



REPRINT OF ARTICLE PAPER
PUBLISHED IN INTERNATIONAL PORTS
AND HARBOUR JOURNAL

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TAKING THE RISK OUT OF MAINTENANCE, REPAIR AND FORWARD PLANNING

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Part of our practice mission statement are the words '*only when in possession of all the relevant information, can a technically correct strategy be formulated*'

A little lengthy, but so true

Ports, Harbours and Marine structures have more to contend with than any other form of structure.

Marine salt water environments are among the most aggressive encountered. Maintenance is often low priority partly due to the need for structures, such as berths and jetties, to be in almost constant use around the clock and throughout the year.

Structures, whether they are built from steel, concrete or a combination have to stand up to not only the aggression nature can throw at it, but the effects of the products that are loaded and unloaded onto them (often highly corrosive). If this were not enough there is the constant risk of physical damage through ships striking the structure to add.



The factor added, that most port structures are in operation 24 hours a day 7 days a week adds the complication of how to survey, inspect, test and repair a structure without intruding on the operations of the port.



Those responsible for the condition, operations, maintenance and repair of port and harbour structures will know that repairs are often unsuccessful and at best problematic for a number of reasons.

- The environment and working practices of the installation make most repair systems difficult at best.
- The extent of the distress is of is not fully understood.
- Other influences such as tides etc make system selection difficult.

RISK REMOVAL

Prior to embarking on any repair and protection strategy all relevant information should be gained.

The way to do this is to have the best survey that time and funds will allow carried out.

The survey must, as a minimum, identify both the true cause and extent of the distress and leave nothing to guess work.

A detailed condition survey where all defects are logged and cross-referenced with AutoCAD drawings are essential for accurate budgeting and remedial measure selection.

Diagnostic testing should be carried out at various test site locations across a structure and not just one type of test, but a combination for accurate correlation.



To carry out inspection, testing and reporting on marine structures requires several key areas to be brought together:-

- An understanding of the structure and its relationship to the environment in which it has to be placed.
- An understanding of the clients short, medium and long-term requirements for the structure, including the need to carry out survey works so as not to impact on the day to day working.
- Experience in all forms of distress encountered from corrosion of steel reinforcement within concrete at accelerated low water corrosion of steel piles.



The most commonly used forms of construction in ports and harbours whether they are jetties, wharfs, ancillary structures such as grain silos etc are steel and concrete — two materials that have common enemies such as salt, water and a host of products used in ports that are equally aggressive.

How then are these two materials diagnostically evaluated:-

STEEL

Highly specialist forms of distress such as ALWC, which is a form of bacteriological corrosion that is increasingly becoming a serious world-wide phenomenon. The corrosion is so aggressive that it can have a corrosion rate of 0.1mm annually, which is of huge concern to ports and harbour managers where sheet steel piling is effected, this means that accurate diagnosis and experience of how to deal with the problem is of vital importance.

More normal forms of corrosion are more easily dealt with and are often part of forward maintenance plans, but still the need for both accurate recordings of the true extent of the distress is important.

An in-depth knowledge of the different types and systems for the protection of steel in the marine environment is also essential if long-term, cost effective durability is to be achieved.

Systems ranging from holding measures to mid-term systems giving 10 years protection through to Cathodic protection giving permanent 20 years plus protection, but having the knowledge that each has its place and where/when to use them is important.

Testing techniques used:-

- Ultra-Sonic Steel Thickness
- Ultra-Sonic Coating Thickness
- Corrosion Mapping
- Corrosion Monitoring
- Weld Testing
- Element Conformity

CONCRETE

Concrete placed in the marine environment is often subject to salt water and aggressive attack by the materials loaded onto and off ships.

Far too often the quality of and cover of concrete over the steel reinforcement contained within it is of less quality than it should be. The result is corrosion of the steel reinforcement, which initially induces cracking and eventually spalling, often of large sections that have safety implications.

Surveys ranging from make-safe to full diagnostic are important if safe and structural integrity of structures are to be maintained.

Only when in possession of all the relevant diagnostic facts can a long-term technically correct repair and protection strategy be formulated.

Testing techniques used:-

- Carbonation Testing
- Cover & Spacing Testing
- Chloride Content Analysis
- Half-Cell Potential Testing
- Schmidt Strength Testing
- Petrographic Analysis

ACCESS

Not only is it of vital importance to understand the environment in which the structure is located, its performance and life cycle requirements and the true cause and extent of distress—but the problem of how to survey the structure in a manner that gives meaningful data and not just results from easy to get to locations.



This will often require some or all of the following which if all are available in-house from one specialist consultancy practice assures continuity and quality as well as economy.

- Dive team with lead diver being a chartered engineer with experience of structure surveys.
- Roped access team with diagnostic range of equipment to test all elements
- Survey boat and underwater video technology to act as both access and safety vessel.
- Under jetty netting access system unit for access under soffits etc.

IN CONCLUSION

Whether the repair and protection strategy is to repair an entire jetty or to carry out a small amount of isolated repairs, the key factors are the same.

Inspection and testing should only be carried out by truly independent consultants that are in no way tied to contractors or material manufacturers.

The consultants should have a proven track record of experience of this specific area of operation and should carry out tasks in-house.

By following this route the risk of an escalating cost or failing project is drastically reduced.



The author's company are Specialist Consulting Engineers engaged throughout the world in port and marine structures surveys.

He would welcome feedback or further discussion of this article

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