

DURABLE TRANSPORT INFRASTRUCTURE IN THE ATLANTIC AREA

NETWORK

2009 / 2012



Project Activity Summary Report

(Preliminary edition)

DURATINET
PROJECT ACTIVITY SUMMARY REPORT
(Preliminary edition)

PREFACE

The main goal of the DURATINET project was to create a network to facilitate an efficient exchange and transfer of knowledge between R&D centres, infrastructure owners and managers, the various bodies responsible for commissioning maintenance works, repair contractors, as well as the manufacturers that are developing products.

This is a summary report of the DURATINET project and it contains the several description of the main activities developed during project implementation and the achieved results.

Several communication and dissemination tools were created which can be the support for further development of this network.

DURATINET project approved by the Atlantic Area Programme and co-financed by ERDF

CONTRACT Nº: 2008-1/049

ACRONYM: DURATINET

PROJECT TITLE: Durable Transport Infrastructure in the Atlantic Area Network

Laboratório Nacional de Engenharia Civil (LNEC, IP)

Materials Department

Manuela Salta

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1 PROJECT CONTEXT

The implementation of the EU transport policy outlined in the 2001 White Paper “European transport policy for 2010” will lead to the construction of new transportation infrastructure and increase the need for the repair/rehabilitation of existing infrastructure in order to adapt them to the current transport policy requirements. This will have a major impact on owners and managers of port, highway and railway infrastructure in the Atlantic Area, both public and private, who will be faced with increasing maintenance costs for their structures as well as the high direct costs of the engineering work. This has a particular relevance to the Atlantic Area because most of the transport structures in the Atlantic Area are exposed to marine environment. This exposure is particularly aggressive for coastal infrastructure such as ports, road and rail bridges crossing river estuaries and other maritime structures that could be in direct contact with seawater. However, structures located away from the coast could also be submitted to chlorides attack from sea mists and also from de-icing salts carried by vehicles. Nowadays, many of these structures, even those with less than 30 years old, show signs of extensive premature deterioration. The main causes of deterioration of steel and concrete transport infrastructure are mainly related with the corrosion of steel in steel structures or corrosion of reinforcement and concrete degradation due to expansive chemical reactions in concrete structures.

The deterioration of structural materials leads successively and ultimately to poor appearance of structures, loss of serviceability performance and in reduction of the safety level of structures with loss of confidence by both infrastructure owners and users and enormous global costs very difficult to quantify. In fact, owners and managers of ports, highways and railway infrastructure in marine environments, both public and private, are now faced with increasing maintenance costs for their structures. The deterioration of transport infrastructure across Europe poses, not only technical difficulties to owners and managers but also a great economic and environmental impact to the society as a whole.

The economic consequences associated with the maintenance and repair of structures are very high and projects are often significantly constrained by limited annual budgets, leading to the need to prioritise the required works. In this prioritisation process, however, the costs associated with the social and environmental impact are very often overlooked although not being less significant than the initial capital outlay.

The managers of transport infrastructure have common technical questions concerning maintenance/rehabilitation. These include, for example: the identification of the most appropriate repair or rehabilitation methodologies, the definition of the extent to which these actions should be carried out, the optimal time to implement the preventive or repair measures, and consideration of the cost-effectiveness in terms of the future maintenance requirements. To address these questions, the owners/managers of structures must continuously improve their knowledge on the tools required for the adequate diagnosis of material damage and for optimising the repair and rehabilitation costs, as well as for estimating the evolution of damage in their structures, so as to allow them to decide on the most cost-effective repair methodology and time of intervention.

Experience has demonstrated that, unfortunately, the transfer of knowledge within the framework of the durability of transport infrastructure has not always been carried out effectively. Studies of structural repair projects have shown that, in some cases, structures performance have not lived up to expectations. Questions have arisen, not only from the point of view of individual repair systems performance and durability, but also on the appropriateness of particular repair techniques in given

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situations. Case studies suggest that the required knowledge of the design, construction and maintenance of repair systems is not being adequately transferred along the supply chain. Effective exchange of knowledge within the construction industry is vital, not only to improve the adoption of harmonised maintenance and repair strategies, but also to encourage the application of preventive measures, thus delaying or even avoiding the deterioration of structural materials. Implemented effectively, a co-ordinated approach will result in a reduction of life cycle costs.

It is also recognised that construction and maintenance activities are associated with intensive use of natural resources. In particular, the production of cement and steel is responsible for producing high levels of CO₂. It is clear that actions must be taken to raise awareness and to encourage more sustainable construction. This can be achieved by improving the technical and scientific development of structural materials and repair techniques, aiming to reduce energy and environmental impacts associated with both construction and maintenance activities.

The existence of technical guides containing recommendations on the most relevant subjects involved in the structures maintenance and repair will give the different parts involved in structural management and maintenance answers to many current technical questions, with which they are confronted during their daily work.

