

September 2015

Marine Pile Restoration and Corrosion Protection Systems



FIVE STAR
MARINE

Most trusted to provide the total solution.™

Agenda

- Who is Five Star Marine, Inc.?
- Product Solutions
- Types of Pile Deterioration
- Choosing an Appropriate Repair Solution
 - Extreme Deterioration
 - Serious Deterioration
 - Moderate Deterioration/Protection
- Other Products for Marine Pile Repair
 - Cementitious Grouts
 - Epoxy Grouts
 - Adhesives & Sealants

Five Star Marine® Product Solutions

From True Structural Repair Systems To Heavy-Duty Protective Wraps

- Cementitious & Epoxy Fill Materials
- Fiberglass (FRP) & Nylon Pile Jackets
- Marine Coatings, Adhesives & Gels
- Marine Repair Mortars
- Marine Pile Restoration & Corrosion Control Systems

The background of the slide features a vibrant image of water splashing, creating numerous droplets and bubbles. A bright rainbow is visible in the upper left portion of the image, adding a colorful, naturalistic touch to the overall design.

There are many causes for

PILE DETERIORATION

CONCRETE Deterioration

The challenging marine environment, weathering, and poor construction practice leads to concrete failure:

- 1) Corrosion of steel and the resulting expansive forces
- 2) Freeze-thaw deterioration
- 3) Sulfate attack
- 4) Alkali-silica reaction
- 5) Impact damage



WOOD Pile Deterioration

Shipworms are not worms at all, but rather a group of unusual saltwater clams with very small shells, notorious for boring into wooden structures that are in sea water.



STEEL Pile Deterioration

Three elements are required for corrosion to exist:

1. A protected metal
2. A corroded metal
3. A current-conducting medium between the two (electrolyte).

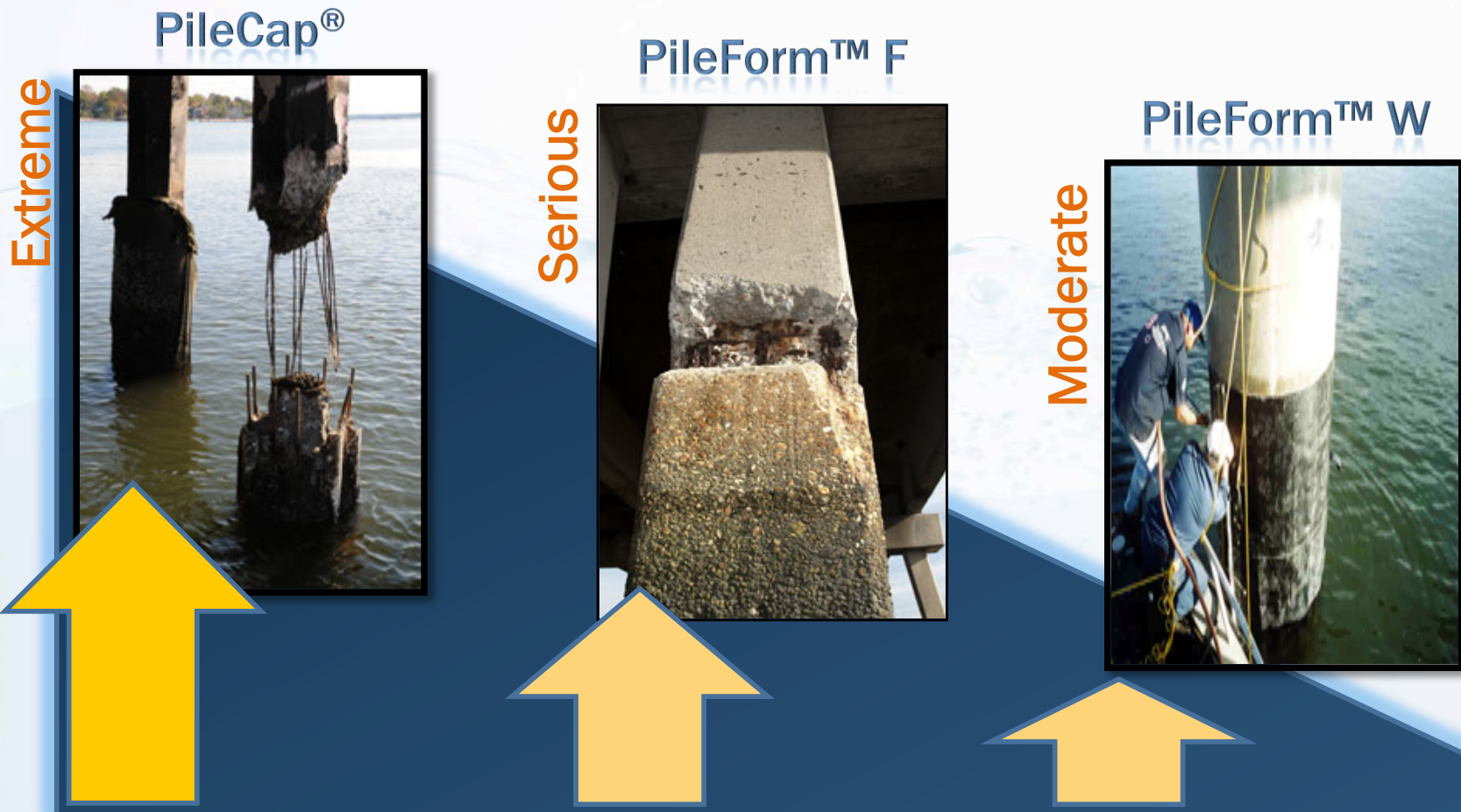


The background of the slide features a vibrant blue sky and a deep blue sea. A bright, multi-colored rainbow arches across the upper left portion of the frame. In the foreground, the white, frothy wake of a boat stretches across the water, with numerous small, sparkling droplets of water suspended in the air, creating a sense of motion and freshness.

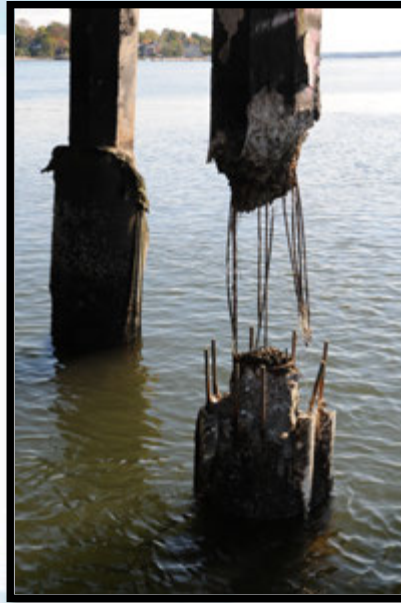
Five Star Marine® **SOLUTIONS**

Choosing the Appropriate Repair Solution

- Different levels of deterioration require different repair or protection methods...



Extreme



PileCap® Marine Pile Restoration Systems for
EXTREME DETERIORATION



PileCap™ Steel System

Designed to repair severely corroded or breached steel piling. The structural jacket becomes a permanent form for strength and durability by bearing the pile's intended load while eliminating corrosion and preventing further damage to the pile.



PileCap™ HP-Pile System

Fully restore the load bearing integrity to an existing HP-Pile by removing the damaged portion and replacing it with a new portion. The new section of piling is connected to the existing.

