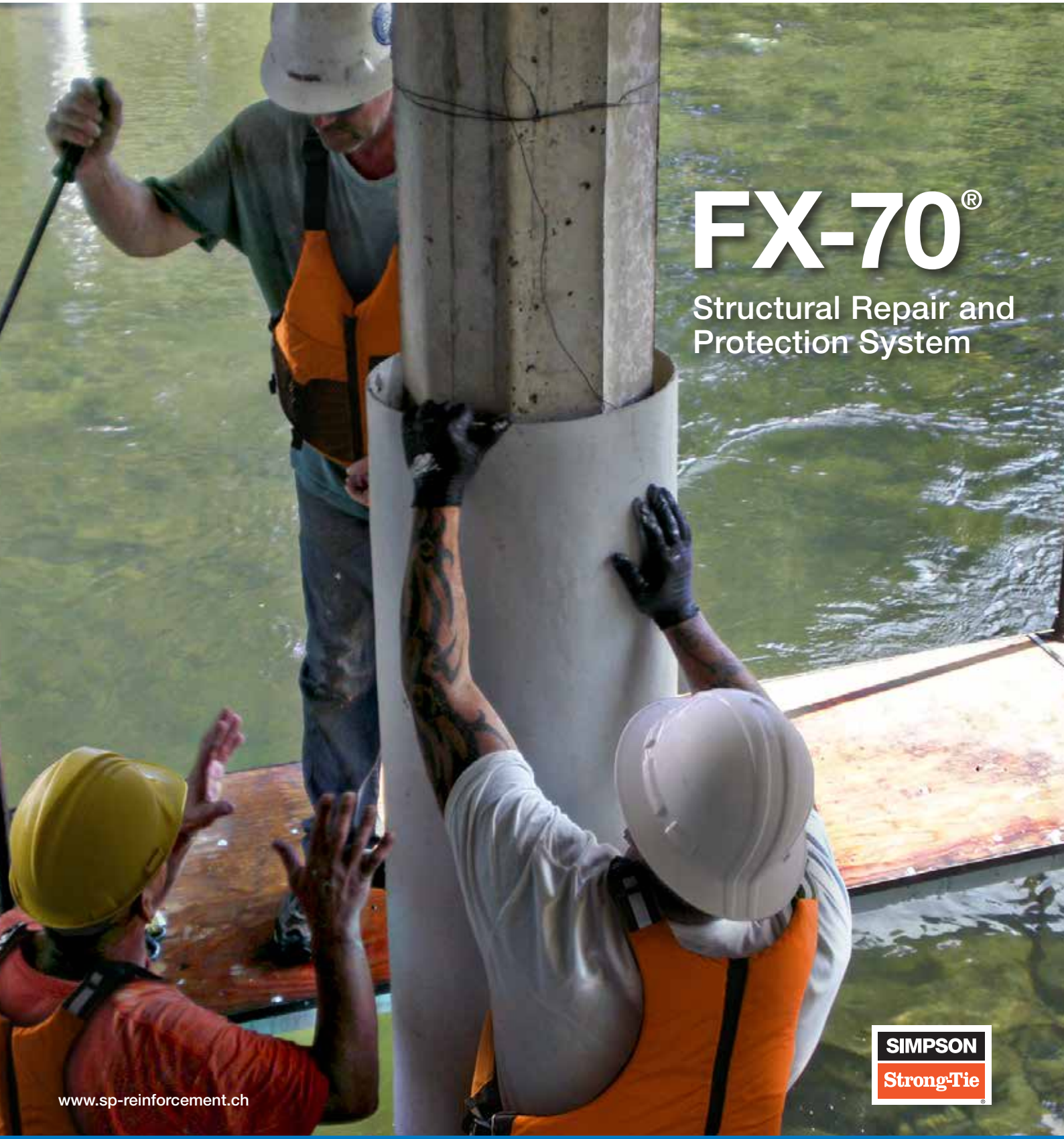
S&P

A Simpson Strong-Tie® Company



FX-70®

Structural Repair and Protection System

www.sp-reinforcement.ch

SIMPSON Strong-Tie®

Innovative, Versatile Solutions with FX-70®

In 1970, the FX-70® Structural Repair and Protection System made in-place repair of damaged marine piles possible and practical, an industry first. By eliminating the need to dewater the repair site or take the structure out of service, FX-70® dramatically reduces the overall cost of restoring the damaged structure. A corrosion-resistant system, both ageing and new structures can realise extended service life as a benefit of the FX-70® system. Many of the first repairs using FX-70® in 1971 are still in service today. The FX-70® structural repair and protection system is customised to the exact specifications of each job, and shipped directly to your jobsite.

