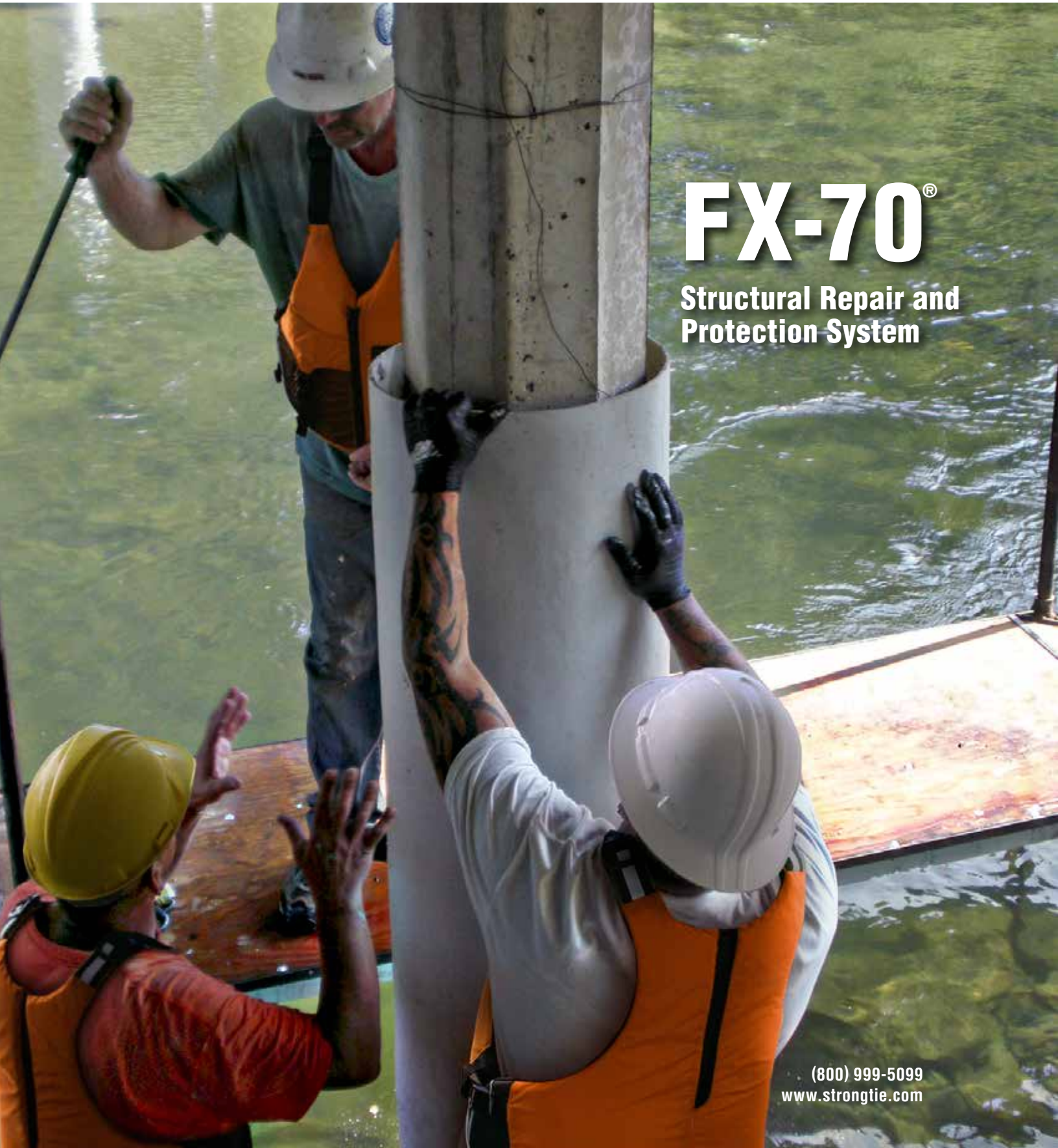
SIMPSON
Strong-Tie
®



FX-70®

Structural Repair and Protection System

(800) 999-5099
www.strongtie.com

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 aging and new structures can realize 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 customized to the exact specifications of each job, manufactured in the U.S.A., and shipped directly to your jobsite.