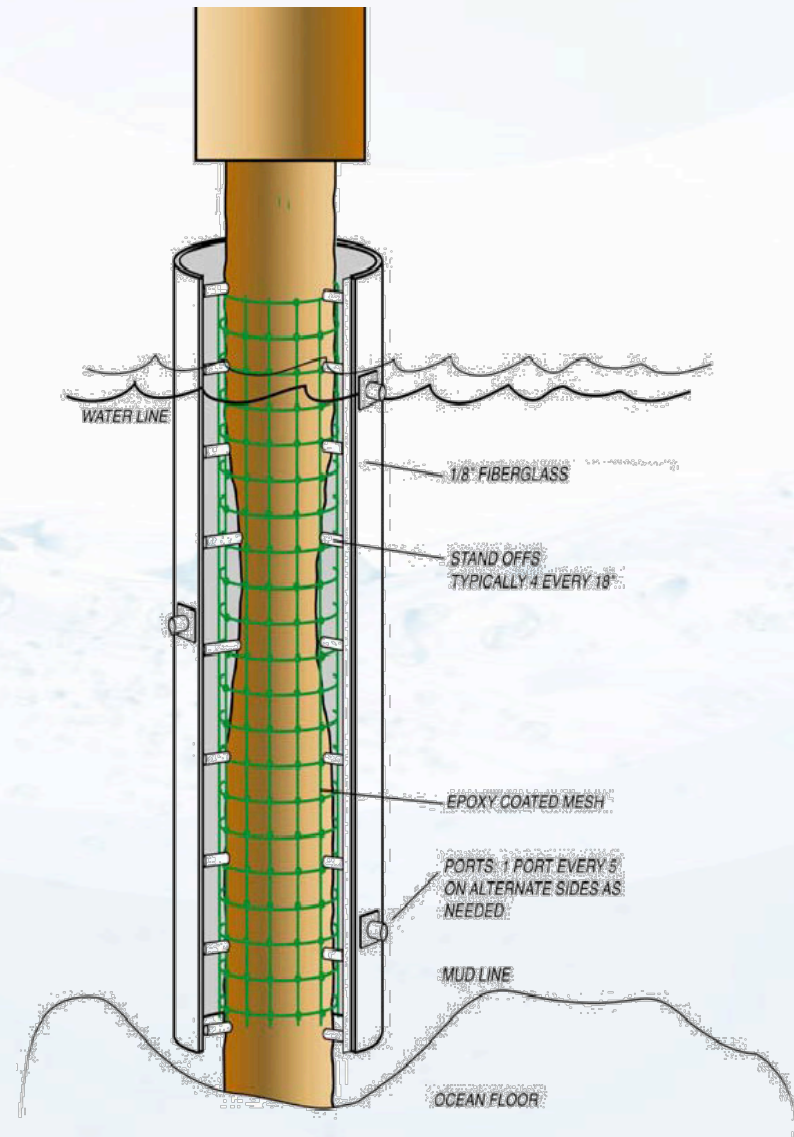
Serious



PileForm™ F (FRP) Marine Pile Encapsulation Systems for
SERIOUS DETERIORATION

PileForm™ F (FRP) Fiberglass Jackets

- **PileForm™ F (FRP)** fiberglass jackets provide protection for piles in hostile environments:
 - Salt water
 - Ice
 - Floating debris
 - Tidal action
 - UV degradation
 - Chemical pollutants
 - Acids
 - Oils



PileForm™ F (FRP) Fiberglass Pile Jackets

Come in a variety of shapes and custom sizes:



- | | |
|-------------|-------------------------------|
| 1. Round | 4. Pile Capitals |
| 2. Square | 5. Customized to your designs |
| 3. H Shapes | |



Round PileForm™ F (FRP) Fiberglass Jackets

Typical timber pile repairs utilizing PileForm™ F (FRP) jackets and engineered fill materials.

ADVANTAGES of the PileForm™ F Systems

- ✓ Easy installation
- ✓ Lightweight for easy maneuvering by divers
- ✓ Non-corrosive
- ✓ High strength
- ✓ Excellent solvent and chemical resistance
- ✓ High abrasion and impact resistance
- ✓ Five Star Marine® professional engineers will help you consider a number of design elements for the perfect custom solution



Engineered Fill Systems Are a Permanent Fix



Engineers Drill Core Samples

Samples Display Full Penetration
and Superior Bonding



Moderate



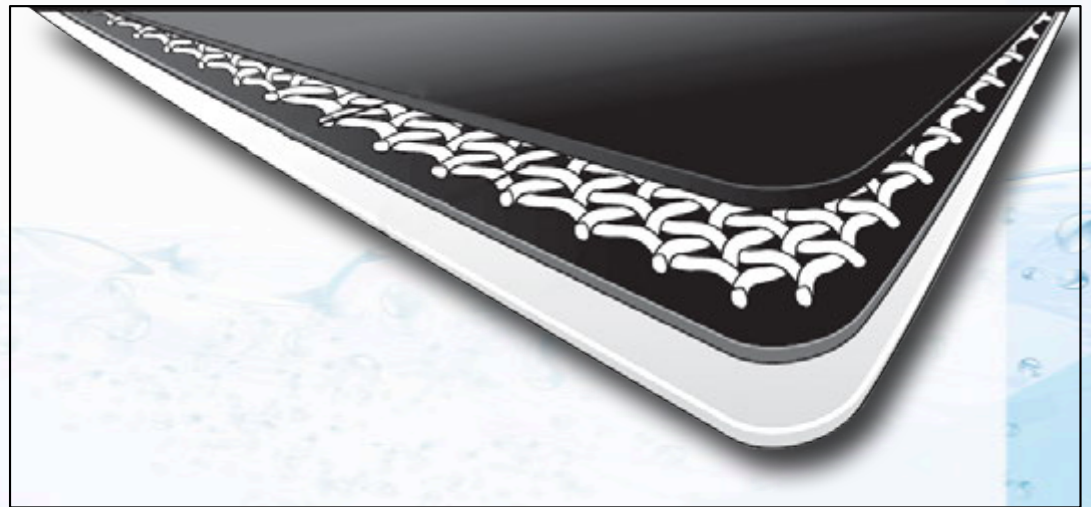
PileForm™ W Retrowrap™ Corrosion Control Systems for

NEW PILES OR MODERATE DETERIORATION

PileForm™ W Retrowrap™ Corrosion Control Systems

Provides splash zone and underwater corrosion protection to new and existing piles, pipelines and risers.