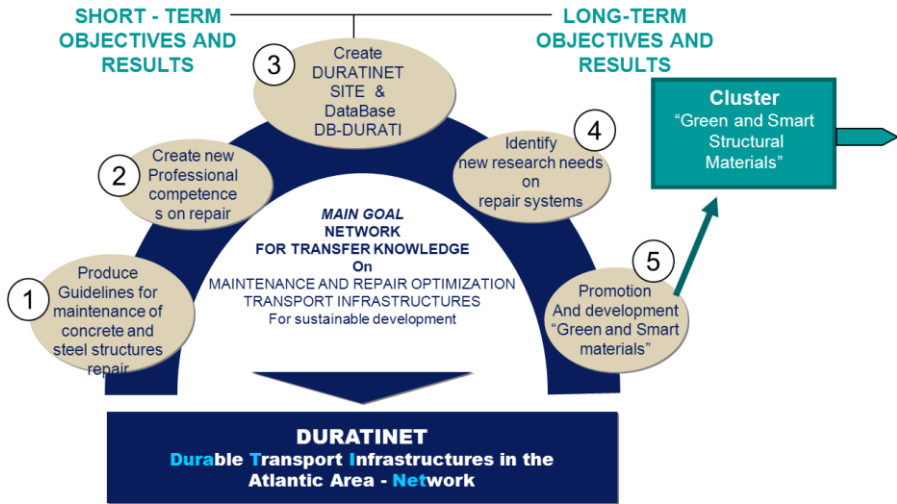
2 PROJECT MAIN GOAL AND OBJECTIVES

The aim of the DURATINET project is to create a network of excellence to facilitate an efficient exchange and transfer of knowledge, and to promote durability, safety and sustainability of transport infrastructure in the Atlantic Area. The DURATINET project addresses the important economic issue of structures deterioration and repair which has an impact on the concrete and steel infrastructure in the Atlantic Area due to its environment aggressiveness. By promoting the transfer of knowledge within the framework of structural durability the project encourages the adoption of trans-national strategies regarding measures intended both to prevent the deterioration of structural materials and to optimise maintenance and repair/ rehabilitation activities. This will contribute to achieve a more sustainable construction and will lead to lower costs and more environmentally friendly maintenance.

Five main objectives have been defined in the trans-national context of this project, with a view to improve both the durability and the optimisation of maintenance methodologies applicable to the transport infrastructure in the Atlantic Area. These objectives are expected to stimulate the cooperation between the different agents, as well as to encourage the development of new R&D fields leading to more sustainable construction and maintenance. The DURATINET objectives are:

1. To produce guidelines on the durability requirements of reinforced concrete and structural steel, the inspection and diagnosis of damage, the repair of materials and methodologies for optimising maintenance.
2. To create new competencies at the infrastructure maintenance level for agents with different skills, through the creation of knowledge dissemination actions and the organisation of courses and workshops within the theme of the project.
3. To stimulate the application of harmonised European standards on repair and to identify the requirement for applied research, in particular research topics concerning the quality control of repair products and the rehabilitation processes resulting from their application.
4. To promote the development and use of “green and smart” structural materials and repair products incorporating wastes recycled materials and by-products, with reduced energy needs during production and application and with increased long-life performance without being hazardous for application technicians or users.
5. To create the DURATINET Website and a Web Platform to facilitate the exchange of information within the technical and the scientific community. The platform will help to generate and to disseminate knowledge on materials performance, on damage diagnosis, on service life prediction and on repair materials ageing. A database (DB-DURATI) will also be created to store information on materials performance obtained from real structures and from large scale specimens under natural exposure. The database will be used for the benchmarking of service life models and for aiding decision-making relating to the selection of reliable structural maintenance and repair strategies in marine environments.

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3 PROJECT CONSORTIUM

DURATINET partnership involves 17 institutions from 7 regions in the Atlantic Area: Portugal - Lisbon Region, Spain - Galiza, Northern Ireland, South and East Ireland, France - Aquitaine, France - Bretagne and France - Poitou Charrentes which are distributed over the five countries with Atlantic regions, indicated on the following table.

Seven partners are national management authorities within the area of road, maritime and railway transportation. One partner is a contractor with certified activity in the area of rehabilitation of structures. Two other partners are national research laboratories in the area of civil engineering, the other six are university research institutions and one is a non-profit institution operating in areas of knowledge dissemination.