Concrete Piles

Steel Piles

Wood Piles

New Structures

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

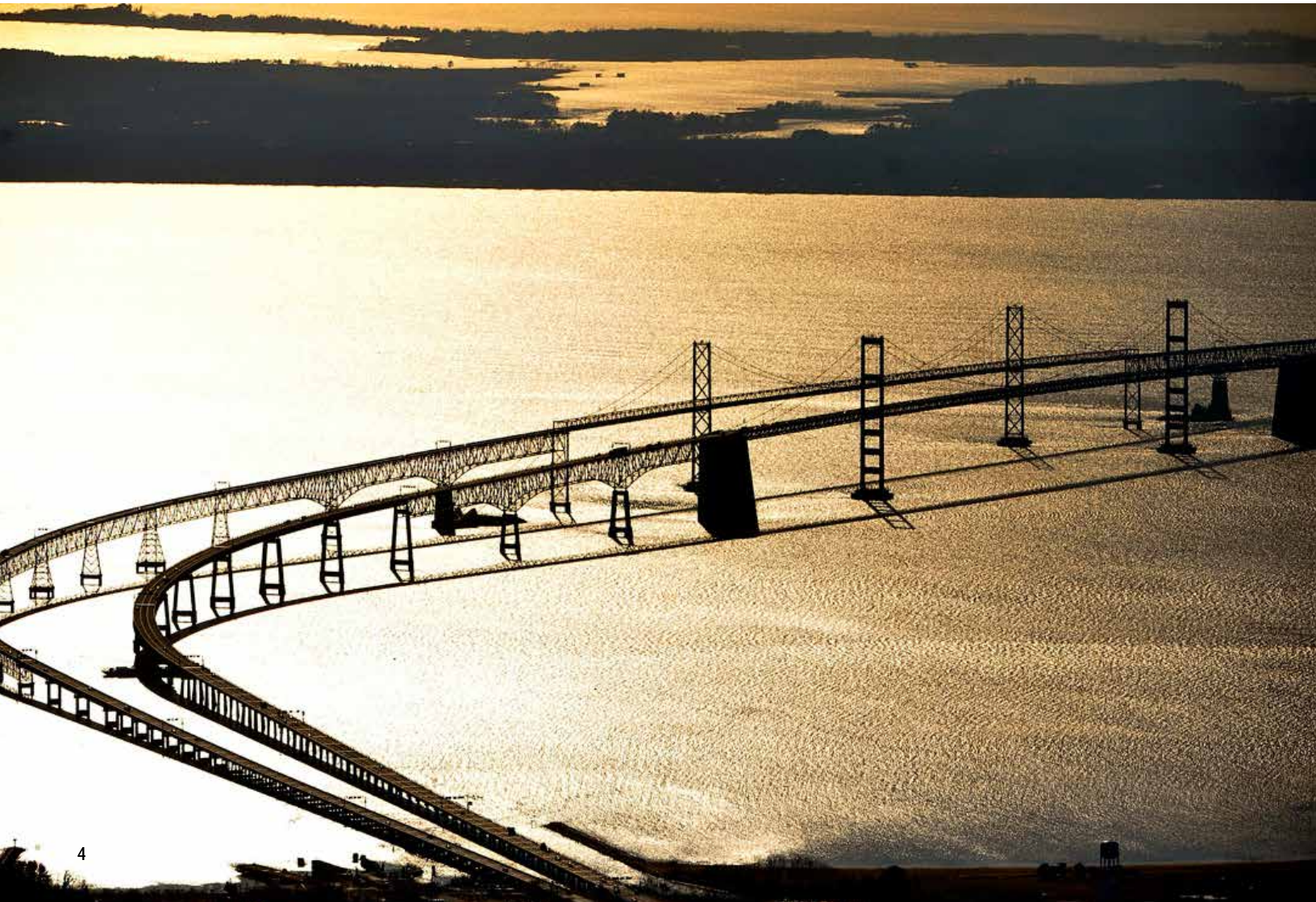
To protect the structure from external attack, the FX-70 Structural Repair and Protection System starts with a high-strength fiberglass interlocking jacket. The tongue-and-groove seamed jacket provides a corrosion-resistant shell to the repair site, ranges from ⅛ in. to ¼ in. thickness, and is UV-resistant.

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



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 Simpson Strong-Tie ensures that only the highest-quality products are shipped to the jobsite. Hand-made and assembled in the U.S.A., the FX-70 jacket has over 40 years of demonstrated in-service performance.

