



MAREO

creating a market for port rehabilitation

2006 – 2010

French ports are of vital importance, handling 80% of the nation's trade and providing a home for the fishing industry and leisure activities as well as playing a fundamental European defence role. However, 60% of port infrastructure are more than 50 years old. This ageing is responsible for some major concerns: what state are these structures really in? should they be decommissioned or rehabilitated? how long will completed repairs last?

No standards or reliable studies exist to answer these questions and help decide between the very large number of technical possibilities.

The MAREO project is a research and development programme that aims to compare the effectiveness, reliability and long-term performance of repair techniques for reinforced concrete coastal structures.

« With MAREO, Arcadis is increasing its expertise in a very specific area: the diagnosis and re-engineering of the parts of port structures that are located in tidal zones. MAREO gives us the opportunity to work with laboratories in order to compare different nondestructive testing techniques for concrete, and test materials under real conditions. The goal is to develop simple and effective tools to enable us to decide if we can extend the service life of a structure by 10, 20 or 30 years »

Luc Barbot, technical director at ARCADIS, an infrastructure engineering consultancy

« The dynamic set up by MAREO produces a warm and cooperative dialogue even between competing companies; it is the quality of these exchanges that allows laboratories to publish documentation that can be applied on an immediate basis. Half-way through, the firms have already gained additional knowledge which has been exploited scientifically by the laboratories. MAREO is an innovative programme which gives us the opportunity to communicate internationally »

Franck Schoefs,
Lecturer at the university of Nantes, researcher at the Institute for research into civil engineering and mechanics (Institut de recherche en génie civil et mécanique (GEM)).



quay beams undergoing repair

HOW THE PROJECT FITS IN WITH THE PGCE'S CONCERNS :

- STUDYING STRUCTURES IN COMPLEX AND/OR EXTREME SITUATIONS
- SUSTAINABILITY AND LIFE CYCLE OF BUILDINGS AND INFRASTRUCTURES
 - SAVINGS IN RESOURCES
 - ENVIRONMENTAL PERFORMANCE OF CONSTRUCTIONS AND FACILITIES
 - OBSERVATION ET MODÉLISATION POUR LA CONCEPTION ET LA GESTION D'UN PROJET URBAIN DURABLE
 - ECO-INNOVATIVE DISTRICTS

A PROJECT THAT RECEIVED THE PGCE'S OFFICIAL STAMP OF APPROVAL IN 2006

The MAREO project was hatched at the PGCE under the impetus of the GEM, and rapidly convinced a large variety of actors: engineering and construction firms, port owners, government departments, research and training centres. This synergy shows the considerable desire that exists to acquire the knowledge needed to launch maintenance and repair programmes on port structures. The MAREO project will create a framework for all the actors to work in and provide the vital foundation for the development of the rehabilitation market, which is still in an embryonic form.

MAREO has also received the official stamp of approval of MRGenci (Maîtrise des Risques en Génie civil) a scientific interest group concerned with civil engineering risk reduction.



Pôle génie civil écoconstruction
CONSTRUIRE AUTREMENT



••••• Technical details



Pilot worksite: a beam before and after repair with wet mix shotcrete

THE R&D PROGRAMME

The MAREO project has three components:

- **identifying performance indicators** for structures to make it possible to draw up specifications for repair works.
- **developing experimental protocols**, both in the laboratory and in-situ (pilot worksites), to provide measurements under controlled conditions and identify the failure mechanisms when these are not already known (watertightness of composites for example).
- **proposing computation methods** based on the above analyses which take account of the variability of properties for re-engineering and risk analysis.

The MAREO project should solve a number of scientific problems:

- **sample taking:** the generally preferred method of obtaining chloride ion profiles in reinforced concrete is core sampling. This technique has not yet been optimized (methodology, reliability and cost) and the use of nondestructive testing techniques is still unexplored.
- **The durability and variability of repairs:** the relationship between representative laboratory tests and in-situ tests on the same products.

- **risk analysis and re-engineering:** the ability to take account of high-variability in-situ measurements of different types in a probabilistic risk analysis model, with a view to optimization (reducing and planning costs and limiting discharges of pollutants).
- **understanding the damage mechanisms for some repairs in marine environments still poses problems.**

COST OF THE PROGRAMME

1.04 million, with a subsidy of 764,000 (75 % from the region / 25 % from the French government (Fonds unique Interministériel).

THE CONSORTIUM

The MAREO project is backed by ARCADIS with the GEM providing scientific coordination.

7 LABORATORIES

- **GEM (université de nantes)**
- **LCPC:** tests, nondestructive diagnosis and testing
- **IFREMER, CERIB, GEM, LMDC (INSA TOULOUSE):** laboratory and tank tests
- **LMDC, CETE de l'ouest, GEM:** re-engineering
- **trinity college of dublin (Eire):** exchanges of results from a similar project

4 FIRMS

- **ARCADIS, OXAND:** re-engineering
- **SEMEN-TP, ETPO:** installation of materials

2 PORT OWNERS

- **conseil général de Loire-Atlantique**
- **grand port maritime de nantes saint-Nazaire**

••••• Further information

on the MAREO project

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