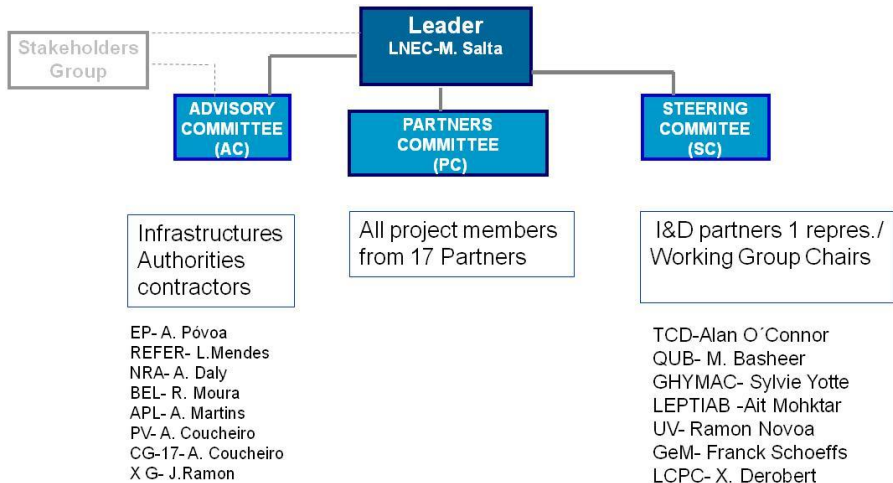
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Portugal	<p>Laboratório Nacional de Engenharia Civil, I.P. (LNEC)</p> <p>PROJECT LEADER</p> <p>Estradas de Portugal, SA (EP)</p> <p>REFER, E.P.</p> <p>Teixeira Duarte, S.A.</p> <p>Administração do Porto de Lisboa (APL)</p> <p>Fundo para o Desenvolvimento das Ciências da Construção (FUNDCCIC)</p>
France	<p>Institut Français des Sciences et Technologies des Transports, de l'Aménagement et des Réseaux (IFSTTAR)</p> <p>Université de Bordeaux</p> <p>Université de Nantes</p> <p>Université de La Rochelle</p> <p>Conseil General de la Charente-Maritime (CG-17)</p>
South and East Ireland	<p>Dublin University- Trinity College (TCD)</p> <p>National Roads Authority (NRA)</p>
Spain	<p>Universidade de Vigo (UV)</p> <p>Porto de Vigo</p> <p>Xunta da Galiza</p>
Northern Ireland	<p>Queen's University Belfast (QUB)</p>



4 INTERNAL CONSORTIUM ORGANIZATION

It is recognized that the success of the network DURATINET and the results tangibility was mainly due to the internal organization strategy implemented since the project initiation. This organization permitted to define very precisely the role and internal responsibility of each partner member. It was also possible with this structure to define efficient means for monitoring the progress of activities and to drive the development of the planned activities, towards the interest of the end users and the objectives defined in the project.



Nine working groups (WG) were organized to develop the work planned in each of project activity A1 to A10 (the activity 1 was related with the preparation of the consortium and submission of the project for co-financing):

- WG A2 - Maintenance decision tools for optimization of repairs
- WG A3 – Maintenance, repair/rehabilitation of concrete transport infrastructure
- WG A4 - Maintenance, repair/rehabilitation of metallic transport infrastructure
- WG A5 - Quality control requirements for repair work and systems
- WG A6 - Smart and green structural and repair materials
- WG A7 - Performance evaluation of repair systems and products
- WG A8 - Web tools for knowledge transfer
- WG A9 - Project promotion, communication and dissemination activities
- WG A 10 - Project management

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The nine working groups have regular semester meetings and sometimes other non-periodic meetings. The WG members also worked on-line using the web platform created for internal communication. The leaders of each WG are responsible for the development of activities planned, preparation of semester WG activity reports and supervision of project publications preparation

A Stakeholder Group was also created comprising representatives from administrations, owners, contractors and other societies operating in the area of infrastructure management and maintenance. Periodic information about project implementation was sent to this preferential group of end users.

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4.1 Project activities - Working groups

WG A2 - Maintenance decision tools for optimization of repairs

Chair

Alan O'Connor
Trinity College Dublin
Ireland



Partners active members

Country	Institution	Members
Portugal	<i>EP</i>	Afonso Póvoa,
	<i>REFER</i>	Hugo Patrício
France	<i>University of Bordeaux</i>	Denys Breysse
	<i>University of Nantes</i>	Sidi Mohammed Elachachi
	<i>Conseil général de la Charente-Maritime</i>	Franck Schoefs
Ireland	<i>NRA</i>	Anne Audouin-Dubreuil
		Albert Daly

Objectives/Deliverables

The main objective of this WG was to produce guidelines for maintenance planning and optimisation for reinforced concrete and steel infrastructure. The key aspects covered are:

- A state-of-the-art review of available deterministic, semi-probabilistic and fully probabilistic assessment tools
- Procedures for the statistical modelling of damage mechanisms of reinforced concrete and steel and incorporation into the chosen analysis framework
- Modification of the aforementioned mechanisms to allow for the effects of repair
- Procedures for the updating of models based upon condition surveys, NDT information, etc.
- Optimisation of maintenance planning to maximise whole life performance with respect to available budget
- Worked examples

Two volumes of TG “Maintenance and repair of transport infrastructure” concerning structures management were prepared inside this WG.

WG A3 – Maintenance, repair/rehabilitation of concrete transport infrastructure

Chair

Sree Manukuttan
Queen's University of Belfast
UK

**Partners active members**

Country	Institution	Members
Portugal	<i>LNEC</i>	Manuela Salta, Paula Rodrigues, António S. Silva, Elsa V. Pereira, Quirino Tomás
	<i>EP</i>	Afonso Póvoa Luis Freire
	<i>REFER</i>	Hugo Patrício
	<i>Teixeira Duarte</i>	Rita Moura
France	<i>IFSTTAR</i>	Xavier Dérobert Géraldine Villain Odile Abraham Laurent Gaillet
	<i>University of Bordeaux</i>	Denys Breyse Zoubir-Mehdi Sbartai
	<i>University of La Rochelle</i>	Karim Ait-Mokhtar, Quali Amiri
	<i>University of Nantes</i>	Marta Choinska Stephanie Bonnet
Ireland	<i>NRA</i>	Albert Daly
UK	<i>Queen's University Belfast</i>	Muhammed Basheer
		David Cleland
		Sudarshan Srinivasan

Objectives/Deliverables

The main objective of this WG was to prepare guidelines on repair/rehabilitation of concrete structures. The key aspects covered are:

- Review of requirements for concrete durability
- Deterioration mechanisms
- Assessment of structure condition
- Critical evaluation of available repair techniques

Four volumes of TG "Maintenance and repair of transport infrastructure" concerning concrete structures were prepared inside this WG.

