

LAKE PONTCHARTRAIN CAUSEWAY
Greater New Orleans Expressway Commission

Corrosion Control International
Seymour, Connecticut

RETROWRAP

Splash Zone & Subsea Elastomeric Encapsulation System

Installed by

Epic Divers Inc. of Harvey, Louisiana
28th October 1998



The Northbound Carriageway approaching the 4 mile marker

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INTRODUCTION

The Lake Pontchartrain Causeway, reputed to be the longest structure of its kind in the world, comprises of two independent bridge structures. The now northbound carriageway was built in the mid 50s while the southbound was constructed some 7 or 8 years later. The causeway, owned and operated by the Greater New Orleans Expressway Commission (GNOEC), was built by Raymond International Inc. using similar designs for both structures which are linked by turn arounds at intervals along the 24 mile length.

In late 1997, J.L. Browne & Associates acting on behalf of Corrosion Control International, identified that Krebs, LaSalle, and Lerieux Consulting Engineers had been appointed by GNOEC to coordinate the evaluation of various rehabilitation and preservation systems. This work included the management of the first phase of the reparation project where approximately 4 miles of each bridge from the North Shore was completed in 1997.

From discussions with K.L.L.C.I. in February 97, it was established that the construction technology used by Raymond Inc. to construct the causeway was similar, if not identical, to that utilized on the Juaymah Trestle where 54 inch and 66 inch site cast post stressed piles and beams were used by Raymond to build an 8 mile long LNG trestle. This trestle links a deep water sea island to the onshore LNG production facility in the eastern province of Saudi Arabia.

By coincidence, the writer's design of an impermeable heavy duty multilayer fabric containing a hydrophobic thixotropic gel and retained in place by mechanically induced hoop tension throughout the design life of 20 to 25 years, was approved by Aramco for the retrofit cladding of the Raymond piles from 2 feet below the mud line to plus 5 feet i.s.l.w.

Evaluation commenced in the summer of 1985 and was completed with the award of a supply contract in March of 1987. Installation by Comex, the major French diving contractor, commenced in the summer of 1987. Since that date the wraps, which are inspected at routine intervals, remain in service in one of the toughest marine environments in the world. They are subject to severe wind induced wave action due to relatively shallow water, high chlorine content, and extreme UV and ambient temperature exposure for the upper sections. A paper based upon the development and the installation of the protection system was presented to the Institute of Corrosion Science Conference in the UK in 1986 and forms the basis of the US patent which was issued in July 1995.

Scope of Trial Installation

From discussions with K.L.L.C.I. engineers and the causeway director of engineering, the writer was able to ascertain the following minimum requirements of a light weight elastomeric encapsulation system that will prevent further ingress of chlorine into the pile structure throughout the design life, typically 15 to 25 years depending upon the physical characteristics of the outer fabric.

1. Proven long term operational life in a marine environment.
2. Minimum surface preparation.
3. Easy one-piece installation.
4. Toughness.
5. Abrasion resistance.
6. UV degradation resistant.
7. High climatic temperature resistant.
8. Closure system that is resistant to third party damage.
9. A system that can be easily removed and reinstalled to facilitate substrate inspection at any time during service life.

From experience gained over the past 14 years while working with many diving contractors in different parts of the world, we have been able to reduce the installation of the Retrowrap System to its simplest possible form.

CCI has long since recognized the importance of establishing a good rapport with its installers and welcome the interest and enthusiasm and services provided by **Epic Divers** who carried out a most satisfactory installation on the 28th of October. The old saying "Any product is only as good as the manner in which it was or can be installed," demonstrates to us the importance of establishing a good working relationship which will provide the client with the best possible supply and installed package.

Surface Preparation

As can be seen from the accompanying photographs, the pile substrate was prepared using a simple hand scraping technique which was easily carried out to a standard well within the limits of acceptance of the Retrowrap System. In a production situation, piles would be pre-prepared using LP water blast followed by a substrate inspection and where necessary crack filling using migrating inhibitors contained within a thixotropic hand applied gel would be carried out.

Trial Installation Comments

1. All CCI one piece wraps are fitted with lifting lugs from which the wrap is suspended at any required elevation prior to installation of the temporary draw bolts which lock the unit into position.

After consultation with the K.L.L.C.I. inspector, the wrap was positioned approximately 5.5 feet above the water level prevailing at the time which equated roughly to 2 feet above the pile connecting joint. Note: From the pile survey currently being carried out should it be considered advantageous to extend upwards the retrofit pile protection area, the writer having now viewed the underside of the causeway deck can confirm that this could easily be achieved without the necessity of using supplementary scaffolding.

