FX-70® INERT CORROSION-FREE SYSTEMS

Structural Restoration and New Construction

PILES-PIERS-MARINE STRUCTURES

CONCRETE

Reconstructed with FX-70®

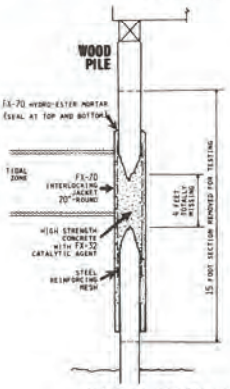
pages 6-7

corrosion

STEEL

Protected with FX-70®

pages 8-9

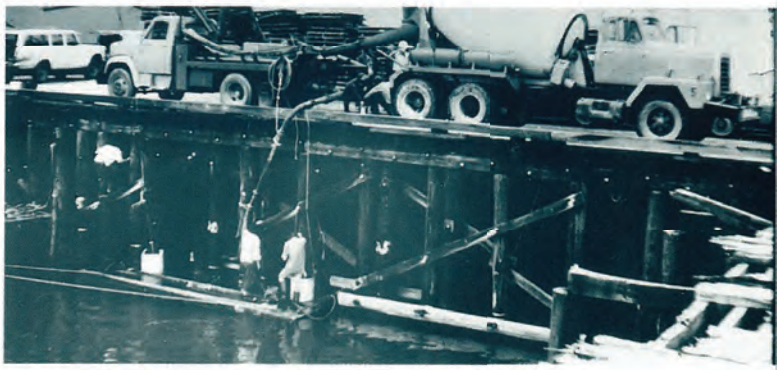


missing sections

WOOD

Reconstructed with FX-70®

pages 10-11



NEW STRUCTURES

Protected with FX-70®

pages 12-13

U.S. PATENT NO. 4,019,301

DENSO, INC. - 9710 TELGE ROAD, HOUSTON, TX 77095 - (281) 821-3355

FX-70® INERT CORROSION-FREE SYSTEMS

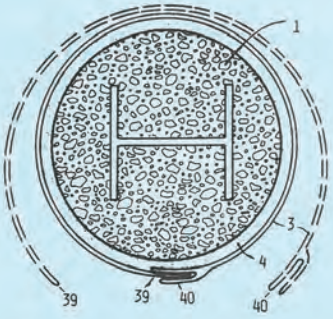


fig. A

1 - CONCRETE PILE
3 - FX-70® INTERLOCKING JACKET
4 - FX-70-6 HYDRO-ESTER MORTAR
39 - TONGUE OF INTERLOCK
40 - GROOVE OF INTERLOCK (FILL WITH FX-763 TROWEL GRADE)

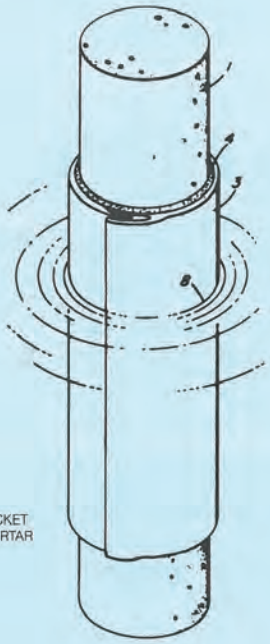


fig. B

1 - CONCRETE
3 - FX-70® INTERLOCKING JACKET
4 - FX-70-6 HYDRO-ESTER MORTAR
8 - WATERLINE

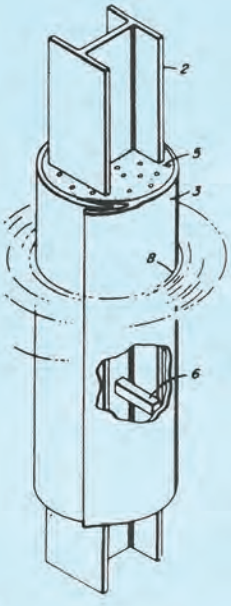


fig. C

2 - STEEL H-PILE
3 - FX-70® INTERLOCKING JACKET
5 - FX-32® CONCRETE OR GROUT
6 - SPACER
8 - WATERLINE

CORROSION PROTECTION BREAKTHRU

Protection of marine structures at the waterline and below was an engineering problem that has now been solved. On some structures a layer of concrete protects steel H-piles or reinforcing bars. On other structures, a layer of steel protects a concrete core.

Should concrete protect steel . . . or should steel protect concrete? Neither has been entirely satisfactory. Both steel and concrete are attacked at the waterline.

Wood piles are often left unprotected and vulnerable to marine borers. With the escalating cost of replacement, waterline protection is both economic and worthwhile.

A technological breakthru has been needed for a long time. Now it is here ... and proven in protective systems in service.

THE FX-70® SYSTEMS

Severe structural damage at the waterline has been discovered in concrete, steel, and wood piles all over the world. Until now replacement was the only real alternative. With the FX-70® Inert Corrosion-Free System, it is both possible and practical to restore the structural integrity of any pile. Furthermore, this complete structural restoration can be accomplished without costly de-watering and without interrupting use of the structure.

The basic FX-70® concept utilizes a permanent high strength reinforced hydro-ester outer surface for protection against salt water, corrosive pollutants, cycles of wetting and drying, cycles of freezing and thawing, and deterioration by electrolysis.

A group of products, starting with the FX-70® jacket as shown on pages 14 and 15, are used in various combinations to economically meet a wide range of job conditions. On page 5 there are detailed descriptions of each product.

FX-70® PROTECTIVE OUTER SURFACE

This inert corrosion-free surface is available as round or square interlocking jackets, flat sheets, seamless shells, or custom shapes. Wall thicknesses range from 1/8" to 1/2" depending on application.

HIGH BOND TO CONCRETE, STEEL, WOOD

The two-component FX-70® Hydro-Ester compounds (FX-763, FX-70-6, FX-70-9, and FX-498), all bond tightly to wet or dry surfaces of concrete, wood, steel and other structural materials. The water-insensitive formulation of these materials make it possible to work successfully in wet environments.

Structural Restoration and New Construction

WORK IN WATER

Reconstruction of severely damaged piles can be accomplished quickly and economically without building cofferdams or using other expensive de-watering equipment. Small equipment and ordinary construction skills are all that is needed to get this long-lasting protection for marine structures.