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	15,000 psi min.
Flexural Strength	ASTM D790	25,000 psi min.
Flexural Modulus of Elasticity	ASTM D790	700,000 psi min.
Barcol Hardness	ASTM D2583	45 +/- 7

CUSTOM SIZES

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 40°F (4°C)

Package Size:

- 15 US gallon (56.8 L) unit
- 3 US gallon 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 35°F (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

Limitations:

- Do not use at ambient or water temperatures below 35°F (2°C)
- Do not exceed 134 fl. oz. (3.9 L) of water per 55 lb. (24.9 kg) bag
- Minimum thickness of 2 in. (5.1 cm) when used as part of the FX-70 structural repair and protection system

Package Size:

- 55 lb. (24.9 kg) bag
- 1,000 lb. (454 kg) bulk bag
- 2,500 lb. (1134 kg) bulk bag

Shelf Life:

1 year in unopened, original packaging

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 1 in. (25 mm)
- As a paste-over material for pressure injection ports
- As a jacket sealer and top-bevel material for the FX-70 system

Package Size:

- 15 US gallon (56.8 L) unit
- 3 US gallon (11.4 L) unit
- 15 fl. oz. (444 mL) dual cartridge

Shelf Life:
2 years in original unopened packaging

FX-764 Splash Zone and Underwater Paste

FX-764 is a 100% solids, two-component, moisture-insensitive epoxy resin system ideal for concrete, steel and timber pile repair above or below the water line in marine environments.

Performance Features:

- May be applied underwater
- Bonds to wet surface and resists wave action
- Convenient 1:1 mixing ratio and long pot-life
- Hand-applied

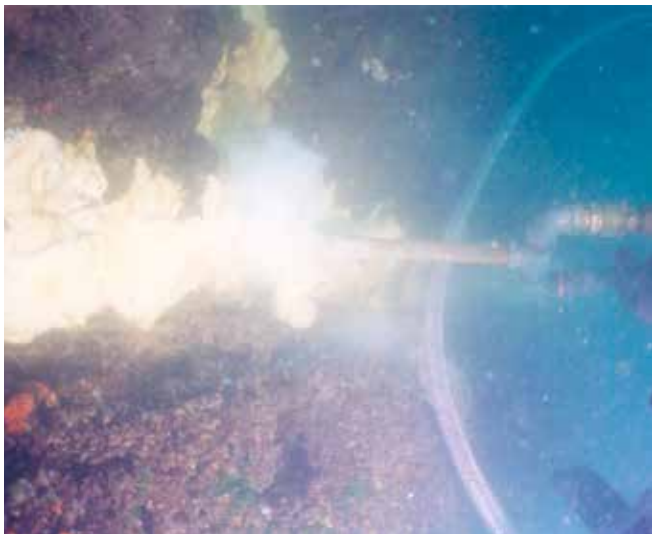
Where to Use:

- Underwater repairs to concrete, wood and steel

Package Size:

- 10 US gallon (37.9 L) kit
- 4 US gallon (15.1 L) kit
- 2 US gallon (7.6 L) kit
- ½ US gallon (1.9 L) kit

Shelf Life:
2 years in original unopened packaging



Evaluation

On-site evaluation should be conducted by a licensed inspector before initiating any repair protocol. This evaluation is critical when planning any marine repair to develop the most effective repair solution for each situation, and should include:

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

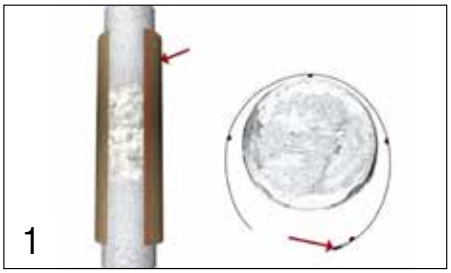
Site Preparation

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.

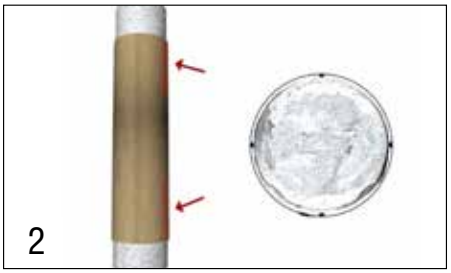
FX-70 Jacket Spacers

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 maximize shipping efficiency. See pg. 9 for recommended annular void recommendations.

