deck Pier (TR-NAVFAC ESC-CI-1223) is available on the NAVFAC portal. Basic MILCON documents at the 35% design level are available from NAVFAC EXWC. As part of the larger Modular Hybrid Pier (MHP) research project, advancements in high strength light weight concrete and the methodology for concrete service life modeling were integrated into Unified Facilities Guide Specification (UFGS) section 03 31 29 for marine concrete.

## **Site Implementation**

In 2004, a large-scale Test Bed structure was built for the MHP research project with key characteristics of the full-scale FDDP. It was fabricated in a graving dry-dock in Tacoma WA and then open-ocean towed over 1,200 miles to Naval Base San Diego, CA.

The Test Bed project successfully validated key design and construction capabilities. For example, the top deck of the Test Bed was load tested with a very large load to simulate a worst case crane outrigger loading scenario. The deck behaved safely and in a linear manner up to the maximum test load of 500 kips.

## **Specific Applications**

The FDDP could be remotely constructed and quickly deployed to virtually any location in the world. The FDDP concept offers distinct advantages for locations with deep water, poor soils, large tides, earthquake activity, cyclonic storms, sea-level change, environmental sensitivity, and short construction windows.

When deciding on pier concepts for your next waterfront MILCON, consideration should be given to initial cost, life cycle cost, design/build time, and service life expectations. The FDDP gives U.S. Navy regions latitude to build the type of pier that best meets their specific operational and local needs, while assuring that facility investments can be economically reused for changing DOD operations and global needs.

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