RECONSTRUCTION AND RESTORATION

For structural restoration work or protection on new piles, the FX-70® interlocking jackets are simply spread apart and slipped around the pile. A small work crew with one diver fixes the jacket firmly in position and FX-70-6 Hydro-Ester mortar or grout is poured thru water, displacing the water, and bonding the bottom edge of the jacket to the concrete, steel or wooden pile.

Where the remaining void space is of large volume (as in reconstructing piles), a high strength cementitious grout, mortar or concrete containing FX-32® Catalytic Admixture is pumped or tremied into place. At the top edge of the jacket another layer of FX-70-6 Hydro-Ester mortar provides a tight, impervious seal.

ADVANTAGES OF FX-70® SYSTEMS

Application procedures utilize proven materials and chemical systems already well known in the construction industry. The FX-70® Hydro-Ester compounds are designed for field use in wet environments. High strength and bond are developed by chemical reaction.

Costly maintenance and repetitive repairs are eliminated. High structural strength combined with inert chemical properties make the FX-70® Systems the most practical way to reconstruct piles and prevent steady deterioration from salt water, corrosive pollutants, ice action, floating debris, marine borers, electrolysis and ordinary weathering.

PROVEN IN SERVICE - ASK FOR TEST RESULTS

Original laboratory testing began in 1970. Field applications began in 1971 and are performing well today. Projects range widely in geographic areas including West coast, Gulf coast, East coast, inland waterways, and overseas. Exposure conditions include tidal action, river currents, salt water, fresh water, ice action, and various pollutants.

Numerous tests have been run by government and independent laboratories covering specific applications of the FX-70® systems including: structural rebuilding of piles, restoration of deteriorating surfaces, and protection of new structures. Just outline your need. Detailed test data on similar applications may already exist.

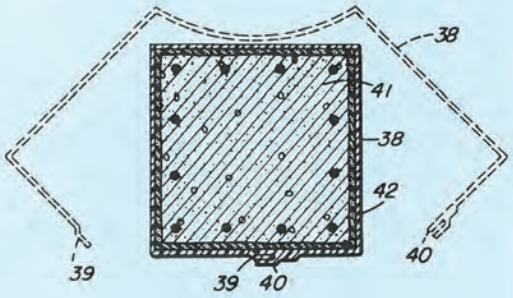


fig. D

38 - FX-70® INTERLOCKING JACKET
39 - TONGUE OF INTERLOCK
40 - GROOVE OF INTERLOCK (FILL WITH FX-763 TROWEL GRADE)
41 - CONCRETE PILE
42 - FX-70-6 HYDRO-ESTER MORTAR

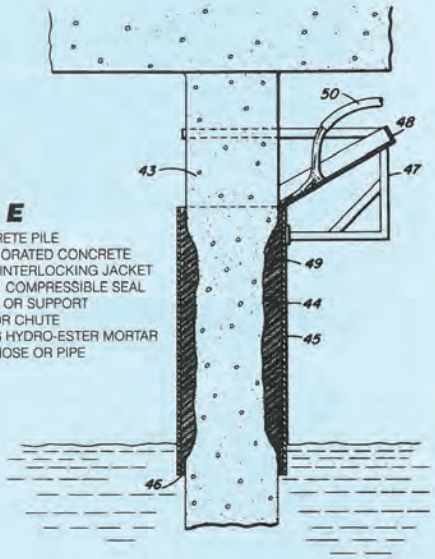


fig. E

43 - CONCRETE PILE
44 - DETERIORATED CONCRETE
45 - FX-70® INTERLOCKING JACKET
46 - FX-70-1 COMPRESSIBLE SEAL
47 - FRAME OR SUPPORT
48 - TRAY OR CHUTE
49 - FX-70-6 HYDRO-ESTER MORTAR
50 - FEED HOSE OR PIPE

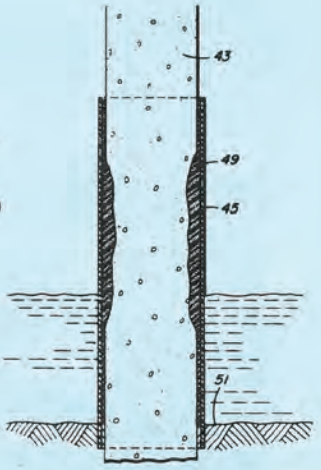
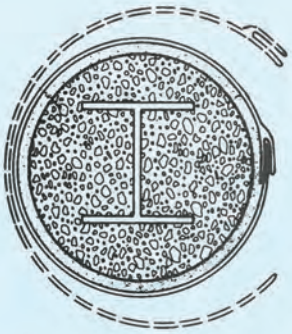


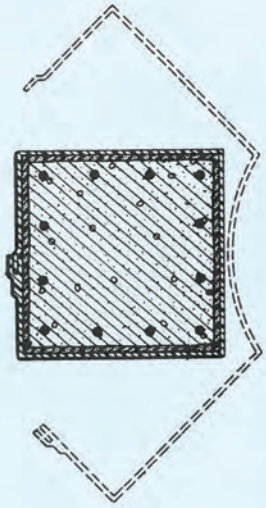
fig. F

43 - CONCRETE PILE
45 - FX-70® INTERLOCKING JACKET
49 - FX-70-6 HYDRO-ESTER MORTAR
51 - BOTTOM (MUDLINE)

FX-70® INTERLOCKING JACKETS



FX-70® PROTECTIVE SURFACES Minimum Structural Properties at 73.4°F (23°C)	INTERLOCKING JACKET (More than 16" square/round)	INTERLOCKING JACKET (16" & under square/round)
Tensile Strength — Ultimate — (ASTM D638-68)	12,000 psi	14,500 psi
Flexural Strength (ASTM D796-66)	25,000 psi	
Modulus of Elasticity Flexural (ASTM D790-66)	.7 x 10^5 psi	7 x 10^5 psi
Izod Impact (ASTM D256)	15-20	15-20
Density	78#/cu. ft.	78#/cu. ft.
Electrical Properties (ASTM D150)	Dielectric Constant — 4.5 @ 60 H2	



The full length of this square FX-70® interlocking jacket is easily opened by one man for positioning around a pile. This saves field time and is a great advantage where the jacket must be handled by divers.