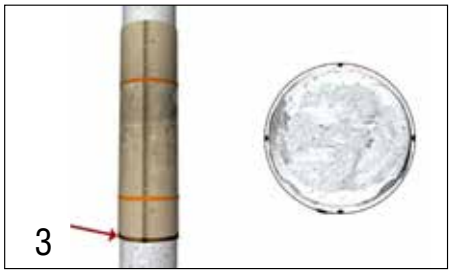
Installation *(Round pile shown; other applications similar)*



Install a bead of FX-763 Low-Modulus Trowel Grade Epoxy into the locking groove of the jacket and place FX-70 jacket around the pile to be repaired.

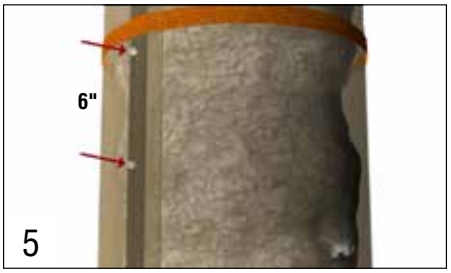


"Close" the jacket by inserting the tongue into the locking groove of the jacket. Position the jacket so there is 18–24" (457-610 mm) of undamaged pile inside the jacket above and below the damaged area.

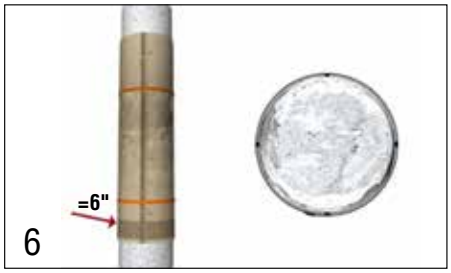


Install temporary bottom seal at base of jacket. Seal may be installed prior to placing jacket.

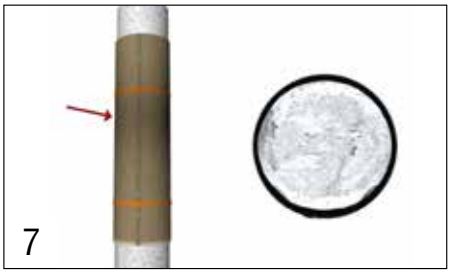
Install external bracing. Ratchet straps shown for round pile bracing.



Install a stainless steel, self-tapping machine screw every 6" (152 mm) o.c. to secure the tongue-and-groove joint.



Install 6" (152 mm) of properly mixed FX-70®-6MP Multi-Purpose Marine Epoxy Grout to create bottom seal; **allow grout to cure overnight.**



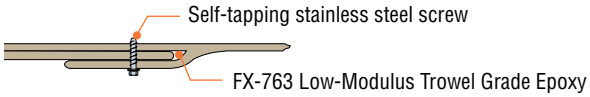
For piles with ≤ 25% section loss, fill remaining void in jacket with FX-70®-6MP. For piles with > 25% section loss fill void with FX-225 Non-Metallic Underwater Grout, leaving 4" (102 mm) open at head of jacket. Allow repairgrout to cure overnight. For FX-225 repairs, fill remaining 4" (102 mm) void with FX-70®-6MP, and allow grout to cure overnight.

Install FX-763 Low-Modulus 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.

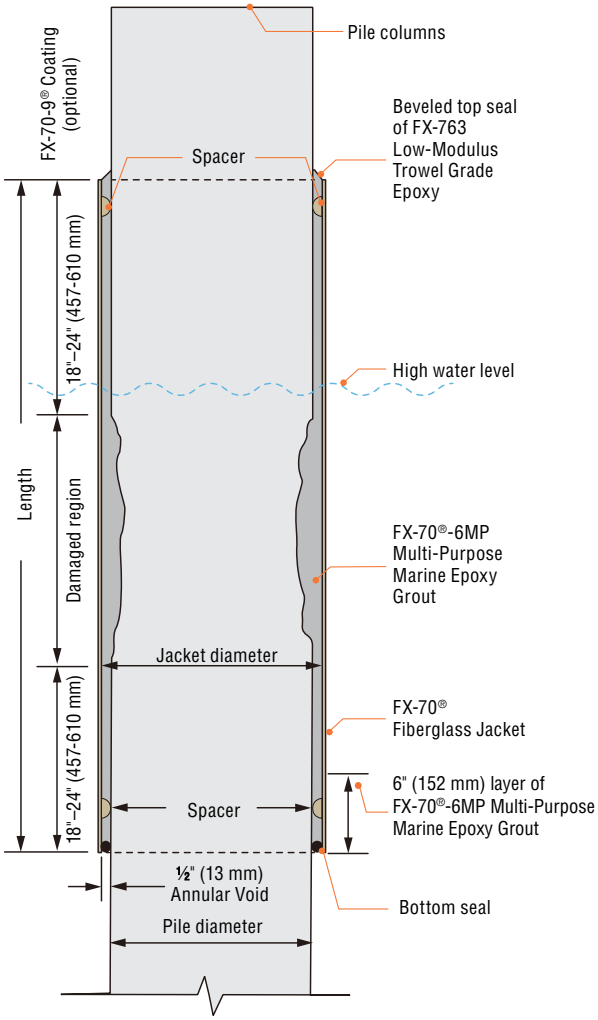
Remove ratchet straps. Repair complete.

