

# Tide Pools and Pile Encasements Brooklyn Bridge Park

Location	Product used	Duration
Brooklyn Bridge Park	Tide Pools and Pile Encasements	2013-2016

## In Short

As part of the holistic environmental theme of Brooklyn Bridge Park, two different enhancement projects using ECONcrete<sup>®</sup> technologies were incorporated into two piers within the park's renovation plan. At pier 4, ECONcrete<sup>®</sup> provided precast tide pools which were integrated between the stones comprising the riprap to increase the biological productivity of the newly constructed beach. At Pier 6, ECONcrete<sup>®</sup> developed an innovative concrete encasement technology applied to restore the required structural properties of the aging wooden piles

while increasing the availability of substrate capable of sustaining rich marine communities. At both locations, ECONcrete<sup>®</sup> exhibited rich and diverse live cover when compared to control units. With the tidepools at pier 4 presenting 89 to 100% live cover and higher biodiversity, in stark contrast to the very poor biological function of the surrounding riprap rock, and at pier 6, ECONcrete<sup>®</sup>'s encasements presented between 70 to 100% live cover and high biodiversity as opposed to only scattered colonization on the control piles.



ECONcrete's tide pool - Brooklyn Bridge Park

## Project Description

Coastal and marine infrastructure (CMI), often imposes much stress on fauna and flora of natural habitats. Concrete based CMI, provide poor substrates in terms of biological recruitment due to the combined effects of the concrete's chemistry, featureless surface texture and high inclination compared to natural habitats. Considering the recent growth of world populations and rural development around coastlines, the effect of CMI on the natural environment is catastrophic.

Brookline Bridge Park, NYC is a popular recreational, environmental and cultural destination enjoyed by many. The Park is a post-industrial 85-acre open space on the Brooklyn side of the East River with a revitalized 1.3-mile (2.1 km) of waterfront. As a part of the holistic environmental theme of the park, two different enhancement projects

using ECOConcrete® technologies were incorporated into the park's renovation plan. The first project features the integration of precast concrete tide pools as part of a newly constructed riprap beach at Pier 4. The tide pools provide shore stabilization of the beach portion of the new waterfront, as well as increase the ecological performance. The second project features a structural repair of aging pier piles supporting Pier 6. The project utilized ECOConcrete's innovative encasement technology based on ecosystem specific concrete mixture and complex design. These physical and chemical alterations create a substrate suitable for valuable habitat and dramatically elevates ecosystem services when compared to standard methods of pile encasement. Standard jackets (Portland-based concrete with traditional fiber glass form), cast at the same time as ECOConcrete's jackets, were used as a control and were monitored with



the ECOConcrete's jackets up to 14 months post-deployment.

## ECOConcrete's Approach

ECOConcrete® supplies a range of modular, esthetic elements, which functionally integrate into coastal infrastructure. The elements can be used to retrofit existing structures or to provide fully structural and load bearing units for new construction. ECOConcrete products increases the ability of species to utilize structures, and can be tailored for specific species of conservational value, without effecting their structural and functional properties. ECOConcrete's elements defer from standard concrete units on three levels; concrete chemistry, surface complexity and macro-design. These three elements combined, mimic natural marine environments and decrease the negative effects of concrete based coastal development. The mix is specially designed for the requirements of marine flora and fauna and the surface complexity mimics the one found in natural habitats. In addition, higher level surface elements offer refuge to



ECOConcrete mold for pile encasement

larger marine life similar to natural habitats.

**ECOConcrete®'s tide pools** are designed to create well-defined water retaining elements that mimic natural rock pools typical to rocky shores. Even though rock armor is made of natural material, due to its low surface complexity and dense nature, it is not a surrogate to natural rocky marine habitats and often provides limited ecological value to the surrounding environment. ECOConcrete®'s designed tide pools add valuable water retaining features completely absent from armored shorelines. The pools that can be easily integrated into breakwaters, revetments and riprap, help compensate for the loss of natural intertidal habitats by increasing biodiversity and biological productivity along the structure. The units take the place of standard armoring stones between mean low to mean high water lines, accommodating an array of diverse species that are absent from standard riprap. In this project, each tide pool retains a volume of 13 gallons (59 liters) and creates a submerged habitat that is disconnected from the open water at low tide.

**ECOConcrete® Pile Encasement** uses an innovative concrete mix that enhances the growth of marine flora and fauna. In addition, textured forms are applied and stripped after casting, imprinting a rough texture onto the surface of the concrete jacket, which helps to further induce rich marine growth. The unique ecological pile encapsulation can be easily substituted for standard

concrete pile encapsulation commonly applied to repair timber piles supporting piers.

## Project Conclusion

Nine months after installation (August of 2014), and after a long harsh winter during which the pools were iced, monitoring of the pier 4 tide pools were conducted. Results showed live cover on the pools to be on the order of 89 to 100%. In contrast, the rocky area surrounding the pools was found to have very limited live cover and poor biological function. Apart from various algae that colonized the pools, different invertebrate taxa were identified including copepods, amphipods,

isopods, as well as Sabellidae and Spirorbis worms. In addition, two individuals of the Harris mud crab (*Rhithropanopeus harrisi*) and 17 individuals of an identified juvenile/post-larval fish were noted.

