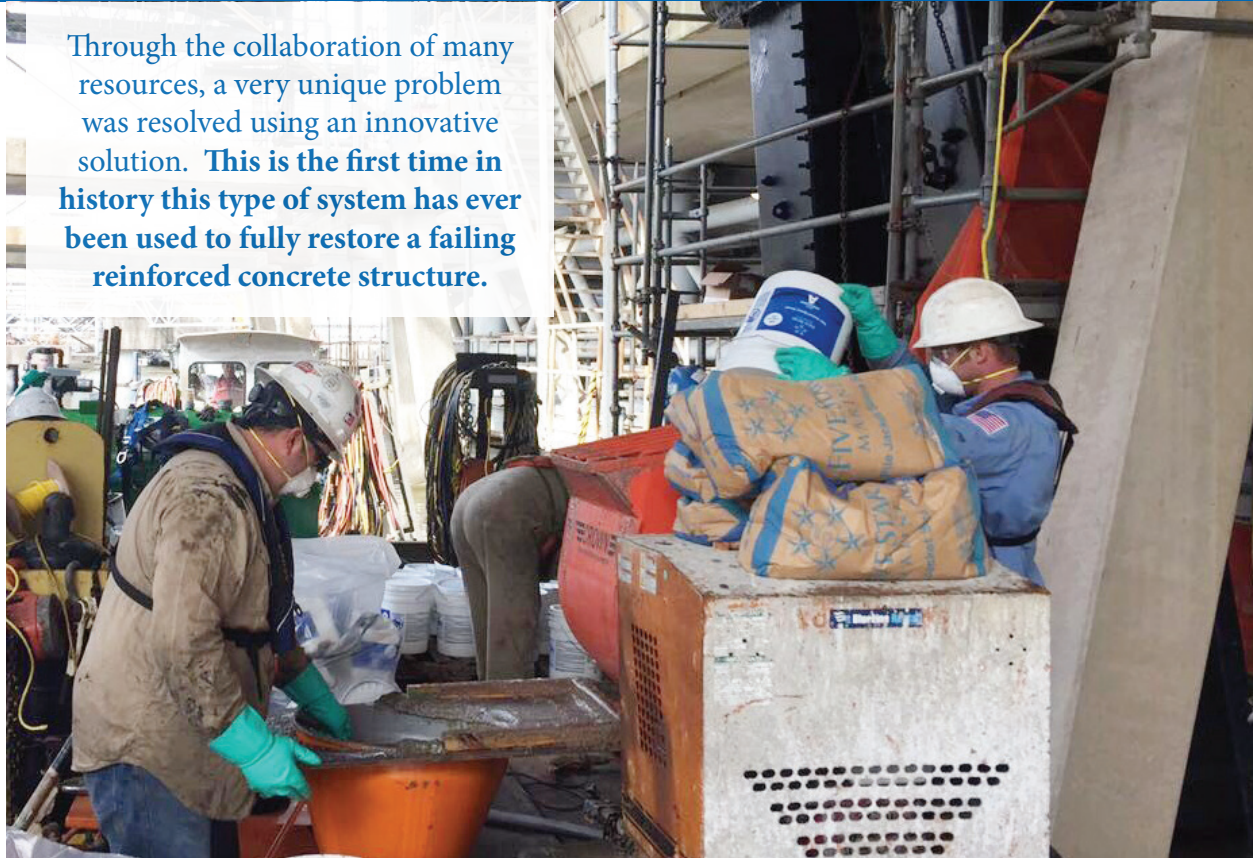


# SOLUTIONS | Case Study



Through the collaboration of many resources, a very unique problem was resolved using an innovative solution. **This is the first time in history this type of system has ever been used to fully restore a failing reinforced concrete structure.**



## Dock Pile Restoration Phase 1

Deer Park, TX

### Products:

Five Star® Pilecap® Concrete System (Custom)

Five Star® Pile Jacket Epoxy Grout LPL (Fill Material)

Five Star® Splash Zone

Five Star Structural Concrete® V/O

Pilecoat® Epoxy Primer



**FIVE STAR**

Specified by the World's Best™

# Dock Pile Restoration Phase 1

**Date of Project:** March 2017

**Project Owner:** Shell Deer Park

**Project Contractor:** Orion Marine

**Project Engineer:** Lanier & Associates

**Market/Environment:** Marine Pile Restoration

**Substrate:** Reinforced Concrete Piles



## Project Details

Years ago, a chemical fire broke out at one of the shipping docks at a refinery in Deer Park, Texas. Reinforced concrete supporting piles that were exposed to the fire were damaged by the intense heat. Portions of the aggregate and cement matrix at the outer face of the piles became so hot they essentially baked off and broke away from the rest of the pile reducing the cross-sectional area and exposing the reinforcing steel leaving it vulnerable to corrosion in the saline environment and compromising the structural integrity of the piles.

## The Challenge

An emergency repair was implemented and the damaged areas were repaired using a concrete repair material. Years later, these repair patches of concrete began to crack away and spall, thus exposing the reinforcing steel again.

After further investigation, it was decided that the two adjacent batter piles under the same bent were in critical condition due to further corrosion of reinforcing steel and cracking of the concrete. Driving new piles was not an option, as vibrations could compromise or damage other nearby supporting piles. Another type of emergency repair was needed.

The Five Star Products marine division was presented with the challenge of designing a custom metal sleeve to fit the irregular shaped rectangular batter piles that tapered from a 24" x 24" section down to a 20" x 20" section closer to the water line. Another obstacle was presented in that one pile must be fully repaired before the other could be repaired because the piles and pile bent were not strong enough to simultaneously support the weight of both metal sleeves during installation.

## Five Star® Solution

The engineers on record needed a fully structural, permanent repair that could be performed in a short amount of time. The Five Star® Pilecap® Pile Restoration System was chosen as the best option of repair having met these criteria.

To resolve the issue of the difficulty in manufacturing a tapered metal jacket, it was decided to use 20' long, 26" x 26" rectangular, two-piece jackets to be clamped at opposite corners around the piles maintaining a 1" annulus between metal jacket and concrete at the top section tapering to a 2" annulus at the bottom section. Five Star® Pile Jacket Epoxy Grout LPL was chosen to fill the annular space between the jackets and concrete pile due to its mechanical properties, pumpable consistency, long working time, and ability to be placed underwater.

The basis of the repair system relied on the high compressive, flexural and tensile strengths and superior bond of the epoxy grout to the concrete and metal surfaces to transfer any lateral and downward forces from the deck above through the pile to the rigid metal jacket.

After delivery of material and staging of equipment, the entire project was completed in only 4 days (2 days per pile). The piles were restored to full capacity after the grout cured for just 24 hours.

## FIVE STAR® SERVICES

- Design-A-Spec™ engineering specification assistance
- Technical on-call center with field and project experienced staff
- Field support representatives for on-site consultation
- Corporate research laboratory available to customize products for unique applications

U.S. Patent No. 6,561,736.

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For worldwide availability, additional product information and technical support, contact your local Five Star® licensee, distributor, local sales representative, or you may call the Five Star Products' Engineering and Technical Service Center at 1-800-243-2206.



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