Concrete Piles

Steel Piles

Wood Piles

New Structures

System Overview

Attack of structures at the waterline is commonplace in marine environments. Tidal action, river current, salt water exposure, chemical intrusion, floating debris, marine borers, electrolysis and general weathering are all examples of factors affecting the lifecycle of structures in marine environments addressed by the FX-70® Structural Repair and Protection System.

FX-70® Jacket

The FX-70® Jacket provides the external protection for the repair. The fibreglass tongue-and-groove seamed jacket provides a corrosion-resistant shell, is UV-resistant and ranges from 3mm to 5 mm thick.

High-Strength Grouting Materials

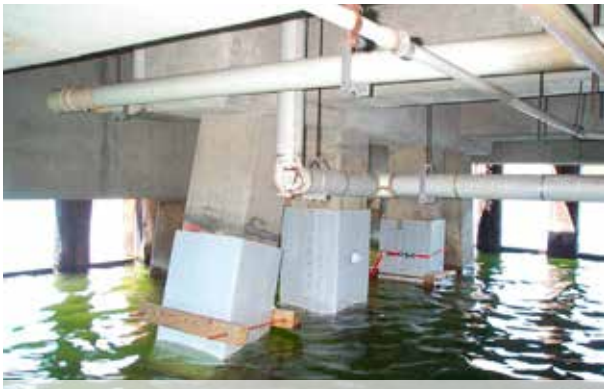
FX-70-6MP™ Multi-Purpose Marine Epoxy Grout and FX-225 Non-Metallic Underwater Grout are both high-strength, water-insensitive repair compounds. FX-70-6MP™ provides excellent bond to concrete, steel, wood and other common building materials. These products displace existing water and can easily be placed into the FX-70® jacket without the costly building of cofferdams or dewatering of the repair site. FX-70-6MP™ is ideal for repairs to structures with less than 25% section loss, and is commonly combined with FX-225 to reduce material cost on large jobs or to repair structures with greater than 25% section loss.

Advantages

- Repair damage in-place, no need to dewater or take structure out of service
- High-strength materials bond well to various substrate materials
- Corrosion-free system prevents deterioration, weathering and erosion
- Accommodates piles of various shape and size
- System is low-maintenance following repair
- Safe for use in marine-life habitats
- UV-resistant

FX-70® Fibreglass Jacket

Round



Square

H-shaped

Octagon

Each FX-70® jacket is custom-made to the precise specifications of each repair project. The production and quality assurance experience of S&P ensures that only the highest-quality products are shipped to the jobsite.

FX-70® Jackets are available in the following shapes:

- Round
- Square
- H-Pile
- Octagonal

Technical Specifications

Property	Test Method	Result
Water Absorption	ASTM D570	1% Max
Ultimate Tensile Strength	ASTM D638	min. 103 N/mm^2
Flexural Strength	ASTM D790	min. 172 N/mm^2
Flexural Modulus of Elasticity	ASTM D790	min. 4826 N/mm^2
Barcol Hardness	ASTM D2583	45 +/- 7

Custom sizes

Grouting Materials

FX-70-6MP™ Multi-Purpose Marine Epoxy Grout

FX-70-6MP™ is a 100% solids, three-component, moisture-insensitive epoxy grout. FX-70-6MP™ is specifically designed for underwater use with the FX-70® Structural Repair and Protection System.

Performance Features:
- Easily pumped or poured
- High-strength, low absorption, impact-resistant grout with extended pot life
- Dewatering not required; can be placed underwater
- Resistant to chemical and aggressive water environments

Where to Use:
- As an epoxy grout in the FX-70® system
- As a high-strength grout in dry or wet applications

Limitations:
- Do not use in ambient or water temperatures below 4°C

Packaging Size:
- 56.8 L unit
- 11.4 L unit

Shelf Life:
2 years in original, unopened packaging.

FX-225 Non-Metallic Underwater Grout

FX-225 is a cohesive, non-segregating, high-strength grout that has been designed for underwater concrete repair. FX-225 may be pumped or tremied into place to provide a durable, corrosion-resistant repair.