Monitoring of the piles at Pier 6, three, ten and fourteen months post-deployment revealed live cover between 70 to 100% on ECOConcrete®'s encasements with strong dominance of filter feeding organisms (barnacles, sessile polychaetes, sponges and bivalves), and habitat forming species (barnacles and sessile polychaetes) that contribute to biogenic build-up on the substrate by calcium carbonate deposition. In addition,





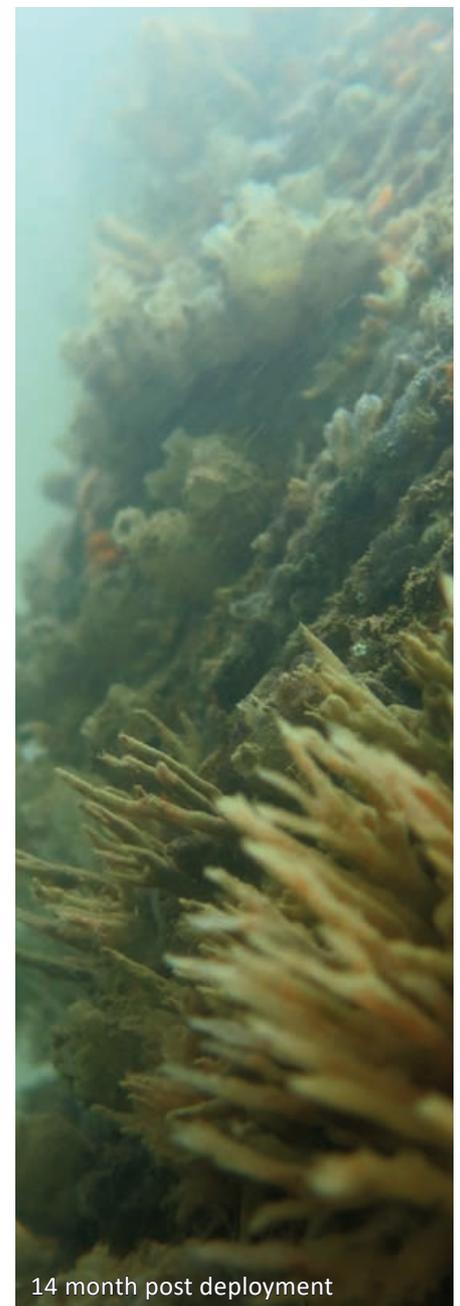
a number of blue crabs (*Callinectes sapidus*) were spotted mating on the bio-enhanced jackets indicating the addition of valuable nursing grounds. The control encasements comprised of concrete and fiberglass, exhibited only scattered colonization (20–50% live cover) with highly limited ecological value. Moreover, accumulated biomass on ECOConcrete sampling units were more than tenfold compared to control fiberglass sampling units. Finally, it is important to note, that the above-mentioned biological assemblages that developed on the enhanced jackets did not interfere with the concrete encasement performance, and a hands-on (level II) inspection of the encasements conducted by CH2MHILL engineers a year post-deployment found hard and sound concrete.

By integrating environmentally sensitive technologies into the design and construction of CMI, ECOConcrete® is able to harness natural processes for ecological enhancement and

reduce a structure's ecological footprint. The improved design of the pile encasement and the addition of the designed tide pools to the otherwise almost barren riprap has several implications on the local marine environment; such as increased biodiversity and productivity, creation of sheltered habitats and nursing grounds, water purification and more.

Apart from its clear ecological significance, ECOConcrete®'s enhancement also provides structural and socio-economic benefits. Biogenic growth of organisms like oysters, tube worms, or barnacles provides bioprotection; acting to strengthen the structure and add to its stability and longevity. This form of bioprotection can reduce the magnitude and frequency

of structural maintenance, which translates into improved ecological stability (reduced anthropogenic intervention), as well as a higher ROI (reduced maintenance costs). The two pilot projects also facilitated Brooklyn Bridge Park's environmental permitting scheme and contributed to its community and education program.



## ECONcrete<sup>®</sup> Company Profile

ECONcrete<sup>®</sup> offers a suite of environmentally sensitive concrete solutions designed to encourage biological productivity on urban and coastal marine infrastructure, such as coastal and riverine erosion control structures, urban waterfront developments, marina's and ports. ECONcrete<sup>®</sup> provides; bio-enhanced concrete admixtures suited for different aquatic environments; custom forms & form liners for creating complex textures and science based design features; as well as a unique line of precast ECONcrete<sup>®</sup> elements. All of ECONcrete<sup>®</sup> products serve to elevate the functionality of local ecosystems, while providing the structural performance required of urban, coastal, and marine infrastructure.

To date, ECONcrete<sup>®</sup>'s innovative technologies have been implemented towards the design and fabrication

of precast seawalls, armoring units, tide pools, marine mattresses, terrestrial bio-active wall tiles, and on-site casting. ECONcrete<sup>®</sup>'s extensive and continuous R&D efforts, coupled with expert environmental and technical consulting allows for the creation of unique solutions for the development of all types of urban, coastal and marine infrastructure projects.

ECONcrete<sup>®</sup> personnel have the capability and expertise to tailor products and designs based not only on the project's specific needs, but also for optimal ecological performance in different marine environments. As such, ECONcrete<sup>®</sup> provides complete project services, from initial planning and site assessment, through detailed design and product fabrication and supply, as well as installation procedures and post installation monitoring.

## ECONcrete<sup>®</sup> Services

### PR services

- Assistance with and development of project ecological collaterals
- Community outreach and education
- Publications (scientific/popular)

### Project Specific Product Development

- Product Customization following structural and biological requirements
- Schematic design and full product specifications

### Consulting and Design

- Preliminary environmental assessment
- Conceptual design for ecological enhancement
- Support in working with regulators and permit facilitation

### Supply of Materials and Products

- Precast units
- Form and form liners
- Admixtures

### Installation supervision

- Guidance and installation coordination with contractors
- Quality assurance of fabricated units, and site placing

### Post Installation Monitoring

- Biological monitoring of flora and fauna
- Scientific project reports