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WG A4 - Maintenance, repair/rehabilitation of metallic transport infrastructure

Chair

Franck Schoefs
GeM, Nantes University
France



Partners active members

Country	Institution	Members
Portugal		Manuela Salta
	<i>LNEC</i>	Paula Rodrigues
		Maria João Correia Hugo
	<i>REFER</i>	Perneta
		Hugo Patrício
France	<i>IFSTTAR</i>	Laurent Gaillet

Objectives/Deliverables

The main objective of this WG was to identify and discuss the practical recommendation followed in the different regions on maintenance, repair/rehabilitation of steel structures and to prepare harmonized guidelines in this field. The key aspects covered are:

- Durability requirements and influencing factors
- Review of damage mechanisms of steel and protection systems for metallic structures
- Available methods for in-situ inspection, interpretation of results and associated uncertainties; applicability of the different techniques, advantages and limitations
- Available techniques for the repair and protection of structural steel

Five volumes of TG “Maintenance and repair of transport infrastructure” concerning steel structures were prepared inside this WG.

WG A5 - Quality control requirements for repair work and systems

Chair

Sylvie Yotte
Bordeaux University
France

**Partners active members**

Country	Institution	Members
France	<i>Conseil General de la Charente-Maritime</i>	Anne Audouin-Dubreuil
Portugal	<i>Teixeira Duarte</i>	Rita Moura

Objectives/Deliverables

The aim of this WG was to prepare guidance documents about quality control requirements and evaluation of the reliability of repair systems and the implications of the recent European standards on concrete repair and steel protection, concerning quality implementation plans by contractors and material suppliers.

Two technical reports were produced inside this WG.

WG A6 - Smart and green structural and repair materials

Chair

Ramon Novoa
Vigo University
Spain

**Partners active members**

Country	Institution	Members
France	<i>University of Bordeaux</i>	Sylvie Yotte
Portugal	<i>LNEC</i>	Manuela Salta; Maria João Correia A. Santos Silva; Elsa Pereira; Susana Fonseca
UK	<i>Queen's University Belfast</i>	Muhammed Basheer; David Cleland Sree V. Nanukkuttan; Sudarshan Srinivasan

Objectives/Deliverables

The aim of this WG was the promotion of "Smart and Green Structural materials" in construction using, "green" concrete incorporating by-products and recycled aggregates; corrosion resistant reinforcing steels; new stainless steel alloys for prestressing, permanent monitoring and environmentally friendly systems for steel protection, Another objective of this WG was to promote the creation of a cluster in Atlantic Area for "smart and green materials".

Five technical reports were produced inside this WG.

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WG A7 - Performance evaluation of repair systems and products

Chair

Karim AIT-MOKHTAR
La Rochelle University
France



Partners active members

Country	Institution	Members
Portugal	<i>EP</i>	Afonso Póvoa Luis Freire
	<i>LNEC</i>	Manuela Salta Ana Paula Melo
	<i>Teixeira Duarte</i>	Rita Moura
France	<i>University of Nantes</i>	Marta Choinska Stephanie Bonnet
	<i>University of La Rochelle</i>	Ouali Amiri
Ireland	<i>NRA</i>	Albert Daly

Objectives/Deliverables

The main focus of the WG was the evaluation of the performance of repair systems and products and the compatibility due to the interaction between the repair material and the old substrate. In this regard, it was studied repair systems applied in different structures and evaluated the performance of new repair materials and systems in small scale specimens exposed in experimental sites.

Two technical reports were produced with the work developed inside this WG.

WG A8 - Web tools for transfer knowledge

Chair

Maria João Correia
LNEC
Portugal

**Partners active members**

Country	Institution	Members
Portugal	EP	Afonso Póvoa
	REFER	Hugo Patrício
	LNEC	Manuela Salta; A Paula Melo Quirino Tomas; Hugo Pernetá
	Teixeira Duarte	Rita Moura
	Administração do Porto de Lisboa (APL)	Antonio Martins
	Fundo para o Desenvolvimento das Ciências da Construção (FUNDCCIC)	Joao Mimoso
France	University of Nantes	Stephanie Bonnet
	IFSTTAR	Xavier Derobert
	University of Bordeaux	Sylvie Yotte
	Conseil General de la Charente-Maritime (CG-17)	Anne Audouin -Dubreuil
	University of La Rochelle	Quali Amiri
Spain	University of Vigo	R. Novoa
	Porto de Vigo	A. Coucheiro
	Xunta Galicia	J. Ramon
UK	QUB	M. Basheer
Ireland	NRA	Albert Daly
	TCD	Alan O'Connor

Objectives/Deliverables

The four main objectives of this WG were:

Creation of a web platform for exchange and communication inside the partnership, to facilitate the work (<https://duratinet.basecamphq.com/login>)

Creation of a web site in four languages for public access and transfer of knowledge to the end users and stake holders (<http://www.duratinet.org>)

Development of a database DB-Durati with compilation of data on durability and performance of structural materials which can be used on the benchmarking of service life models or to evaluate the efficiency and reliability of repair materials and systems.