Repair Options Based on Section Loss

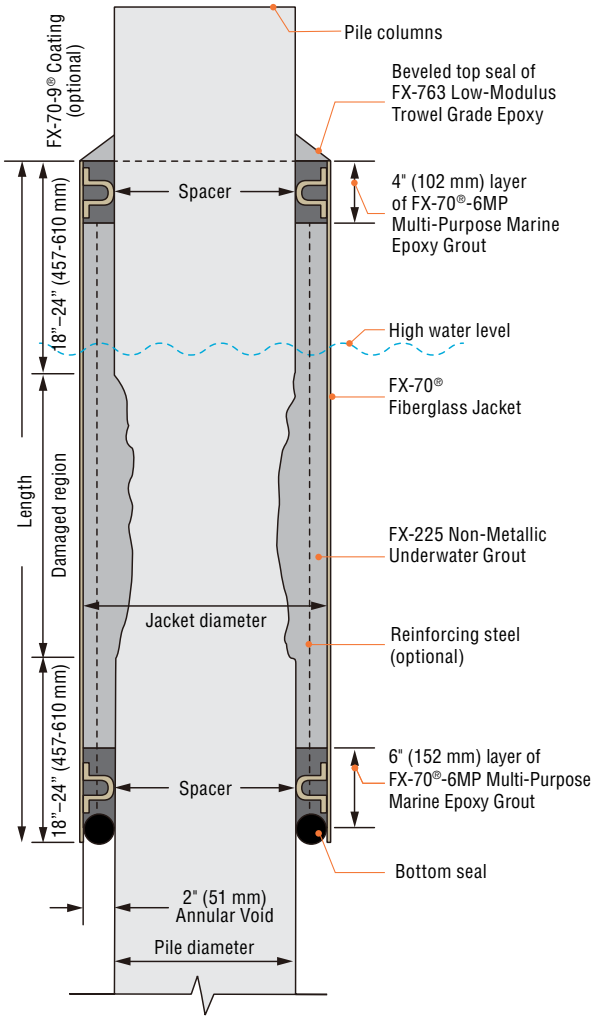
CROSS-SECTION OF TONGUE-AND-GROOVE JOINT



Section Loss ≤ 25%



Section Loss > 25%

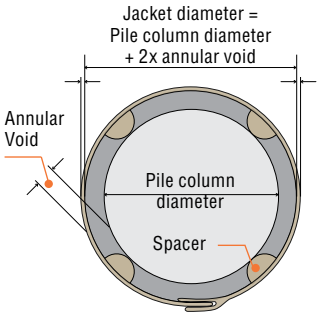


Section Loss ≤ 25%

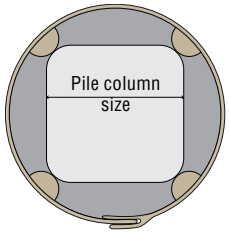
- FX-70®-6MP Multi-Purpose Marine Epoxy Grout used for bottom seal and repair
- Typical annular void of ½" (13 mm)
- ¾" (19 mm) annular void for H-piles

Section Loss > 25%

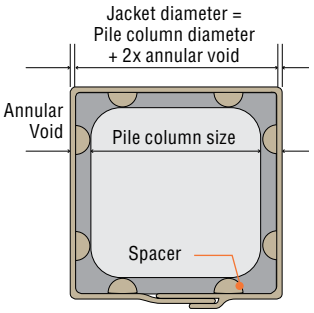
- FX-70®-6MP Multi-Purpose Marine Epoxy Grout used for top and bottom seal
- FX-225 Non-Metallic Underwater Grout used for repair
- Typical annular void of 2" (51 mm)