Performance Features:
- Suitable for marine environments at 2°C and above
- Ready-to-use with the addition of water
- May be extended by up to 50% by weight with clean, coarse aggregate
- Can be pumped or tremied through water
- Will not stain or rust
- No dewatering required

Where to Use:
- Marine structure restoration, where forming is required
- As a high-strength, non-metallic grout to encapsulate wood, concrete or steel

FX-225 Non-Metallic Underwater Grout (cont.)

Limitations:
- Do not use at ambient or water temperatures below 2°C
- Do not exceed 3.9 L of water per 25 kg bag
- Minimum thickness of 5 cm when used as part of the FX-70® structural repair and protection system

Packaging Size:
- 25 kg bag

Shelf Life:
- 1 year in unopened, original packaging

Epoxy and Repair Paste

FX-763 Low-Modulus Trowel-Grade Epoxy

FX-763 is a 100% solids, two-component, non-sag, low-modulus moisture-insensitive epoxy adhesive.

Performance Features:
- Bonds to dry or damp surfaces
- May be feather-edged and will not shrink
- Easily dispensed through cartridge dispensers
- Excellent resistance to gasoline, oil, sewage and aggressive water
- Non-sag material ideal for vertical and overhead repairs
- May be applied with trowel, putty knife or squeegee

Where to Use:
- As a high-strength construction adhesive for common building materials
- For vertical and overhead concrete patching, maximum lift thickness of 25 mm
- As a paste-over material for pressure injection ports
- As a jacket sealer and top-bevel material for the FX-70® system

Packaging Size:
- 56.8 L unit
- 11.4 L unit
- 444 ml dual cartridge

Shelf Life:

2 years in original unopened packaging

Installation Procedures

Evaluation

On-site evaluation should be conducted by a licensed inspector before initiating any repair protocol. This is critical when planning any marine repair and to achieve an effective solution it should include:

- Column type, shape, diameter
- Overall length of affected area
- Estimated % section loss
- Water temperature range
- Tidal zone range
- Environmental factors potentially contributing to damage

Site Preparation

Areas of application must be free of marine growth, laitance, grease, oil, and debris that could inhibit bond. For best results, prepare surface to be treated with water or sand blasting. Blow or brush clean to remove remaining debris.

FX-70® Jacket Spacers

Spacers to ensure a consistent annular void surrounding the area to be repaired may be installed during jacket fabrication, or in the field. Field installation is advisable for large jobs to maximise shipping efficiency. See pg. 9 for recommended annular void recommendations.

Installation (Round pile shown; other applications similar)

Install a bead of FX-763 into the locking groove of the jacket and place FX-70® jacket around the pile to be repaired.

Insert the tongue into the locking groove of the jacket and position it leaving 460-610 mm of undamaged pile above and below the damaged area.

Install temporary bottom seal at base of jacket. Seal may be installed prior to placing jacket.

Install external bracing. Ratchet straps shown for round pile bracing.

Install a stainless steel, self-tapping machine screw every 150 mm o.c. to secure the tongue-and-groove joint.

Install 150 mm of FX-70-6MP™ Marine Epoxy Grout to create bottom seal; allow grout to cure overnight.