Construction of an informatics application for the dissemination of the guidelines developed inside the network, concerning maintenance and repair of structures in an interactive way adequate to internet access (<http://durati.lnec.pt/techguide/index.html>)

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WG A9 - Project promotion, communication and dissemination activities

Chair

Manuela Salta
LNEC
Portugal



Partners active members

Country	Institution	Members
Portugal	EP	Afonso Póvoa
	REFER	Hugo Patrício
	LNEC	Ana Paula Melo
	Teixeira Duarte	Rita Moura
	Administração do Porto de Lisboa (APL)	Antonio Martins
	Fundo para o Desenvolvimento das Ciências da Construção (FUNDCCIC)	Joao Mimoso
France	University of Nantes	Stephanie Bonnet
	IFSTTAR	Xavier Derobert
	University of Bordeaux	Sylvie Yotte
	Conseil General de la Charente-Maritime (CG-17)	Anne Audouin -Dubreuil
	University of La Rochelle	Quali Amiri
Spain	University of Vigo	R. Novoa
	Porto de Vigo	A. Coucheiro
	Xunta Galicia	J. Ramon
UK	QUB	M. Basheer
Ireland	NRA	Albert Daly
	TCD	Alan O'Connor

Objectives/Deliverables

The main objective of this WG was the establishment of strategies for project promotion, namely by the organisation of events, participation in events organised by other international teams for disseminating project activities and results, and through the preparation of periodic and non-periodic publications (newsletters, press releases and flyers) to disseminate project activities and results.

To achieve these objectives: seven trans-national workshops in the several countries of the consortium, an international conference and a course on inspection/repair were organized.

WG A 10 - Project management

Leader

Manuela Salta
LNEC
Portugal

**Partners active members**

Country	Institution	Members
Portugal	EP	Afonso Póvoa
	REFER	Hugo Patricio
	LNEC	Ana Paula Melo
	Teixeira Duarte	Rita Moura
	Administração do Porto de Lisboa (APL)	Antonio Martins
	Fundo para o Desenvolvimento das Ciências da Construção (FUNDICIC)	Joao Mimoso
France	University of Nantes	Stephanie Bonnet
	IFSTTAR	Xavier Derobert
	University of Bordeaux	Sylvie Yotte
	Conseil General de la Charente-Maritime (CG-17)	Anne Audouin -Dubreuil
	University of La Rochelle	Ouali Amiri
Spain	University of Vigo	R. Novoa
	Porto de Vigo	A. Coucheiro
	Xunta Galicia	J. Ramon
UK	QUB	M. Basheer
Ireland	NRA	Albert Daly
	TCD	Alan O'Connor

Objectives

The main objectives of this WG were:

- General monitoring of all the technical activities
- Monitoring by AC and SC of the execution and results obtained relatively to the work plan, objectives and respective indicators.
- Administrative and financial management of the project consortium.
- Preparation of semester technical progress reports and financial reports to comply with the commitments to the managing authority of the Atlantic Area, in accordance with the contract.

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4.2 Advisory Committee

Advisory Committee

Chair

Albert Daly
National Roads Authority
Ireland



Partners active members

Country	Institution	Members
Portugal	<i>EP</i>	Afonso Póvoa
	<i>REFER</i>	Hugo Patricio
	<i>Teixeira Duarte</i>	Rita Moura
	Administração do Porto de Lisboa (APL)	António Martins
Spain	Porto de Vigo	Antonio Coucheiro
	Xunta da Galiza	José Sancho
France	<i>Conseil General de la Charente-Maritime (CG-17)</i>	Anne Audouin -Dubreuil

Objectives

The function of the DURATINET Advisory Committee (AC) was to ensure that owners' views and needs are taken into account in all of the project activities and outputs. The AC brings together all the non-academic partners of the project and coordinates input from the National Administrations and Industry responsible for the management and operation of road, rail and water infrastructure. This ensures that the project results and deliverables are disseminated and implemented in a consistent way across the Atlantic Area regions. It is a fundamental component of the project.

The particular functions of the AC include the following:

- It is responsible for creating the project Stakeholders Group
- It ensures that the focus of all DURATINET activities is aligned with the needs of end-users
- It provides recommendations to the DURATINET SC and PL regarding dissemination and implementation of the project results and deliverables.

