



PIANC

The World Association for
Waterborne Transport Infrastructure

Recommendations for increased durability and service life of marine concrete infrastructure

Terms of reference

1. Historical background – Definition of the problem

In many countries, deterioration and repair of important marine concrete infrastructure has emerged as a most severe and demanding challenge for the owners of structures. Although a number of deteriorating processes may represent potential problems, extensive experience demonstrates that electrochemical corrosion of the embedded steel poses the most critical and greatest threat to the durability and long-term performance of the structures. Although current standards have been improved in recent years, still an uncontrolled penetration of salt with subsequent steel corrosion can take place on relatively new important marine concrete structures. As soon as the corrosion starts, the owner has a problem, which in the beginning only represents a cost problem but later on also develops into a more difficult safety problem.

The durability and service life of the structure is dependent upon preventing the initiation of electrochemical corrosion. This is typically done by ensuring a quality concrete (low permeability, free of chlorides, reactive aggregates, high temperatures during curing, etc.), concrete resistant to environmental attack (freeze thaw, alkali-aggregate reaction, sulfate attack, carbonation, chlorides, etc.), and concrete cover. Additional measures can be undertaken to extend the life of a structure, such as sealers, coatings, corrosion resistant materials and cathodic protection systems. The durability of a structure is dependent upon the system of cementitious materials, aggregates, water, admixtures, and reinforcing.

Although all minimum durability requirements stated by existing standards must always be followed and fulfilled for new concrete structures, more and more owners are willing to invest somewhat more in order to obtain an increased and more controlled durability and service life beyond what is possible when only based on current standards. New recommendations and guidelines for increased durability, service life and service life modeling of new and important marine concrete infrastructure should be developed.

With the environmental constraints placed on the construction of new facilities in many countries, it may be easier or more economical to extend the service life of an existing structure. Guidance should also be developed for mitigation measures to extend the service life of existing structures.

2. Objective of the Working Group

This Working Group would provide guidance to owners and designers of marine concrete infrastructure worldwide, in order to provide a safe, efficient and cost-effective design and construction of these structures





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The report of the WG is only to be considered as a guidance in addition to existing standards for concrete durability and service life. It should also be considered as an additional document for improved quality assurance during concrete construction as well as the regular condition assessment and preventive maintenance during operation of the structures.

3. Earlier reports to be reviewed

- *Durable Concrete Structures – Recommendations and Guidelines for New Concrete Harbor Structures*, published by PIANC Norway and the Norwegian Association for Harbor Engineers, 2009;
- any other standards, recommendations and reference documents from private or public organizations.

Consistency shall be achieved with existing PIANC report on near topics, such as :

- *Life Cycle Management of Port Structures – General principles*, 1998 ;
- *Accelerated low water corrosion*, 2005 ;
- *Life Cycle Management of Port Structures – Recommended Practice for Implementation*, 2007.

4. Matters to be investigated

Review whether any companies or national or international public organizations have existing modern engineering standards, recommendations or guidelines for increased durability and long-term performance of marine concrete structures that are publically available or which the owners would be willing to share with the Working Group for use.

Review available documents related to the service life, durability and degradation of concrete in various environments that we operate in, as well as the methods of mitigating these degradation mechanisms and of providing durable repair.

5. Suggested final product

Recommendations for durability design, quality assurance as well as regular condition assessment, repair and preventive maintenance of new marine concrete infrastructures.

6. Desirable disciplines of the members of the Working Group

In addition to the owners of marine concrete infrastructure and port authorities, the Working Group members should represent all parties involved such as consulting engineers, contractors and public authorities. Members with a research background shall also be welcomed.

7. Relevance for countries in transition

The final product would help countries in transition through the increased durability and increased service life of their new marine concrete infrastructure, taking advantage of the collective knowledge gathered by this PIANC Working Group.



"Setting the Course"