Components which combine to form the Five Star Marine® PileForm™ W Retrowrap™ system are resistant to long term immersion in both seawater and fresh water, and to the attendant biological and chemical attack.



The system will withstand attack from environmental UV, ozone and temperature variations while providing permanent protection in service, by resisting wave and current forces.

PileForm™ W Retrowrap™ HD

- ✓ Multilayer, heavy-duty construction
- ✓ Does not require substrate shotblast preparation
- ✓ Provides the highest abrasion resistance
- ✓ Full-length closure flanges for easy installation
- ✓ Easy removal and replacement for reinspection
- ✓ Provides active protection with environmentally safe corrosion inhibitors
- ✓ Hoop tension forces created within the outer skin resist high wave suction forces



Five Star Marine® Offers A Full Line of

PILE REPAIR PRODUCTS

Structural Repair Products

- Five Star Marine® offers solutions for the structural repair and rehabilitation of above-water and underwater structures:
 - Structural Concrete Underwater HP
 - Perfect for small volume hand placements with minimal washout underwater.
 - Structural Concrete Underwater PG
 - Excellent pumping properties and minimal washout during large volume placements. Provides increased corrosion protection of steel reinforced structures with migrating corrosion inhibitor.
 - Splash Zone Epoxy Compound
 - 100% solids, two component epoxy compound .
 - Waterproof Plug
 - Fast-setting hydraulic cement that stops active leaks.

Engineered Fill Materials

- Epoxy Pile Jacket Grouts
 - FSM Pile Jacket Epoxy Grout HP
 - FSM Pile Jacket Epoxy Grout
 - FSM Pile Jacket Epoxy Grout LPL
- Cementitious Pile Jacket Grouts
 - FSM Structural Concrete UW PG
 - FSM Cementitious Underwater Grout
 - FSM Cementitious Underwater High-Strength Grout

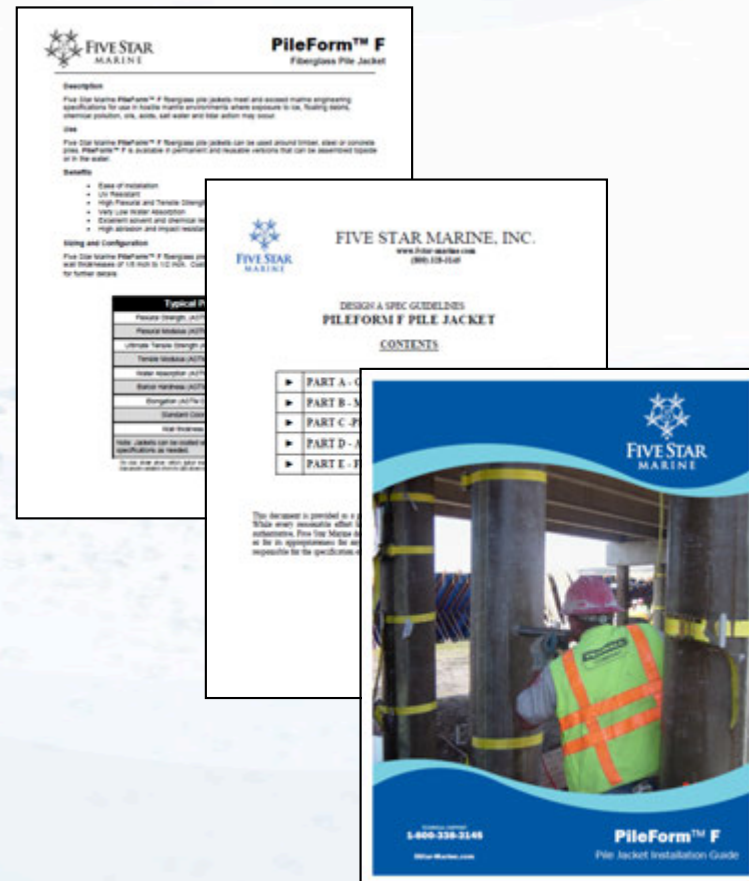
Erosion Control Products

- Tidal/Wave action and flooding cause erosion and the undermining of structures:
 - PileForm™ ABM
 - PileForm™ ABM mats are useful tools for underpinning and slope stabilization.
 - PileForm™ SPB
 - Scour Protection Bags represent a revolutionary step forward in the technology of underwater scour protection.



Support Materials

- Five Star Marine® has all the support material needed to specify and install any marine pile stabilization, rehabilitation and protection project:
 - Datasheets
 - SDS
 - Design-A-Spec™ Guides
 - Installation Guides and Videos
 - Detail Drawings



Thank you for your time!

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