MANUFACTURING TO YOUR NEEDS

FX-70® Interlocking Jackets are manufactured at the Fox Manufacturing plant in Baltimore, Maryland. Dimensions, chemical composition, and overall quality are closely controlled to assure long dependable service in field applications all over the world.

Fox has pioneered the development of materials and techniques to reconstruct piles of all types so they provide the full structural capacity of the original design. On new structures the FX-70® System Materials provide inert corrosion-free protection at the waterline and thus eliminate the most frequent source of costly maintenance.

Curing room is an important step in the closely controlled manufacturing process.

Light weight of only 1 pound per square foot of 1/8" thick surface make handling of FX-70® jacket both safe and fast.

FX-70® SYSTEM MATERIALS

FX-70® HYDRO-ESTER JACKETS

These are available in standard shapes, round and square, in sizes from 8" to 54". Special shapes, including H-shape for steel H-piles, can be made to suit any requirement for new work or reconstruction of piles and piers. FX-70® Jackets have a tensile strength of 12,000 psi, and will not corrode even in highly polluted water.

FX-70®-1 COMPRESSIBLE SEAL

This closed-cell inert foam material is bonded to FX-70® Hydro-Ester jackets with FX-70-2 adhesive to provide a seal along the bottom edge of the jacket adapting to any slight surface irregularities.

FX-70®-2 ADHESIVE

This fast-setting one-component adhesive is used to bond the FX-70-1 Compressible Seal to the FX-70® jackets.

FX-763 HYDRO-ESTER TROWEL-GRADE

This two-component (2:1 ratio) material is 100% solids and therefore does not shrink or crack upon curing. FX-763 is power-mixed just prior to application. The heavy trowel consistency is useful for an application on vertical surfaces to set anchor bolts, to bond plastic grouting valves, and to provide a permanent bond along the interlocking joint of the FX-70® jacket. FX-763 is also available in a faster setting "Cold Weather grade."

FX-741® HYDRO-ESTER FAST LV

The low viscosity of the FX-741 permits penetration in fine cracks and porous areas. This two-component system is 100% solids, and has a very short 4-minute pot life after mixing. FX-741 is used for grouting in damp or wet areas, and as a binder for rapid setting mortar when mixed with FX-701 Filler.

This mortar is also used for setting grout nipples just prior to the placement of FX-32® grout or FX-70-8 Premixed Grout.

FX-70®-6

HYDRO-ESTER POURABLE MARINE PACK

FX-70-6 Hydro-Ester Pourable Marine Pack is a moisture insensitive, two-component, 100% solids epoxy resin. It is used as a binder for mortar, when mixed with 3 to 5 parts of FX-700 Epoxy Extender (C Component) in conditions where a dry or wet environment is encountered. This material is specifically designed for use with FX-70 Inert Corrosion Free System.

FX-70®-6

HYDRO-ESTER POURABLE-GRADE

This 100% solids two-component material is used as a binder with FX-701 Oven-Dried Filler. The resulting mortar is very workable and will bond to wet or dry surfaces of concrete, steel, aluminum, or wood. Compressive strength will exceed 8,000 psi at 7 days. Also available in "Cold Weather grade."

FX-701 GRADED OVEN-DRIED FILLER

This siliceous base filler is specially graded to work well with the FX-70® Hydro-Ester two-component binders. Mortars and grouts can be mixed, placed, and finished easily without "tearing" the surface or using excessive amounts of the binders.

FX-70®-8 PRE-MIXED GROUT

Just add water to this dry mix to produce a very fluid non-shrink cementitious grout. Initial set is approximately 2 hours at 70°F and 28-day strengths exceed 8,500 psi tested in accordance with ASTM C-109.

FX-70®-9 HYDRO-ESTER COATING LV

This paintable 100% solids two-component formulation is used with the FX-70-10 Field Formed Protective System, and is applied by brush or roller. It penetrates the cloth and provides a high bond to concrete, masonry, wood, steel, and other exposed surfaces. Also available in "Cold Weather grade."

FX-70®-10

FIELD-FORMED PROTECTIVE SYSTEM

Inert fibers of the FX-70-10 System provide a layer of reinforcing to bridge across hairline cracks on structural surfaces. It is used with FX-70-9 to build up a multi-layer system on concrete, masonry, wood, or steel. The FX-70-10 fiber reinforcing is available in various widths including 4", 6", 12" and 36".

FX-498

HYDRO-ESTER HIGH-BUILD COATING

The medium consistency of this 100% solids two-component system makes it ideal for direct coating of structurally sound surfaces that are free of cracks. Clean surfaces need not be dry as FX-498 is not sensitive to dampness and will bond tightly to such surfaces.

The quality control laboratory is located next to the manufacturing area.

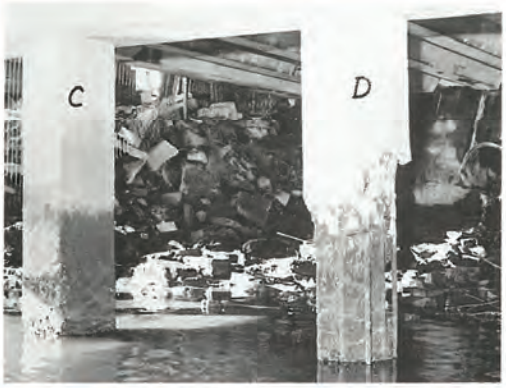
CONCRETE RECONSTRUCTED WITH FX-70®

CONCRETE PILE REPAIRS — MARYLAND

BAY CITY CONSTRUCTION CO., INC.

Severe deterioration of concrete at the waterline exposed the reinforcing steel to brackish tidal waters. Reconstruction of 2000 lineal feet of 23" square pile was accomplished with FX-70® Inert Corrosion-Free System.

1. Deteriorated concrete was removed by chipping.
2. Rectangular FX-70® jackets from 3 to 9 feet long were positioned around the piles down to the mudline.
3. FX-70-6 Hydro-Ester mortar was poured to seal the bottom perimeter.
4. Portland cement grout with FX-32® Catalytic Agent was used for the middle area.
5. Top was finished off with a seal of FX-70-6 Hydro-Ester mortar.



REPAIR OF STREET BRIDGE — LONG ISLAND

Disintegration of piles at the waterline on a local street bridge in Long Island, New York created an urgent maintenance problem for the county Public Works Department.

