

Enhanced Guidelines for Marine Concrete Repair

Technology Description

Naval Facilities Engineering and Expeditionary Warfare Center (NAVFAC EXWC) develop a repair specification based on enhanced guidelines for marine concrete repair and document a full-scale concrete repair project accomplished using these enhanced specifications. The completed project serves to demonstrate the practicality of the specification and act as a prototype for Architectural and Engineering firms who are responsible for future concrete repairs Navy wide.

The enhanced specification includes three primary advancements:

- enhanced quality control/quality assurance
- embedded galvanic anodes
- form and pressure pump repair methods



Improved quality control/quality assurance practices including the use of bond strength pull-off testing were specified.

The full-scale demonstration project at Fueling Pier H, Pearl Harbor, HI successfully demonstrated the enhanced repair guidelines in a real-world application. Laboratory testing confirmed the durability of the concrete mix and pull-off tests validated field procedures for surface preparation of repair areas by ensuring that adequate bonding was achieved between the repair material and existing substrate concrete. The use of embedded galvanic anodes demonstrated the feasibility of utilizing them in a large number of repairs and the need for supplemental instruction on anode placement and tying locations beyond what is in current Navy practice. Form and pressure pump repair locations demonstrated proper formwork design and the procedures necessary to ensure that the repair material inside the forms is sufficiently pressurized. Enhanced quality assurance was provided by utilizing the Engineer of Record for on-site Title II oversight of the project.



The enhanced marine concrete repair specification was successfully used at Pier H, Pearl Harbor, HI

Value to the Warfighter

By accomplishing high-quality marine concrete repairs that have an expected service life double that of repairs performed using conventional practices, the time before subsequent major concrete repairs are required is increased. This minimizes facility down-time associated with construction activities resulting in increased readiness of the structure.

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Economics of the Technology: ROI or Payback

Concrete repairs are one of the leading maintenance costs associated with U.S. Navy piers and waterfront structures. By using enhanced repair procedures such as proper substrate surface preparation, embedded galvanic anodes, form and pressure pump concrete placement, and improved quality control practices, the service life of concrete repairs is expected to double. Since the service life of concrete repairs using conventional repair methods is often observed to only be approximately 7 years, the repairs accomplished using the enhanced methods are expected to last 14 years. If these methods are used on just one pier a year for 5 years with an average repair cost of \$1M, then the ROI for this \$260K effort is 10.5.

Technology Transition Documentation

The final report, TR-NAVFAC EXWC-CI-1304 Enhanced Guidelines Marine Concrete Repair, is available on the NAVFAC portal Waterfront Community page and was submitted to the OSD Corrosion Prevention and Control Program. The report contains the enhanced repair specification, guidelines for its use, and lessons learned at the Pier H project.

Site Implementation

The enhanced specification was utilized for a \$5M concrete repair project at Pier H, Pearl Harbor, HI. This facility provides fuel facilities for tanker vessels (AOE & TAO) and barges at Naval Station Pearl Harbor. The facility also provides berthing and moorings for large vessels such as amphibious assault ships (LHA and LHD) and aircraft carriers (CVN) for mooring service Type I (mild weather) mooring conditions.



Embedded galvanic zinc anodes were attached to the steel reinforcement to prevent corrosion around the repair perimeter

Specific Applications

The enhanced guidelines for marine concrete repair can be applied to any concrete repairs performed on facilities exposed to the marine environment. The improvements made to quality control/quality assurance requirements can be of value to any concrete repair project regardless of its environmental exposure conditions.

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