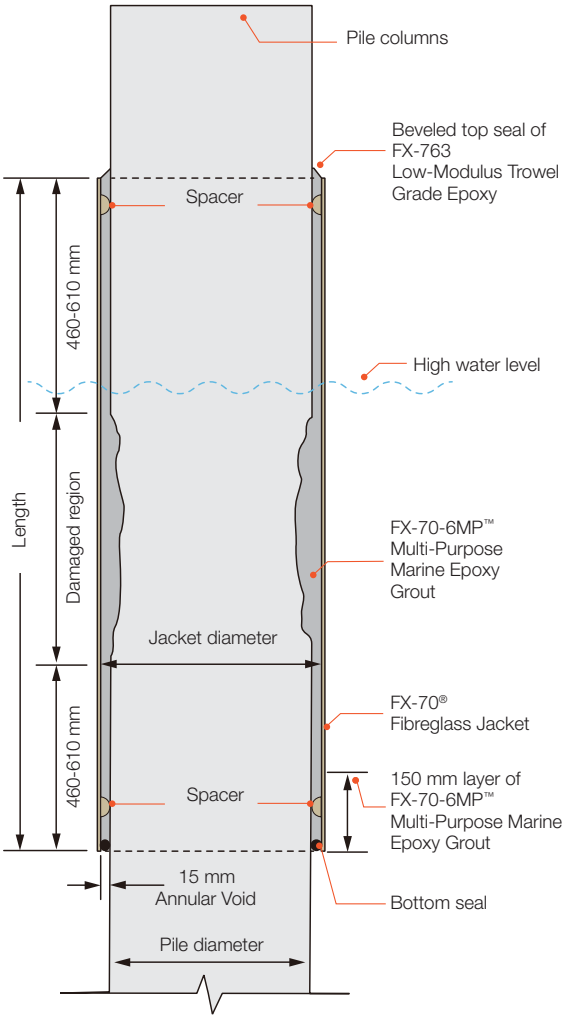
Piles with ≤ 25% section loss, fill remaining void in jacket with FX-70-6MP™. Piles with > 25% section loss, fill void with FX-225 Underwater Grout, leaving 100 mm open at top of jacket (allow to cure overnight); fill remaining 100 mm with FX-70-6MP™ (allow to cure overnight).

Install FX-763 Trowel Grade Epoxy at the head of the jacket and finish to a 45° tapered bevel, creating a water and chemical-resistant barrier to the repair system.

Remove ratchet straps. Repair complete.

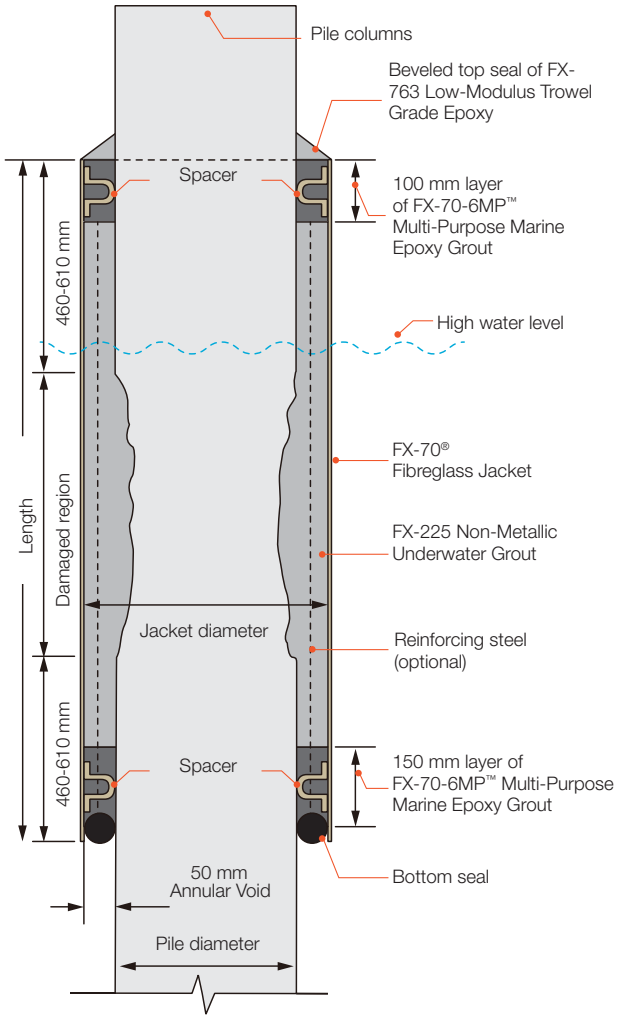
Repair Options Based on Section Loss

Section Loss ≤ 25%



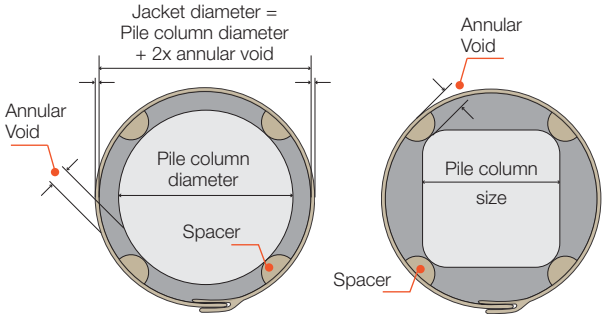
- FX-70-6MP™ Multi-Purpose Marine Epoxy Grout used for bottom seal and repair
- Typical annular void of 15 mm
- 20 mm annular void for H-piles