They needed a long lasting and economical method that could be performed by their own maintenance forces.

1. Piles were numbered and a reconstruction procedure was planned.
2. A test of the FX-70® system was carried out with supervision from Fox Industries.
3. After 3 years of successful performance, other piles were reconstructed with FX-70® materials.

PRESTRESSED PILES

18" square prestressed concrete piles with a 9" center void were used to cross this salt water bay. Several piles were damaged during construction, probably as a result of hitting boulders during driving. Cracks in the concrete exposed the prestressed wires to corrosion. A full scale test of corrective measures was made with the FX-70® system.

1. 32" round FX-70® jacket was placed around the pile with FX-763 used to seal the interlock.
2. Bottom was below mudline and was sealed with FX-70-6 Hydro-Ester mortar.
3. Cementitious grout made with FX-32® Catalytic Agent was pumped in through a bottom entry displacing all water.
4. Tests were successful and other damaged piles were repaired with this system.

CONCRETE RECONSTRUCTED WITH FX-70®

HIGHWAY BRIDGE — FLORIDA

Concrete protecting steel H-piles on this state highway bridge had deteriorated at the waterline exposing the steel to corrosion. Permanent and economical repairs were carried out by state highway personnel.

1. Deteriorated concrete was removed with a hydro laser.
2. 24" FX-70® jackets were cut to exact lengths, and the interlocking joint was filled with FX-763 Hydro-Ester Trowel Grade.
3. The jackets were placed in position around the pile, and FX-70-6 Hydro-Ester grout was poured through the water to make a tight seal at the bottom.
4. The next day the water was pumped out and an annular void was filled with concrete to within 3" of the top.
5. Top was sealed with a final layer of FX-70-6 Hydro-Ester mortar troweled to a neat beveled finish.

COUNTY DEPARTMENT OF PUBLIC WORKS

REHABILITATION OF PILE BENTS — VIRGINIA

Rehabilitation of the pile bents on a bridge in Norfolk utilizes the FX-70® Inert Corrosion-Free System.

1. Piles show severe deterioration.
2. After cleaning with accomplished high pressure water blasting, FX-70® protective jackets are placed around each pile.
3. FX-70-6 Hydro-Ester and FX-701 Filler are mixed mechanically to mortar consistency.
4. Mortar is poured into annular void displacing water and forming high chemical bond both to jacket and pile.

CROWDER CONTRACTING CO., INC.

"This 26th Street Bridge project has been most interesting and worthwhile, and I feel that it marks the beginning of a new, ideal type of repair for concrete bridges.

R.N. HARRELL
DEPT. OF PUBLIC WORKS
CITY OF NORFOLK

REPAIR OF DUAL HIGHWAY BRIDGE

Dual bridges carry a major traffic artery across a tidal river. Severe deterioration down to and behind steel reinforcing caused great concern.

1. Test sample of the FX-70® Inert Corrosion-Free system was installed in late 1971. Performance was very satisfactory.
2. In 1973, all piles were reconstructed using the FX-70® system with FX-70-6 Hydro-Ester mortar.

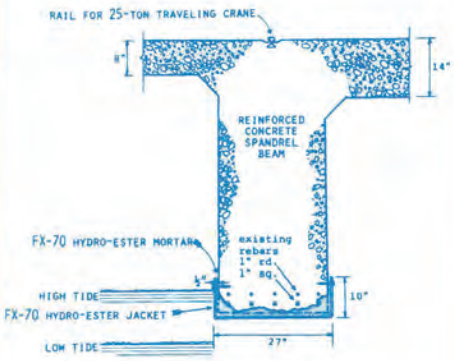
JOHN D. SHEETZ CONSTRUCTION CO.

COAST GUARD PIER — MARYLAND

Wet and dry twice each day since construction in 1941, has subjected the tension portion of the reinforced concrete spandrel beams under the 25 ton traveling crane to over 23,000 cycles of alternate wetting and drying with salt water. This severe exposure caused extensive deterioration of the concrete and corrosion of the reinforcing bars.

1. Deteriorated concrete was removed by high pressure water jet.
2. A channel-shaped FX-70® jacket was bolted into position on the underside of the beam.
3. FX-70-6 Hydro-Ester and FX-701 Filler were mixed to a heavy grout consistency and poured into the void area displacing the salt water, and bonding the jacket to the concrete.

EASTERN GUNITE CO.



STEEL RECONSTRUCTED WITH FX-70®

REPAIRS TO NAVY PIER — TEXAS

SAM PARISH
CONSTRUCTION CO., INC.

The H-piles on this U.S. Navy pier lost more than 50% of the steel section through electrolysis.

1. Water is used to clean pile surface. (note deterioration)
2. Welder attaches steel plates to span corroded section.
3. FX-70® interlocking jackets of 20" diameter are easily positioned in tight working space. Void is filled with concrete.

GRAIN PIER — LOUISIANA

Flowing water of the Mississippi River reduced the steel cross-section of these H-piles on the grain handling pier. Various repairs have been tried over the years. The current repairs are with the FX-70® system.

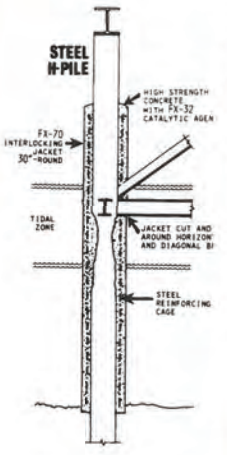
1. FX-70® interlocking jacket is positioned and tightly fixed to resist the river current.
2. Seal is made with FX-70-6 Hydro-Ester mortar.
3. Void in middle area was filled with cementitious grout made with FX-32® Catalytic Agent.
4. Work is completed with top layer of FX-70-6 Hydro-Ester mortar.

CRESCENT ENTERPRISES, INC.

STRENGTHENING PETROLEUM PIER — NEW JERSEY

Loss of section of the steel H-piles at the waterline due to polluted water and elec-trolysis required a plan for strengthening.

1. The 34" diameter FX-70® jackets were cut and fitted to accommodate the cross-bracing. Jackets were provided in 6 to 9-foot lengths and were field spliced at the horizontal bracing.
2. Reinforcing cage was placed around the H-pile.
3. FX-70® jacket serves both as form for concrete and outer protection against corrosion.