4.3 Steering Committee

Steering Committee

Chair

Mohammed Basheer
Queen's University of Belfast
United Kingdom



Partners active members

Country	Institution	Members
Portugal	<i>LNEC</i>	Manuela Salta
France	<i>University of Nantes</i>	Franck Schoefs
	<i>IFSTTAR</i>	Xavier Derobert
	<i>University of Bordeaux</i>	Sylvie Yotte
	<i>University of La Rochelle</i>	Karim Aint-Mokthar
Spain	<i>University of Vigo</i>	R. Novoa
Ireland	<i>TCD</i>	Alan O'Connor

Objectives

The Steering Committee (SC) integrates all the leaders of the working groups responsible for each specific activity in the project. SC meets every six month.

SC was responsible for monitoring the technical activities in the project and for providing the assistance needed for the project management relating to:

- verification of the compliance of the development of the technical activities according to the general work plan established in the project;
- validation of the six month plans prepared within each WG;
- evaluation and discussion of WG progress activities;
- monitoring of the execution of the activities plan based on results and on the execution indicators achieved, taking consideration of the six month reports presented by each WG chair;
- mobilisation of the necessary means for the execution of the work plan;
- definition and approval of general guidelines for implementing the policy to be adopted for disseminating the project activities, after previous analysis and validation of the contents and their verification according the EC and the Atlantic Area Programme rules.
- discussion and approval of documents prepared in support of activities of WG's 8 and 9 and the participation in international meetings for dissemination of the project results.

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4.4 Editorial Commission

Editorial Commission members

Country	Institution	Members
Portugal	<i>LNEC</i>	Manuela Salta
France	<i>University of Bordeaux</i>	Dennys Breysse
Spain	<i>University of Vigo</i>	R. Novoa
UK	<i>QUB</i>	M. Basheer
Ireland	<i>NRA</i>	Albert Daly

Objectives

This commission was created to supervise the project publications, particularly the Technical Guide.

5 DISSEMINATION AND COMMUNICATION ACTIONS

The dissemination of results and the transfer of knowledge is a key-factor in the DURATINET project and several actions were planned within this objective. The dissemination and communication plan defined was mainly focused on the interest of end users: managing authorities operating the transport infrastructure, contractors, structural engineers and repair materials producers. The following objectives were taken into account:

- To create conditions inside the network for efficient communication between partners and with the end-users permitting to drive the network results towards these end users.
- Imparting of knowledge to end users with the purpose of mobilizing them for the use and application of project results, namely the guidelines developed.
- Dissemination of the project activities to promote ideas exchange with the international scientific and technical community, in the particular area of knowledge considered in the project.
- Promotion and development of more ecologic and smart structural materials and the use of environmental sustainable repair materials, creating the support for the generation of a Cluster "Green and Smart Structural Materials in Atlantic Area".

On the establishment of the plan for dissemination and communication, several type of actions were considered:

- Creation of tools for adequate dissemination and communication
- organization of technical events, namely, semester trans-national workshops in the various regions having as main objective to promote the dialogue and knowledge transfer with local end-users;
- collaboration on the organization of international conferences and special sessions associated to national or international conferences;

- organization of a technical course on testing techniques for inspection with demonstration actions, mainly addressed to technicians from repair companies and testing materials laboratories and engineers from owners and management bodies operating in transport infrastructure;
- preparation of semester newsletters and posters for presentation in technical and scientific meetings by DURATINET initiative or promoted by other associations operating in similar specific areas. Preparation of leaflets for distribution and project news for publication in technical magazines and in the press.

5.1 DURATINET Web-tools

For internal communication of consortium members, a DURATINET web platform was developed.

<https://duratinet.basecampmq.com/login>

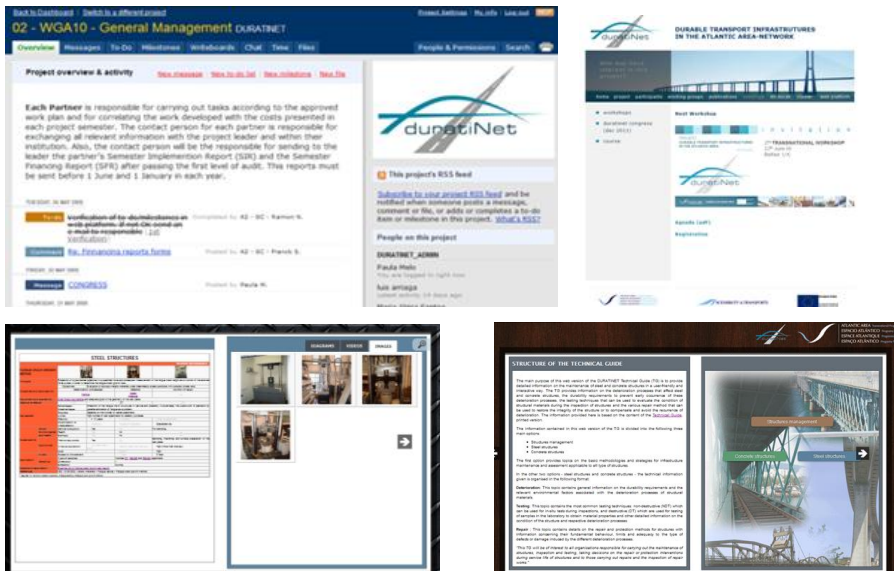
For external communication the DURATINET web site, in four languages, was created which contains the most relevant information about the several project activities, and publications produced during project execution.