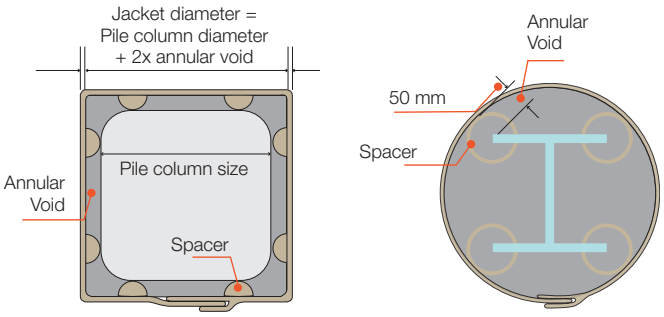
Section Loss > 25%



- FX-70-6MP™ Multi-Purpose Marine Epoxy Grout used for top and bottom seal
- FX-225 Non-Metallic Underwater Grout used for repair
- Typical annular void of 50 mm

Application examples :





H-Pile Repair Options

Many bridges are constructed with steel pipe and H-piles. Deterioration is generally caused by:

- Corrosion of steel
- Wetting and drying cycles
- Chemical attack
- Exposure to atmosphere

H-Shape Repair Method

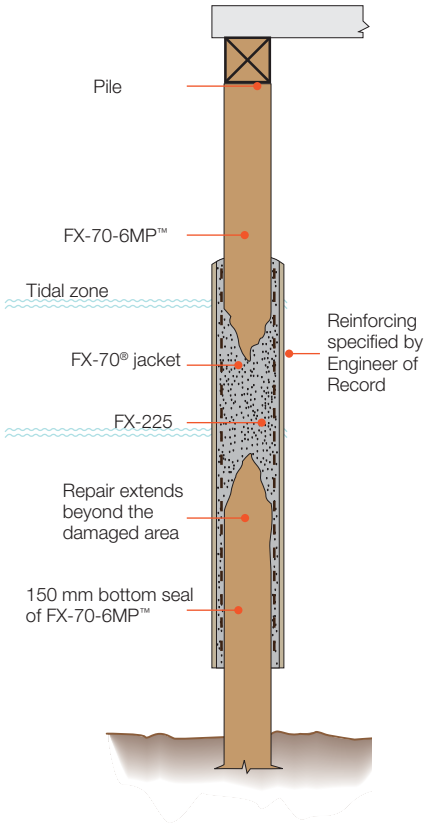
- FX-70® Jacket fabricated in H-pile shape
- Two-piece construction
- Standard annular void is 20 mm
- FX-70-6MP™ Multi-Purpose Marine Epoxy Grout used for repair

Circular Pile Repair Method

- Round FX-70® Jacket around H-pile
- Fill void with combination of FX-70-6MP™ Marine Epoxy Grout and FX-225 Non-Metallic Underwater Grout
- FX-70-6MP™ placed in bottom 150 mm and top 100 mm of void
- Remainder of void filled with FX-225
- FX-70-6MP™ encapsulates FX-225 to protect from moisture and air

Wooden Pile Repair

The FX-70® Structural Repair and Protection System can be an effective repair solution in instances of full-section loss of wooden piles. In the example shown, the Engineer of Record specified a rebar cage to reinforce the area between the two pile sections. Using FX-70-6MP™ Multi-Purpose Marine Epoxy Grout and FX-225 Non-Metallic Underwater Grout inside an FX-70® jacket can restore the performance of the wooden pile.



New Pier Reinforcement

Case Studies Concrete Pile Repair

Chesapeake Bay Bridge-Raymond Hollow

Repaired and protected over 300 piles

- Exhibited cracks that allowed moisture and salt to penetrate pile
- Exposed to temperatures from -18 °C - +38 °C
- If untreated, structure was in danger
- Jacket dimensions: 1.4 m diameter, 3 mm thick, 2.4 m length, with a 15 mm annular void
- Placed in splash zone
- Filled with FX-70-6MP™ Marine Epoxy Grout
- No dewatering required

Workboat and divers preparing piling for installation of FX-70® System

FX-70® System in place and ready for FX-70-6MP™ grout

Example of pile “scour”