HARTER UNDERWATER CORFORATION

STEEL PROTECTED WITH FX-70®

MAINTENANCE OF TOLL BRIDGE — VIRGINIA

Corrosion, cracking, and separation of the steel jacket from the concrete pile at the waterline required a practical and effective maintenance procedure.

1. Steel shell is badly deteriorated.
2. After removing loose scale and barnacles, FX-70® interlocking jackets were slipped around each pile base.
3. FX-70-6 Hydro-Ester mortar was poured into the annular void and finished at the top providing an encapsulation of all exposed surface area. (Near pile is completed.)

CROWDER CONTRACTING CO., INC.

INDUSTRIAL PIER — MARYLAND

Fluted steel piles on this acid receiving pier were badly corroded. Replacement or reconstruction was needed, and they selected reconstruction with FX-70® .

1. FX-70® jackets were slipped around the pile at the waterline area.
2. FX-70-6 Hydro-Ester and FX-701 Filler were poured into the annular void displacing the water. (Notice the bell-lip to facilitate the pouring.)

SHIPYARD FACILITIES — NEW JERSEY

Steel pipe piles supporting heavy shipyard repair facilities were deteriorating in the polluted waters of the Hudson River. Repairs were made without interrupting work of the shipyard.

1. Divers worked in the low clearance area and positioned FX-70® jackets.
2. FX-70-6 Hydro-Ester and FX-701 Filler were mixed to grout consistence and pumped into the annular void space displacing the water.

OCEAN SYSTEMS, INC.

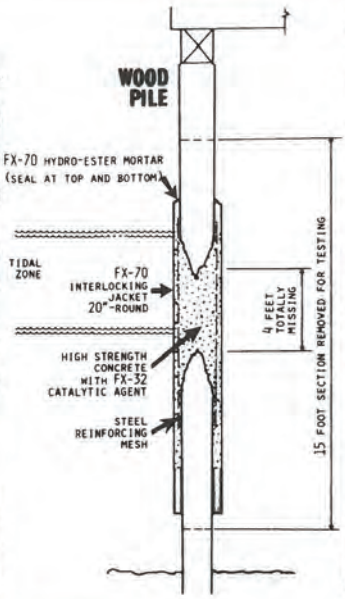
WOOD RECONSTRUCTED WITH FX-70®

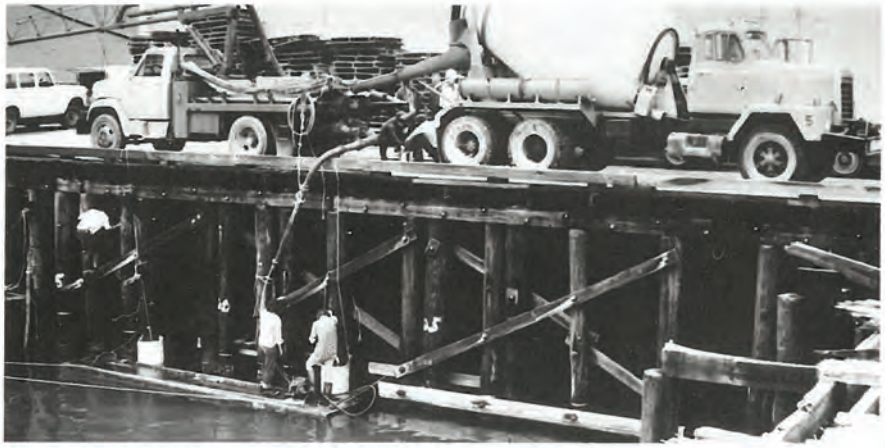
MUNICIPAL PIER — TEXAS

Sections were totally missing at the water line from many of the wood piles supporting this municipal pier. Reconstruction with FX-70® was preceded with a full scale test:

1. Rotted wood was removed from piles.
2. Wire reinforcing cage was attached to top and bottom sections, spanning the missing area.
3. FX-70® jacket was prepared with an FX-70-2 seal along the bottom and positioned around the pile.
4. FX-70-6 Hydro-Ester Mortar was poured through the salt water to permanently seal the bottom.
5. Cementitious grout made with FX-32® Catalytic Agent was pumped into the jacket displacing the water and filling the entire center section.
6. Top was sealed with FX-70-6 Hydro-Ester mortar.
7. Full sections of the reconstructed pile were removed and tested in a 100-ton hydraulic press.
8. Result: reconstructed section of the pile was stronger than the original.

OGLETREE AND GUNN





OIL PIER — CALIFORNIA

Wood piles showed varying degrees of deterioration at the waterline on this petroleum pier.

1. FX-70® jackets were installed as permanent 36" diameter forms from the mudline to the cap.
2. Void space was filled with high strength concrete.

RAILROAD TRESTLE — FLORIDA

Wood piles on this railroad bridge were rotting away at the waterline in this shallow waterway. Repairs were made from above the waterline.

1. FX-70® jackets were positioned around the pile, well into the mudline.
2. Annular space of 2 to 3 inches is created.
3. Cementitious grout made with FX-228 High-Early Non-Metallic Compound displaced the water in the annular void.

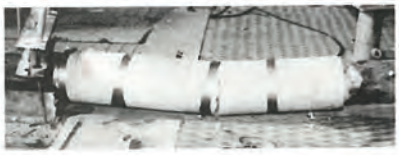
WOOD RECONSTRUCTED WITH FX-70®

UTILITY POLES — FLORIDA

Wooden utility poles in wet land areas and shallow water often show deterioration at the base. A full scale laboratory test was carried out to show how the FX-70® systems provide full strength.

1. A 6" gap was selected for reconstruction.
2. A 5-foot long FX-70® jacket was slipped around the splice area.
3. FX-70-6 Hydro-Ester and FX-701 Filler were mixed to grout consistency and poured into the void.
4. Pole was positioned horizontally for testing.
5. Failure occurred at 26,266 ft-lbs, or a fiber stress of 2005 psi.

FLORIDA POWER & LIGHT CO.



FIELD FORMED FX-70®

NAVY MAINTENANCE — VIRGINIA

Mothballing in a propeller shaft without putting this Navy ship in dry-dock was accomplished with FX-763 Hydro-Ester Trowel Grade and FX-70-10 Fiber Reinforcing.