2. Reusable draw bolts are used to achieve induced tension and flange to flange closure following which the permanent SS316L fasteners are installed. In a production situation, two compressed air impact wrenches each fitted with the appropriate size socket would further simplify installation.
- 3 Independent floating work stations approximately 10 foot x 10 foot with a cut out to suit pile diameter and fitted with 4 point mooring for stabilization would significantly speed up installation on a production basis.

Conclusion

Having now had the opportunity to visit the site and carry out this first installation without incident, both **CCI** and **Epic Divers** trust that we have demonstrated the unique properties and practicality of the Retrowrap System when used as a third party damage resistant environmental barrier that will prevent further chlorine ingress into the pile structure.

In conclusion, CCI takes this opportunity to confirm that where necessary additional concrete migrating corrosion inhibitors can be included into our hydrophobic thixotropic gel to pacify any existing corrosion that has occurred in the spiral outer pile reinforcement. However, protection of the main post tension cables presents an interesting challenge. One solution that may be worthy of further consideration is to drill small diameter holes into the cable ducts then inject under high pressure water solvable vapor phase migrating inhibitors. The injection holes then being sealed with gel and sited underneath the Retrowrap outer jacket.

CCI and Epic Divers want to thank T.N.O.E.C. and K.L.L.C.I. for the opportunity of being able to install our system and look forward to further discussions in early 1999 regarding the scope of the next phase of this most challenging project.



One piece 141 ft.² Retrowrap shower curtain folded for easy underwater deployment. Note: Air operated heavy duty impact wrench fitted with extended box wrench for high speed tensioning and closure of the system (approx 8 - 10" gap) when wrap initially positioned around pile.



The 54"Ø x 10 (141 ft.²) Retrowrap showing hydrophobic thixotropic gel impregnated inner layer and removable draw bolts preinstalled in opposing closure flanges.



Diver hand scraping marine growth from pile. LP water jet would be the recommended production procedure.

