



MOLDED FIBER GLASS COMPANIES FRP PILE REPAIR SLEEVES PART OF ENCAPSULATION SOLUTION FOR PORT OF NEW YORK'S CHALLENGING SUBSTRUCTURE REPAIRS.

PROJECT PROFILE/CHALLENGE

A cleaner Hudson River is in everyone's best interest; just not the piles supporting the New York City Passenger Ship Terminal (PST) at the Port of New York. In recent years the pollution-laden waters of the Hudson have become cleaner which has invited the return of wood-boring marine worms that have infiltrated and eroded the timber piles of the PST's three, approximately 1,000 feet long and 125 feet wide, finger piers.

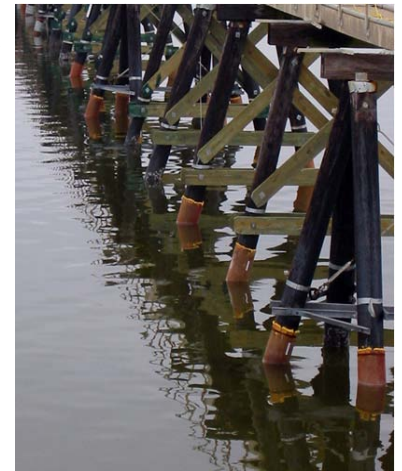
As part of the New York City Economic Development Corporation's \$50 million PST improvement plan, part of the Master Plan to advance the city's \$20 + billion tourism industry and accommodate the growing cruise segment, stabilizing the facilities infrastructure and restoring its structural integrity was essential to the world-class terminals' trade and transport capabilities.

As severe structural infrastructure deterioration caused by corrosion exists in concrete, steel and wood all over the world, finding restoration vs. replacement solutions is vital to economic growth and stability. Each year nearly million passengers pass through the PST, located a few blocks west of Times Square in the heart of Manhattan, therefore finding the best pile restoration solution vs. replacing the PST's deteriorating piles (which would mean an extremely costly, extended shutdown) was the project's goal.

Bidding and selection of the encapsulation system partners then began to ensure cost-efficiency/quality mix optimization for the PST pile project.

ENCAPSULATION PARTNER-SOURCE SELECTION

An FRP (Fiberglass Reinforced Plastic) Pile Encapsulation system was chosen as the project's pile restoration/protection solution. The encapsulation system is comprised of a molded FRP jacket, epoxy grout and aggregate mix. Divers abrade and clean each pile and then place the jackets around them. Epoxy grout and aggregate mix is then pumped by the divers from the bottom up, displacing the seawater.



Phase II of the project was awarded to Trevcon Construction Company, Inc. (Liberty Corner, NJ) who had extensive marine construction experience and knowledge of underwater environments. In phase II Trevcon evaluated the condition of the pilings and decided to experiment with different epoxies and pile sleeves to maximize savings, assembly time and seam strength.

MFG Construction Products Company (Independence, KS) was selected as the FRP Pile sleeve source as MFG provided a single tube solution which meant less assembly time and a single seam which was stronger. The MFG pile sleeve also offered a more flexible, peel-away liner design seam and resin bond finish to the jacket that eliminated the need to sand blast for chemical adhesion to work in conjunction with the epoxy selected for the project.

According to Trevcon President Ron Treveloni, "MFG was recommended and chosen based upon service and the fact that they could provide the required length and diameter of pile sleeves needed for the project; thus avoiding costly custom built sleeves." Additionally, Treveloni noted, "The MFG jackets' rough finish also strengthen the bonding epoxy, which was supplied by Sika Corporation (Lyndhurst, NJ), to the shell."

After testing concrete epoxy solutions, which were too heavy and would result in unnecessary weight added to the piers, Sika devised a epoxy solution. In combination with the MFG sleeve design, the solution provided a smaller annulus (space between existing pile and the interior of the jacket) at a weight that was lighter than the cement filler.

PILE SLEEVE SOLUTION:

To help restore the structural integrity to the deteriorating piles, MFG provided its one-piece FRP pile repair sleeve. Designed to leave in place, the sleeves are chemically resistant to acids, alkalis, and most solvents, thus providing long-lasting, reliable protection.



Made from chop strand mat and woven roving, the two materials provide better physical properties the jackets meet/exceed specifications vs. gun roving/shopper gun applied which is not as strong. This result is resistant to abrasion and impact when concrete or grout is properly placed in the form.

For underwater assembly, the MFG sleeves offer a slip joint closure which makes divers jobs easier. Standard diameters are available is 12-36" and custom sizes can be accommodated. Lengths are produced to specifications and ultraviolet resistance accommodations are available.

Combined with the correct epoxy bond the MFG sleeves provide the ability to refurbish (vs. replacing) the existing timber (or steel/concrete) piles and strengthen them to their original or better strength. In addition to replacement savings, the easy-use MFG Sleeve also accommodates the efficiency of requiring no terminal shut-downs.

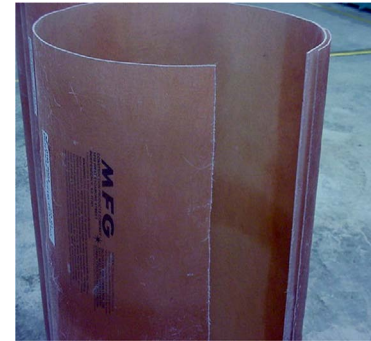
EPOXY SOLUTION:

Sika USA utilized its Sikadur 35, Hi Mod LV/LTL which is a 2-component 100% solids, moisture tolerant, low-viscosity, high-strength, multi-purpose, epoxy resin adhesive. Conforming to the current ASTM C-881 and AASHTO M-235 specifications, the epoxy is an aliphatic amine blend offering low viscosity-long pot life which increases the materials working time.

Bob Wallace, Sika's Senior Project Sales Manager, noted that "This is essential since the pre-blended mixture was entered hot into a single pump/hose (vs. individual A/B lines), thus lessening the divers reaction/working time with the material."

CONCLUSION:

According to Trevcon Project Manager Dennis Mullins, "not only did MFG provide pile jackets that met the standard criteria for the project, they responded quickly to field modifications that needed to be made based on the pumping applications required by the divers after pile cleaning and measurement analysis of the diameter of the annular space with relation to the Sika epoxy infusion. MFG made these modifications to achieve the maximum savings on each pile filled."



MFG also provided a prototype sleeve that was tested by Trevcon divers. According to Jim Williams MFG Construction Product Plant Manager/Project Leader, after the test they requested a design change: increase dimension by 1/4" between the tongue and groove. The additional space was needed because of the limited sight issues posed by the Hudson River during installation. After MFG modified its design a total of 1,500-2,000 jackets were produced for the project, which began in 2004 and scheduled to be complete by the end of 2006.

Williams also noted MFG's commitment to advancing its pile jacket operations, "We established our pile jacket effort approximately three years ago and it represents a growing business segment for us. With new installations and private label/joint encapsulation partnerships growing, we're poised to capture 15 % of the pile sleeve market in the near future." In conclusion he states, "We recognize the need for strengthening city infrastructures via alternative, cost effective restoration solutions and MFG plans to be at the forefront."

Finally Ron Treveloni noted that the encapsulation partners shared a combined goal to run seamless construction operations while active shipping was taking place, "Making this more vital was the fact that the 1st pier construction began approximately one month after the event of 9/11 and was the housing center of the Joint Task Force Offices: including Rudi Giuliani, then mayor of New York City. Additionally the 2nd pier was set up as a control strategy center for FEMA and therefore security considerations around the construction sites had to be made to ensure seamless construction."