1. Divers apply FX-763 to clean propeller shaft.
2. 6" wide FX-70-10 fiber reinforcing is wrapped around the coated shaft.
3. TV camera monitors the work through murky water.

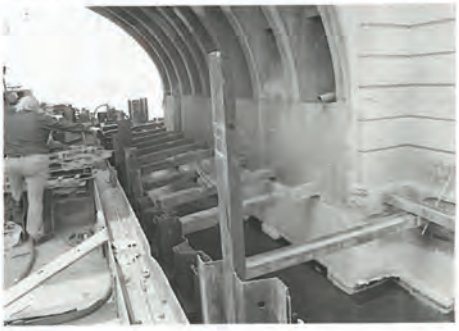
OCEANEERING INC.

HIGHWAY BRIDGE — BALTIMORE

Divers discovered considerable deterioration just below the waterline on the concrete piers supporting the bascule spans of this 4-lane bridge.

Repair methods were studied and a detailed specification was prepared outlining the following procedure:

1. Cofferdams were constructed.
2. Deteriorated concrete was removed.
3. Shotcrete containing FX-32® catalytic agent was applied to rebuild the missing sections.
4. FX-70-9 Hydro-Ester Coating LV was applied by roller.
5. FX-70-10 Reinforcing was unrolled and embedded in the coating.
6. Another layer of FX-70-9 was applied to produce a finished surface.



PRESSURE CONCRETE CONSTRUCTION CO.

NEW STRUCTURES

54" CONCRETE PILES — MARYLAND

Prestressed hollow piles 54" in diameter on this new bridge were protected at the tidal zone with the FX-70® Inert Corrosion-Free System. As superstructure was being completed, the protective FX-70® jackets were installed by workers on floats.

1. FX-70-1 seal was installed along the bottom perimeter of the 5-foot long jacket.
2. FX-763 Trowel Grade was buttered on the interlocking joint.
3. The jacket was banded in place.
4. FX-70-6 Hydro-Ester mortar was poured into the 1/2" annular space to provide a firm continuous bond over the entire protected area.

OIL PIER — CALIFORNIA

New oil receiving pier was designed with steel H-piles for support and FX-70® jackets for protection against corrosion.

1. Interlock of the jacket was buttered with FX-763 Hydro-Ester Trowel Grade.
2. FX-70® jackets were installed from mudline to within 24" of the cap.
3. Portland cement concrete was used to solidly fill the void area.

MARINE INTERFACE

FLUTED STEEL PILES

Fluted steel piles on this new state highway bridge are protected with FX-70® Inert Corrosion-Free System.

1. FX-70® jackets are positioned from the mudline to one foot above mean high tide.
2. FX-70-6 Hydro-Ester mortar was poured through the brackish water to fill the annular void.

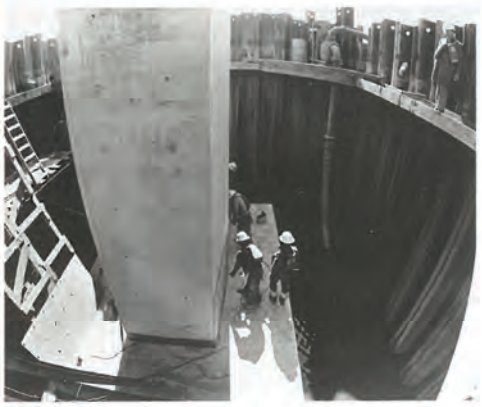
PROTECTED WITH FX-70®

INDUSTRIAL PIER — MARYLAND

Contaminated and corrosive salt water in this industrial area resulted in high maintenance costs for piers. This newly designed pier utilizes the FX-70® Inert Corrosion-Free System to provide long term protection.

1. Steel H-piles were driven and cut-off to specified elevation.
2. FX-70® Hydro-Ester jackets were slipped around the piles and fixed into position.
3. Portland cement concrete with FX-32® Catalytic Agent was used to fill the void space.
4. Deck forms were constructed so that FX-70® jackets and H-piles would protrude into the underside of the cast-in-place deck.

MC LEAN CONTRACTING CO., INC.



NEW EXPRESSWAY BRIDGE — MARYLAND

Recognizing the corrosive attacks on the piers of an existing bridge, engineers looked for the best possible means of protection for the piers on this new bridge. After thorough investigation and review of the testing at the Maryland State Roads Commission laboratory, the consulting engineers specified the FX-70® Inert Corrosion-Free System.

1. FX-70® protective sheets with spacers attached are fastened to the concrete piers with metal fasteners. Void is filled with FX-70-6 Hydro-Ester mortar after each level of sheets is fastened in place.
2. After installation, cofferdam is removed and the concrete pier base is fully shielded from corrosive attack at the waterline and below.

"The completed project is impressive and the FX-70® System enhances the project. We appreciate the cooperation your organization rendered on the project, instructing the contractor and enabling him to complete the contract ahead of schedule."

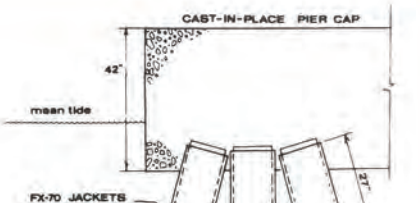
ALBERT P. BACKHAUS, P.E.
MARYLAND DEPT. OF TRANSPORTATION

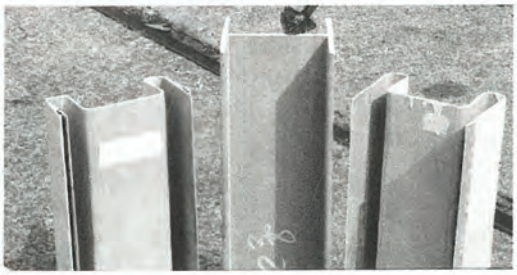
PIER EXTENSION — BALTIMORE

This new extension to a high capacity shipyard pier is supported on clusters of steel H-piles. FX-70® two piece H-shaped jackets were selected to prevent corrosion in the tidal zone.

1. H-piles were driven and cut off to exact length.
2. FX-70® H-shaped jackets with FX-70-1 seals and FX-763 troweled in the interlock were bonded into position.
3. Hydro-Ester grout was made with FX-70-6 and FX-701 was poured into the 1/2" void space displacing all water.
4. Massive concrete pier cap was cast-in-place.