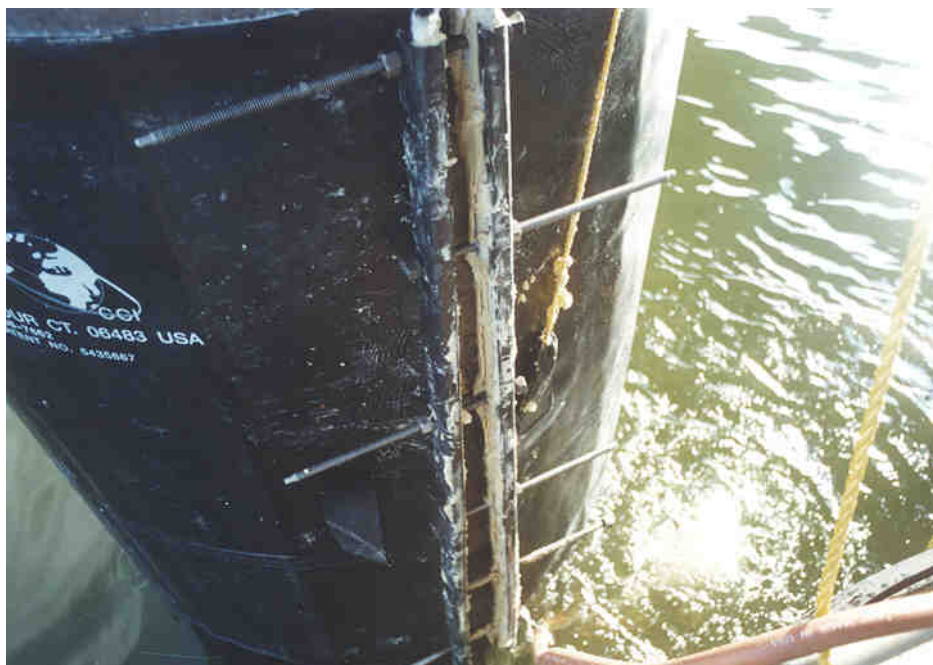




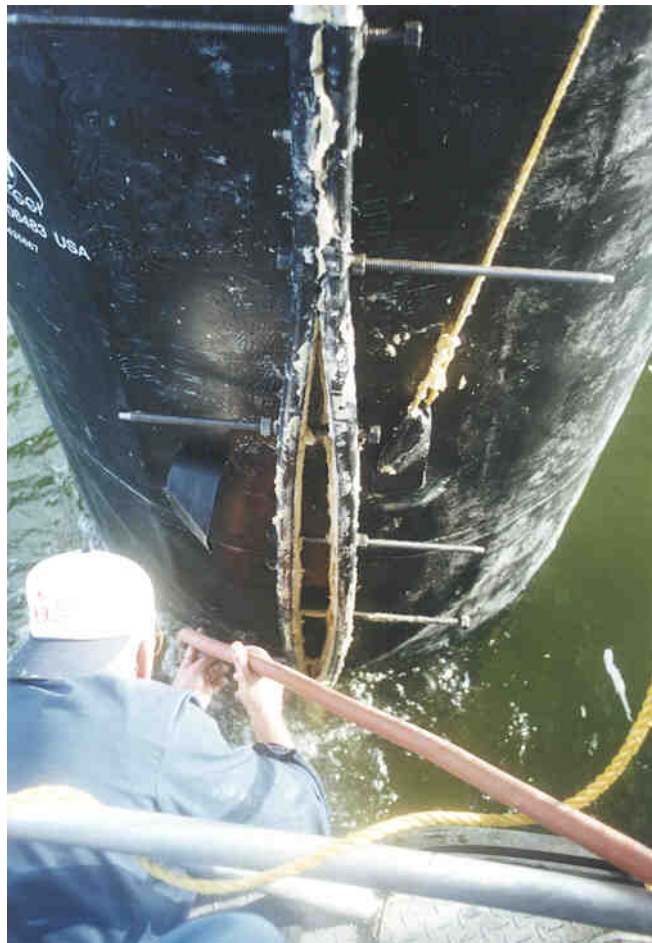
Retrowrap suspended from lifting loops factory welded to outer skin. Retrowrap lifted 5.5 ft. above water level via pulley block attached to preinstalled suspender rope.



Installation of removable draw bolts in opposing directions. Note: Length of draw bolt also provides alignment leverage during final stage of line up prior to driving bolt through the opposing flange.



Induced tensioning of the wrap working from top to bottom keeping flanges as parallel as possible.



Commencing final closure and installation of first SS316L bolt. Note: Load on closure flanges and gel exuding from upper closed portion of closed joint.



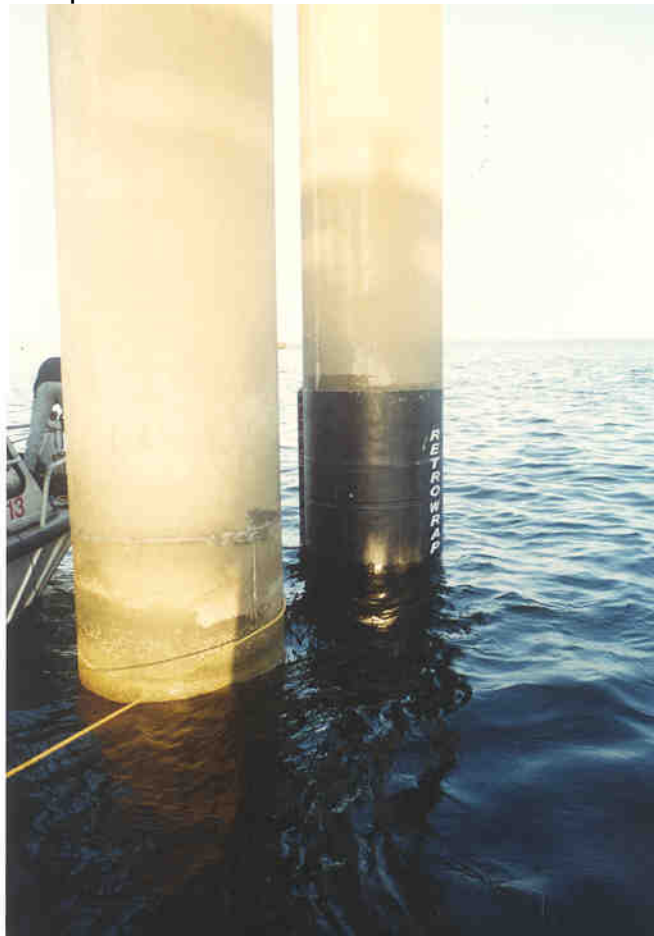
Upper section closure complete with draw bolts removed and permanent fasteners in position. Diver still working below.



Completed installation. Outline of joint in concrete pile clearly visible.
Note: Thixotropic gel exuded around upper edge of wrap and front of closure flange.



Completed installation viewed from southwest.





Before and After!
Note Outline of Pile Joint Clearly Visible