<http://www.duratinet.org>

A database DB-Durati was also developed to include a compilation of data on durability and performance of structural materials, repair systems and products which can be used for the benchmarking of service life models or for the evaluation of repair methods and products application.

An informatic application for a wider dissemination of the TG in an interactive format was also developed by the network in English and Portuguese.

<http://durati.lnec.pt/techguide/index.html>



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5.2 Technical events

Several events for dissemination and communication were organized:

- Seven Trans-national workshops in the different countries involved in the project.
- Collaboration in the organization of an international conference.
- One course on testing techniques for inspection with demonstration actions on specific techniques.
- Two Special Sessions in national conferences promoted by other institutions.
- Participation in events organised by other international associations for dissemination of project activities and results
- Nine partners meetings, organized in the different countries involved in the project with all the partnership.

5.2.1 Trans-national workshops

Each workshop was organized by a joint cooperation between the project leader and the local partner. Seven trans-national workshops have been organized within the project. A common organization format was adopted for all the workshops. In general the workshop programme contains two sessions. One session includes presentations by the project leader and WG's chair and is mainly devoted to present the progress of DURATINET project activities. The other session provides to the local transport infrastructure authorities and other local users, the opportunity to exchange their experiences and specific needs in management, maintenance and repair of their transport infrastructure.

The oral presentations done in all the workshops (power point presentations) can be downloaded from DURATINET web site.

In all workshops a discussion panel was also organized between the local end users and the project members, concerning several topics related with maintenance and repair of structures.

A total of more 400 participants in these workshops were registered involving representatives from transport infrastructure administration, contractors, consultants, repair producers and other individual participants. Summary indications about these workshops are given.

1ST TRANS-NATIONAL WORKSHOP

Organization: LNEC

Date: 20.02.2009

Local: Lisbon, Portugal

Participants: 70

Invited Speakers from:

EP-EPE, PT

REFER, PT

A2P Consultants, PT



2ND TRANS-NATIONAL WORKSHOP

Organization: QUB

Date: 20.06.2010

Local: Belfast, United Kingdom

Participants: 47

Invited Speakers from:

National Roads Authority

McFarland Associates



ACTIVITY SUMMARY REPORT

3RD TRANS-NATIONAL WORKSHOP

Organization: University of Bordeaux

Date: 21.01.2010

Local: Bordeaux, France

Participants:55



4TH TRANS-NATIONAL WORKSHOP

Organization: TCD

Date: 10.06.2010

Local: Dublin, Ireland

Participants: 51

Invited Speakers from:

National Road Authorities of Ireland

Irish Rail

Roughan O'Donovan Consulting Engineers



5TH TRANS-NATIONAL WORKSHOP

Organization: University of Vigo

Date: 21.01.2011

Local: Vigo, Spain

Participants: 41

Invited Speakers from:

Road Authority Xunta de Galicia

ENMACOSA

University of Vigo



6TH TRANS-NATIONAL WORKSHOP

Organization: University of Nantes & IFSTTAR

Date: 07.06.2011

Local: Nantes, France

Participants: 22

Invited Speakers from:

CETE de l'Ouest

Oxand



7TH TRANS-NATIONAL WORKSHOP

Organization: LNEC

Date: 30.05.2012

Local: Lisbon, Portugal

Participants: > 100

Invited Speakers from:

Road and Railways Portuguese

Management Authorities

PTPC

A2P Consultants



ACTIVITY SUMMARY REPORT

5.2.2 Partners meetings

Six partners meetings have been organized by the project leader. During these meetings, all project partners could discuss in detail aspects related with the plan of activities, milestones and deliverables, dissemination, communication and all important project management subjects. After partners meetings technical visits to local infrastructure were organized in different countries.

For all the meetings detailed minutes including the semester evaluation of progress activities and the planning of activities for the next semester were prepared.

Additionally two technical meeting of WGA2, WGA3 and WGA4 were organized in Lisbon to discuss specific subjects concerning activities of these WG's concerning the preparation of guidelines on testing techniques for steel and concrete.

1ST PARTNERS MEETING (Kick-off-meeting)