EMPIRE CONSTRUCTION CO.

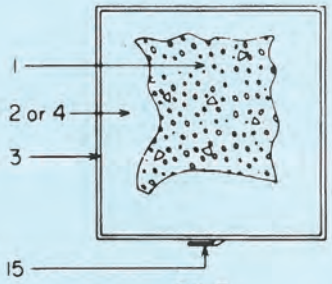




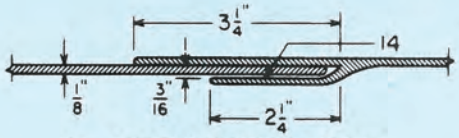
FX-70® DESIGN AID

LEGEND

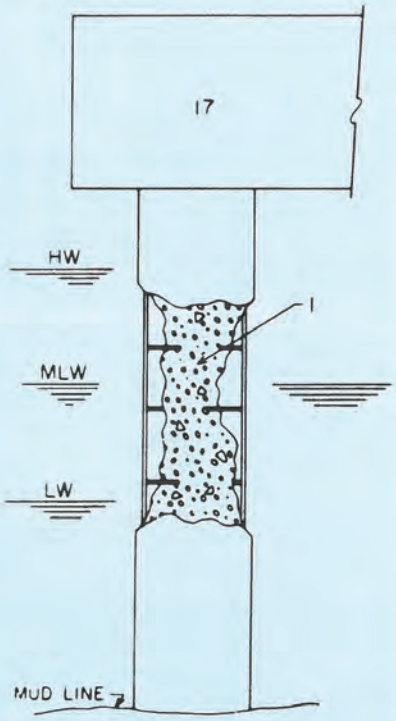
1. deteriorated concrete
2. FX-70-6 Hydro-Ester Grout
3. FX-70® Interlocking Jacket
4. FX-70-8 Pre-Mixed Cementitious Grout
5. FX-70-1 Compressible Seal
6. concrete or wood pile
7. square or rectangular concrete pile
8. steel shell pile filled with concrete
9. cleaned concrete surface
10. FX-70-9 Hydro-Ester Coating LV
11. FX-70-10 Fiber Reinforcing
12. completed FX-70-10 six-layer field formed system with final thickness of approximately 3/16"
13. concrete pier
14. FX-763 Hydro-Ester Trowel-grade
15. FX-70® Interlocking Jacket (detail of interlock)
16. steel H-pile
17. pile cap



PILE
CROSS SECTION



15– INTERLOCKING JOINT



DETERIORATED
PILE

Steel, concrete or wood with any cross-section or length.

FX-70 HYDRO-ESTER GROUTING COMPOUNDS

DESCRIPTION: FX-70® Hydro-Ester compounds are 2-component, 100% solids systems designed for use with FX-70® Inert Corrosion-Free Systems.

FX-763 Hydro-Ester TROWEL GRADE:

Non-sag for sealing interlocking joint of FX-70® jacket.

FX-70-4 Hydro-Ester FAST LV:

4-minute pot life after mixing where low viscosity and rapid set are needed.

FX-70-5 Hydro-Ester LV:

30-minute pot life after mixing where low viscosity and normal set are needed.

FX-70-6 Hydro-Ester POURABLE:

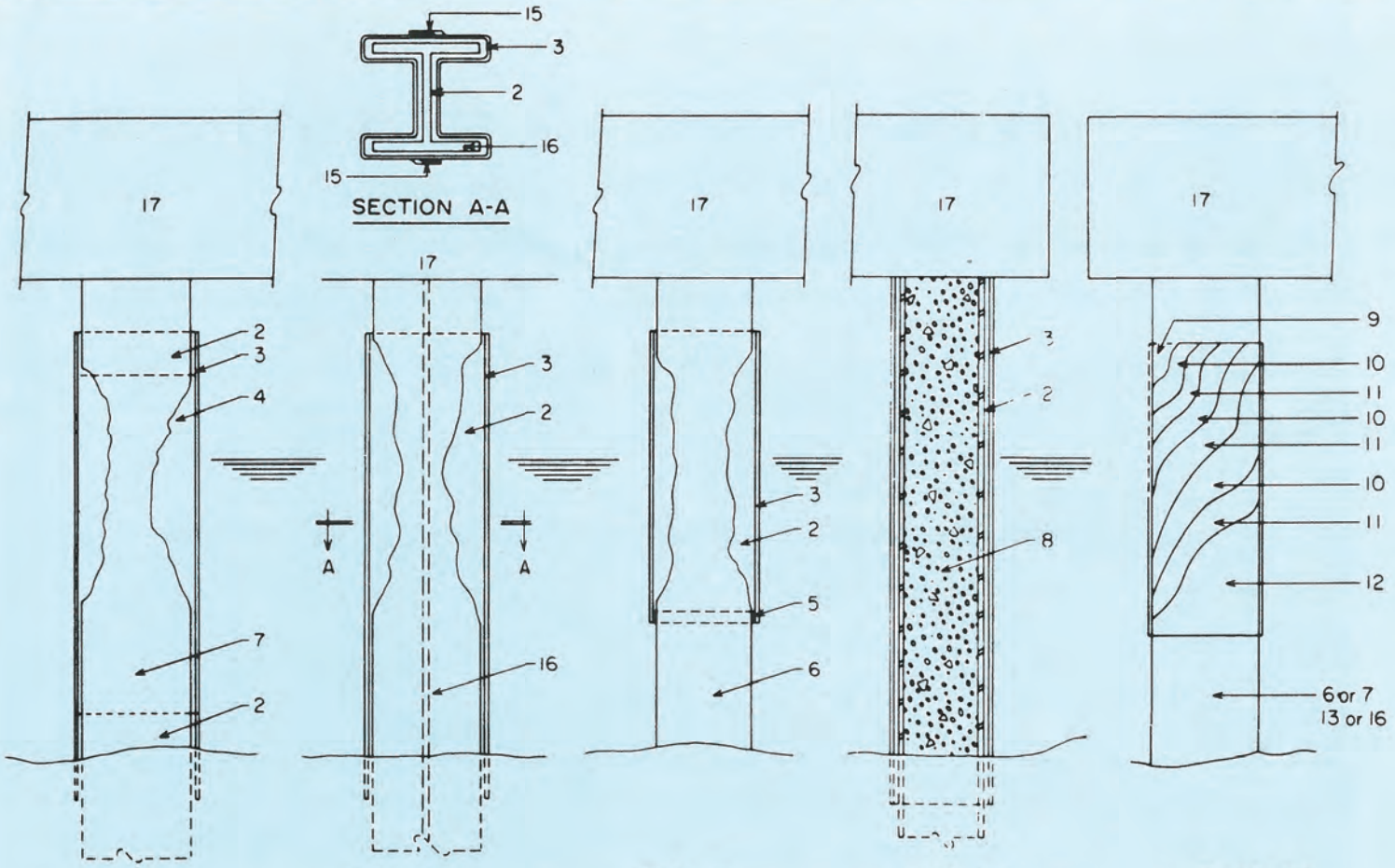
normal set and medium viscosity.