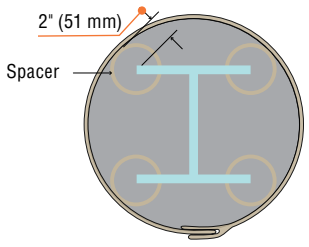
MODEL ONE



MODEL TWO



MODEL THREE



MODEL FOUR

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

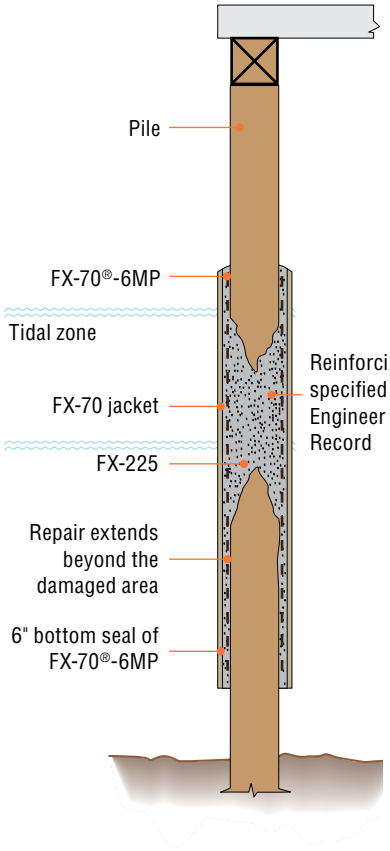
- FX-70® Jacket fabricated in H-pile shape
- Two-piece construction
- Standard annular void is ¾" (19 mm)
- FX-70®-6MP Multi-Purpose Marine Epoxy Grout used for repair

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 6" (152 mm) and top 4" (102 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

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 0°F to 100°F (-18°-38°C)
- If untreated, structure was in danger

Jacket dimensions: 55 in. (1.4 m) diameter, ⅛ in. (3 mm) thick, 8 ft. (2.4 m) length, with a ½ in. (13 mm) annular void

- Placed in splash zone
- Filled with FX-70®-6MP Multi-Purpose Marine Epoxy Grout
- No dewatering required

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

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

Example of pile "scour"

3 FX-70®-6MP grout mixed in work boat

4 FX-70®-6MP grout placed in jacket without dewatering

30 Years Later

View of piles repaired with FX-70® System on western shore approach

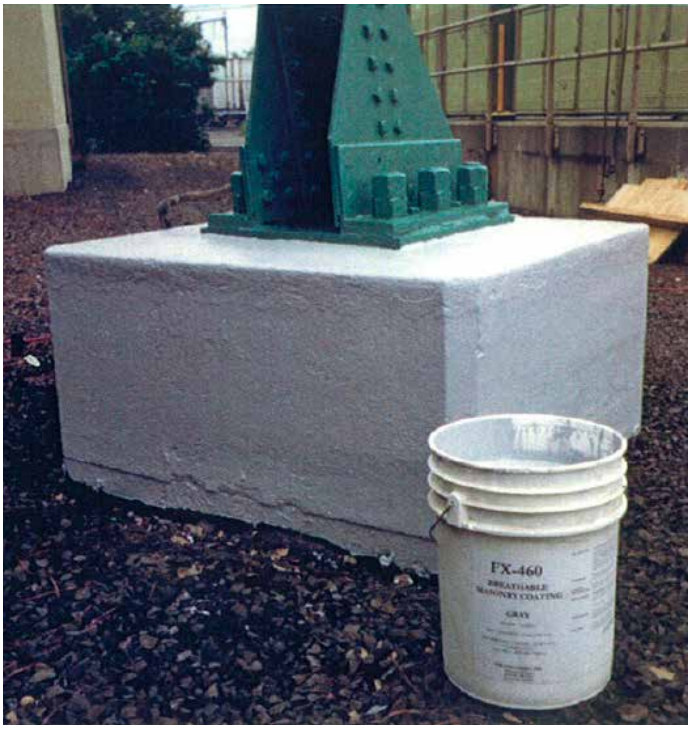
Close up of FX-70® repair to Bent #1A; in service 30 years