FX-70-6MP™ grout mixed in work boat

FX-70-6MP™ grout placed in jacket without dewatering

Completed repair

Close-up of a repaired pile

Case Studies Concrete Foundation Repair

Paulsboro Refinery

Severe damage to concrete foundation

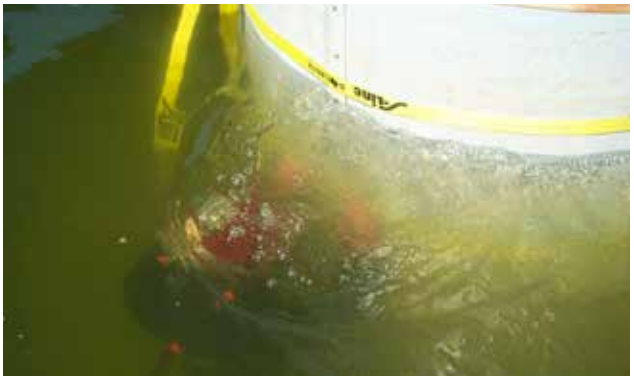
Foundation prepared and excavated; FX-70® jacket installed below ground level for additional protection

FX-70® jacket installed and backfilled

Repair completed with FX-70-6MP™ Multi-Purpose Marine Epoxy Grout as the bottom and top seal material. Coating system is used as a final finish on the outside of the FX-70® jacket.

Installation Images

Before



After

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FX-70® System Project Information Form

In order to better assist you in making a solution recommendation, complete knowledge of all factors involved in the potential use is necessary. Recommendations can only be based on information at hand today. Our recommendation will be as good as the information you provide. In order to provide the most accurate recommendation possible, send project specifications and drawings along with the completed form. Please be assured that all information will be held in strict confidence.

Contact Name: _____ **Date:** _____

Company Name: _____ **Phone Number:** _____

Email Address: _____ **City, Region:** _____

Project Information

Project Name: _____ **City, Region/Country:** _____

Bid Date: _____ **Engineer:** _____

Type of structure: _____ **Owner:** _____

Repair Type:	☐ Pile	☐ Beams	☐ Bulkhead	☐ Pier	☐ Other _____
Pile Composition:	☐ Timber/Wood	☐ Concrete	☐ Steel	☐ Other _____	
Pile Shape:	☐ Round	☐ Square	☐ H Pile	☐ Octagonal	☐ Other _____
Condition of Pile:	☐ Cracked	☐ Spalled	☐ Rusting	☐ Other _____	
Section Loss:	_____% (Sectional loss ratio)				

FX-70® Jacket Information

Quantity Required: _____

Jacket Shape:	☐ Round	☐ Square	☐ H Pile	☐ Octagonal	☐ Other _____	
Jacket Size (IN):	Diameter:	Square:	H-type piles:	Octagonal:	Other _____	
Jacket Length:	Metres per Jacket :			Various Lengths: (If various lengths, list each separately)		
Jacket Thickness:	☐ 3 mm	☐ 5 mm	☐ Other _____			
Number Of Vertical Joints:	☐ None	☐ 1	☐ 2	☐ 3	☐ 4	☐ Other
Spacers / Standoffs:	☐ 15 mm Spacers	☐ 25 mm Spacers	☐ 50 mm Spacers	☐ Other _____		
Size of Annular Void:	☐ 15 mm	☐ 20 mm	☐ 25 mm	☐ 50 mm	☐ 100 mm	☐ Other _____
Filler Material:	☐ FX-70-6MP™		☐ FX-225		☐ Other _____	

This form can also be found on our website.

A Simpson Strong-Tie® Company

Since 2012 S&P has been part of Simpson Strong-Tie, an international building products company based in California with multiple locations across Europe.

Simpson Strong-Tie was founded in 1956 and has established itself as the world-wide leader in wood-to-wood, wood-to-steel and wood-to-concrete structural connectors.

The company is committed to helping customers succeed by providing exceptional code-listed products, full-service engineering and field support, product testing and training, and on-time product delivery. With the acquisition of S&P, Simpson Strong-Tie continues to expand its offering to include a full array of concrete repair, protection and strengthening solutions. By combining the strengths of our two brands, Simpson Strong-Tie and S&P can offer the highest level of quality and service to meet all your concrete repair, strengthening and restoration needs. We look forward to working with you on your next project.

Contact us: +41 41 825 00 70

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