APPLICATION: FX-70® Hydro-Ester compounds are insensitive to moisture and will bond to wet or dry contact surfaces. Cured grout will produce excellent adhesion and resistance to impact and abrasion. Inert qualities resist chemically severe environments. All contact surfaces should be free of laitence, grease, oil, rust, and other bond inhibiting materials.

PROCEDURE:

a. Thoroughly mix Component A and Component B.
b. Blend Component A and Component B at ratio per manufacturer's recommendations.
c. Mix thoroughly with an electric drill and mixing paddle.
d. Introduce FX-701 Filler slowly to the desired consistency (use with FX-70-6).
e. A ratio of one part mixed compound to one part FX-701 filler will yield 350 cu. in./gallon.
f. Pour grout into annular void provided by the FX-70® shell.
g. Avoid contact with skin and inhaling of vapors.

FX-70® DESIGN AID



TYPE I

FX-70® Interlocking Jacket, round or square, with FX-70-8 high-strength cementitious grout at the middle area, and FX-70-6 Hydro-Ester Grout at the top and bottom to provide full encapsulation from mudline to tidal zone.

TYPE II

FX-70® Interlocking Jacket, H-shaped, with FX-70-6 Hydro-Ester Grout from the mudline to the tidal zone.

TYPE III

FX-70® Interlocking Jacket installed as a collar at the tidal zone.

TYPE IV

FX-70® Interlocking Jacket installed on a round or fluted steel shell pile, new construction or repair.

TYPE V

FX-70-10 Field Formed System on pile, pier base, or sea-wall for new construction or repair.

FX-32® GROUT SPECIFICATION
(Portland cement grout)

FX-32® is a water soluble polymer resin that works in each stage of the complex hydration process of portland cement. Design mixes with FX-32® require from 15 to 25% less water. This water reduction helps produce the high strength, greater density, and reduced drying shrinkage. The excellent workability aids in placement consolidation.

FX-32® can be used in temperatures as low as 32°F in the cold winter months.

The catalytic properties of FX-32® make possible the development of additional strength gains from portland cement for concrete, mortar, and grout. Other properties are also improved including durability, tensile strength, density, and bond of new concrete to old concrete.

Recommended preparation is 1 pound of FX-32® powder per sack of cement. Lesser proportions of 3/4 pound and 1/2 pound per sack may be used when correspondingly lower results are adequate.

High-early strength — 24-hour over 4000 psi.

Shrinkage reduction — 28-day drying shrinkage of FX-32® concrete is from 23 to 31% less than a plain mix.

Tensile strength — The 3-day tensile strength of FX-32® concrete has a 38% greater tensile strength than plain concrete.

Flexural strength — 28-day over 1100 psi.

Density — Due to the large reduction in mixing water and good consolidation properties, the density of FX-32® concrete with air entrainment is increased from 6 to 8 pounds per cubic foot.

Initial retardation — The initial set of FX-32® concrete is retarded by 25-35%, at a 1-lb./sack addition.

Durability — Air-entrained concrete containing FX-32® exceeds ASTM C-666 at 300 cycles. Testing of some cylinders continued well beyond 1000 cycles without sign of failure.

LABORATORY TEST PROGRAM

Both steel and concrete specimens were tested.

FX-70-6 Hydro-Ester mortar is poured through salt water solution.

High bond is apparent as many fibers remain embedded in FX-70-6 Hydro-Ester mortar.

Core shows monolithic bond to concrete.

In a constant search for better methods and materials, the Bureau of Bridges requested tests on the FX-70® Inert Corrosion-Free Systems. Tests were carried out at the Maryland State Roads Commission laboratory.

A cut-off section of a steel shell pile and an 18" diameter concrete pipe section were set up in vertical positions side-by-side on a test stand. The FX-70® protective layer was supplied as 1/8" thick round jackets.

Each jacket was spread open and slipped around the section. It was closed to an 18" inside diameter. The overlapping longitudinal edge was firmly closed with self-tapping stainless steel screws in pre-drilled holes.

The bottom perimeter between the pile and the jacket was sealed. The void space was filled to the top with water containing 5% salt solution.

Placing the FX-70® Hydro-Ester mortar **without dewatering** is a key feature to the economics and practicability of the system. This step of the test was observed by many interested engineers and maintenance supervisors.

The mortar was proportioned and mixed to a flowable consistency. Being both heavy and repellent to water, the mortar was poured from opposite sides, displacing the water and solidly filling the 1/2" annular void.

Initial hardening was complete in 4 hours at the laboratory temperature of 72°F. Compressive strength of the mortar was determined on 2" cubes to be 8,000 psi at 24 hours.

After seven days, an attempt to separate the protective surface from the mortar was attempted. Using hammer and chisel, the surface was peeled from the mortar; however, many strands and fibers refused to be separated, showing the excellent bonding characteristics.

A 3" core was cut with a diamond drill through the wall of the concrete specimen. The FX-70® Hydro-Ester Mortar provided full bond both to the protective jacket and the section being protected, thus producing a monolithic structural system.

While no cores were taken on the steel specimen, hammering and chipping by the laboratory technicians (and other interested observers) showed bond to be excellent. No pieces could be removed regardless of the punishment given with the hammer. In fact, the mortar absorbed the hammer impact in a way that dampened the vibrations which normally occur in steel.

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