Paulsboro Refinery

Severe damage to concrete foundation

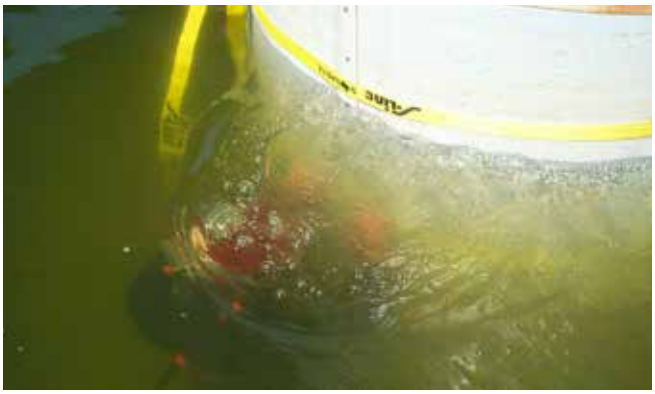
Foundation prepared and excavated; FX-70 jacket installed below ground level for additional protection

FX-70 jacket installed and backfilled

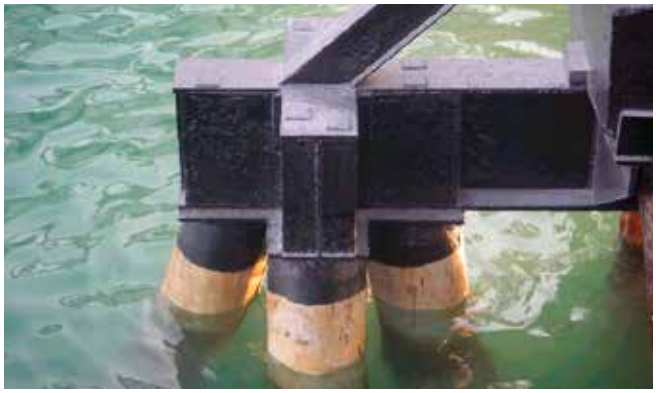


Repair completed with FX-70®-6MP Multi-Purpose Marine Epoxy Grout as the bottom and top seal material, FX-928 Concrete Mix as the structural infill material, and FX-460 High-Performance Breathable Coating System as the finish coating.

Before



After



SIMPSON Strong-Tie®

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, State:** _____

Project Information

Project Name: _____ **City, State/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:	Feet per Jacket :			Various Lengths: (If various lengths, list each separately)		
Jacket Thickness:	☐ ⅛" (3 mm)	☐ 3⁄16" (5 mm)	☐ ¼" (6 mm)	☐ Other _____		
Number Of Vertical Joints:	☐ None	☐ 1	☐ 2	☐ 3	☐ 4	☐ Other
Jacket Color:	☐ Translucent	☐ Gray	☐ Brown	☐ Other _____		
Spacers / Standoffs:	☐ ½" Spacers	☐ 1" Spacers	☐ 2" Standoffs	☐ Other _____		
Size of Annular Void:	☐ ½" (13 mm)	☐ ¾" (19 mm)	☐ 1" (20 mm)	☐ 2" (51 mm)	☐ 4" (102 mm)	☐ Other _____
Filler Material:	☐ FX-70®-6MP		☐ FX-225	☐ Other _____		

Please return completed form(s) to *fx70@strongtie.com* along with copies of project specifications and drawings.

SIMPSON
Strong-Tie
®

Simpson Strong-Tie has become a trusted manufacturer of chemical, mechanical, direct-fastening, and carbide drill bits and accessories since entering the market in 1994.

Now in our 20th year, we continue to expand our product offering to provide the most comprehensive product offering to serve infrastructure, commercial, industrial, and residential construction markets. The innovative products in this guide are the result of more than 40 years of laboratory development, field study and contractor input, and have passed the rigorous performance and quality assurance testing you have come to expect from Simpson Strong-Tie. We will continue to expand upon this line of repair, protection and strengthening products, and provide our customers with industry-leading jobsite, technical, and customer support.

For the most up-to-date information and new product releases, please visit www.strongtie.com/rps or call us at 800-999-5099.

This flier is effective until December 31, 2015, and reflects information available as of September 1, 2014. This information is updated periodically and should not be relied upon after December 31, 2015; contact Simpson Strong-Tie for current information and limited warranty or see www.strongtie.com.

 • P.O. Box 10789, Pleasanton, CA 94588 **F-R-FX7014 9/14 exp. 12/15**

800-999-5099
www.strongtie.com