

FRP reinforcement grants concrete fishing pier decades more use



Installation of FRP using the Bridgewalker under-bridge access machine in place of costlier traditional scaffolding.

BACKGROUND Popular 40-year-old concrete fishing pier was showing vulnerability, necessitating reinforcement

The Edmonds Fishing Pier is a public resource originally built in 1978 under the direction of the Washington Department of Fish and Wildlife. Open 24 hours a day, 365 days a year, the L-shaped concrete pier is located just next to the Olympic Beach visitor station and has made itself a popular spot both day and night for fishing salmon, smelt, squid, crab and other species, as well as for its gorgeous views of Puget Sound.

Like many similar structures exposed to the ocean elements, the pier has endured considerable wear over the decades and, in 2016, underwent significant structural rehabilitation.

In early 2020, further deterioration on the underside of the pier was discovered, where the centerline slab joint was inadequately bonded to the structure above and allowing moisture to intrude into the joint. This deficiency had the potential to reduce the 40-year service life of the 2016 rehabilitation project.

PROJECT INFORMATION

Project

Edmonds Fishing Pier in
Edmonds, WA

Project Category

Bridge and Marine

Project Owner

Washington Department of Fish and Wildlife

Project Engineer

City of Edmonds

Application

Repair and strengthening of concrete pier's inadequate centerline slab joint

Simpson Strong-Tie Products

CSS-CUCF2224 code-listed unidirectional carbon fabric; CSS-ES epoxy primer and saturant; CSS-EP epoxy paste and filler; FX-263 rapid-hardening vertical/overhead repair mortar

CHALLENGE

Using existing grant funds, reinforce insecure centerline slab joint to extend the expected life of the pier.

SOLUTION

Install Simpson Strong-Tie FRP fabric over the deficient centerline slab joint instead of demolishing it and replacing it with new concrete.

RESULTS

The FRP reinforcement, completed in less than a month, saved the pier owner well over \$100,000 and taught City of Edmonds workers a valuable new concrete repair skill.

THE CHALLENGE Employ structural reinforcements to extend pier life without wholesale demolition and replacement of any concrete



The FRP panels provided structural reinforcement, sealed the underside of the pier against moisture ingress, and eliminated the need to demolish the deficient joint repairs.

The necessary retrofit posed a design challenge in that the centerline slab joint, though structurally integral, was comparatively inaccessible. Even if a contractor demolished and replaced the deficient slab joint alone using high-performance concrete while working from scaffolding, the estimated project cost was prohibitively expensive, far in excess of existing grant funds. A more efficient and economical solution was therefore sought.

Project engineers from the City of Edmonds were already familiar with Simpson Strong-Tie's breadth of structural products and solutions and reputation for high-quality engineering services. Researching the possibilities of the Simpson Strong-Tie Composite Strengthening Solutions™ concrete reinforcement line, the engineers decided to contact the company for product recommendations specific to their challenge. In consultation with a concrete repair, protection and strengthening (RPS) specialist from Simpson Strong-Tie, the team arrived at a solution using fast-curing repair mortar and a fiber-reinforced polymer (FRP) strengthening composite.

THE SOLUTION Use Simpson Strong-Tie repair mortar to rebuild weathered concrete, FRP composite to strengthen and protect centerline slab joint

Eric Olsen, the Simpson RPS specialist, not only explained the features and advantages of an FRP solution, but also trained the City of Edmonds work crew in preliminary substrate repair and in FRP surface preparation and installation.

The first step was to restore the deteriorated concrete to its original profile with Simpson Strong-Tie® FX-263 rapid-hardening vertical/overhead repair mortar. Next, layers of Simpson Strong-Tie CSS-CUCF2224 code-listed unidirectional carbon fabric were applied using both CSS-ES epoxy primer/saturant and CSS-EP epoxy paste/filler to strengthen the deficient joint and help protect the existing concrete and internal steel from direct saltwater exposure. Utilizing a lightweight FRP solution allowed installation with the assistance of an under-bridge access machine called the Bridgewalker, eliminating the extra cost of erecting and dismantling worker scaffolding.



Completion of a reinforced and protected joint on the pier.

THE RESULTS Carbon-fiber reinforcements, installed in under a month, add decades of life to the structure using only existing grant funds



After completion of initial concrete repair, the entire surface needed to be ground to remove contaminants due to saltwater exposure prior to FRP installation.

With proper training and consultation from Simpson Strong-Tie, a four-person City of Edmonds crew was able to complete the entire repair — both the mortar application and the FRP installation — in just over 16 working days between May and early June 2021.

In a series of post-installation direct adhesion tests, carbon-fiber panels successfully exceeded the specified bond. In each test case, the bond either maxed out the test apparatus at 480 psi or caused a test fixture bond failure well above the 200 psi minimum requirement.

Apart from the proven strength of the repair, the FRP solution also met the owner’s cost constraints and came in under budget. Had the team instead chosen a more conventional solution to demolish and replace the deficient centerline slab joint while working from scaffolding, the project cost was estimated at \$200,000 or more. By contrast, using the Bridgewalker, the FRP repair cost \$45,000 plus 16 days’ labor costs for the City of Edmonds crew, cutting overall projected costs by more than half.

the project could be completed without exceeding existing grants. Moreover, the experience of installing FRP on the Edmonds Fishing Pier has provided City workers with a skill transferable to similar concrete strengthening projects in the future.

The Washington Department of Fish and Wildlife, which owns the pier, expressed great satisfaction that

Henry Schroder, P.E., Capital Projects Manager in the City of Edmonds Engineering Division, had this to say about the design and support from Simpson Strong-Tie:

Utilization of Simpson Strong-Tie’s fiber-reinforced polymer (FRP) system was a cost-effective approach to remedy the deficient [. . .] joint repairs on the Edmonds Fishing Pier. The FRP panels provided structural reinforcement, sealed the underside of the pier against moisture ingress, and eliminated the need to demolish the deficient joint repairs. Simpson Strong-Tie provided excellent upfront training and intermittent construction support, which quickly transformed our City crew into an experienced FRP work team.



With a strengthened pier and a newly trained city crew to keep it in good repair, the people of Edmonds should be enjoying fresh-caught seafood for a long time to come.

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