Organization: LNEC

Date: 20 and 21 .02.2009

Local: Lisbon, Portugal

Participants: 25



2ND PARTNERS MEETING

Organization: QUB

Date: 20 and 21.06.2010

Local: Belfast, United Kingdom

Participants: 25



TECHNICAL VISIT – Bridge at Northern Ireland



WGA2 & WGA3 & WGA4 TECHNICAL MEETING

Organization: LNEC

Date: 06 and 07.01.2010

Local: Lisbon, Portugal

Participants: 14



3RD PARTNERS MEETING

Organization: University of Bordeaux

Date: 21 and 22.01.2010

Local: Bordeaux, France

Participants: 32



ACTIVITY SUMMARY REPORT

4TH PARTNERS MEETING

Organization: TCD

Date: 10 and 11.06.2010

Local: Dublin, Ireland

Participants: 24



TECHNICAL VISIT – Ferrycarrig bridge



WGA3 & WGA4 TECHNICAL MEETING

Organization: LNEC

Date: 13,14 and 15.10.2010

Local: Lisbon, Portugal

Participants: 16



5TH PARTNERS MEETING

Organization: University of Vigo

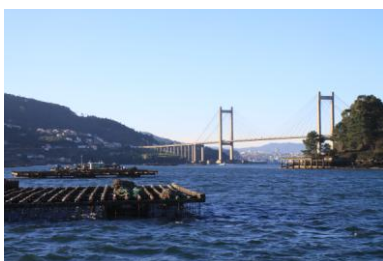
Date: 21.01.2011

Local: Vigo, Spain

Participants: 24



TECHNICAL VISIT: Port of Vigo



6TH PARTNERS MEETING

Organization: University of Nantes & IFSTTAR

Date: 08 and 09.06.2011

Local: Nantes, France

Participants: 24



TECHNICAL VISIT: IFSTTAR Laboratory and Port of Nantes



ACTIVITY SUMMARY REPORT

7TH PARTNERS MEETING

Organization: LNEC

Date: 28 and 29.11.2011

Local: Lisbon, Portugal

Participants: 22



5.2.3 Special sessions

Two DURATINET Special Sessions were organised for dissemination of project activities and discussion of DURATINET achievements with Portuguese project end users.

These special sessions were included in two Portuguese important congresses.

SPECIAL SESSION

Organization: REABILITAR 2010

Date: 24.06.2010

Local: Lisbon, Portugal



This National meeting was attended by more than 250 delegates and has included in its programme the special session.

SPECIAL SESSION

Organization: ASCP 2011

Date: 29.06.2010

Local: Coimbra, Portugal



The DURATINET special session was included in the programme of ASCP'11. This conference was attended by more than 200 delegates. Several project members participate in this session presenting project activities and results.

5.3 Technical Course and International Conference

INTERNATIONAL CONFERENCE MEDACHS'10

Co-Organization:
University of La Rochelle

Date: 28 to 30.04.2010

Local: La Rochelle, France



On this International Conference several members of DURATINET made oral presentations including results of activities developed in the project. It was organized by University of La Rochelle and was attended by more than 100 participants.

ACTIVITY SUMMARY REPORT

JOINT TRANSNATIONAL CONFERENCE

Organization: Atlantic Area Operational Program

<https://registration.livegroup.co.uk/transnational-cooperation/>

Date: 15 and 16.09.2011

Local: Katowice, Poland

Collaboration on the preparation of the video involving the 18 projects selected, to be presented during the Joint Transnational Conference. Participation of a DURATINET partner to present the project in this meeting.

INTERNATIONAL CONFERENCE ICDS 12

Co-Organization: LNEC

Date: 31.05 and 1.06.2012

Local: Lisbon, Portugal



<http://durablestructures2012.lnec.pt>.

TECHNICAL COURSE ON TESTING TECHNIQUES

Organization: DURATINET

Date: 31.05 and 1.06.2012

Local: Lisbon, France

Participants: Expected more than 70 delegates

<http://durablestructures2012.lnec.pt>.

5.4 Publications

Several publications have been produced in the project. Some of them correspond to interim reports and were prepared during different phases of project execution, therefore are not for public

dissemination. Some of these interim reports originated final public reports. All public publications can be downloaded from the network website.

- Technical guide on maintenance/repair of concrete and steel transport infrastructure, containing 12 volumes (public)
- 32 interim reports (not public) concerning different subjects developed during the project
- 10 technical reports (public)
- 31 technical papers for Scientific Journals and international or national conferences (public) prepared with DURATINET support
- 7 DURATINET Newsletters (public)
- One project activities summary report (public)
- A booklet for TG dissemination (public)
- Book containing the supporting texts prepared for the technical course (public)
- Power point presentations done by speakers in the 7 workshops (public)
- Several posters, flyers and press news (public)

6 OPPORTUNITIES FOR JOBS

The development of DURATINET project created several grants positions occupied by young engineers: LNEC (3 positions), TCD (1 position), Univ. of Nantes (1 position), QUB (1 position), Univ. La Rochelle (1 position) and Univ. of Vigo (1 position).

These engineers have been developing project activities and, simultaneously, had the possibility to get knowledge and specialization in the areas concerned in the project which give them new opportunities for getting jobs.

7 PROJECT RESULTS

As project results must be considered all the public technical documents and publications produced inside the network consortium and also the web tools created in the project.

All the technical meetings (trans-national workshops, international conferences co-organization and demonstration techniques course) indicated in session 5 should be also consider relevant project results. These actions are means to promote the dissemination of DURATINET activities and certainly represented an important contribution for exchanging practical knowledge, in the area of infrastructure maintenance.

Some specific indications are given about the Technical Guide and Technical Reports.

ACTIVITY SUMMARY REPORT

7.1 DURATINET Technical Guide

One of the main deliverables of the project and with potential for a wider dissemination is the Technical Guide (TG) on reinforced concrete and steel durability requirements, inspection and diagnosis of damage, repair of materials and methodologies for optimising the maintenance of infrastructure. This will be a very useful guide to support decisions on maintenance.

The Technical Guide is organized in four parts each one containing several volumes:

Part I - Introduction to technical guide

Part II - Maintenance and assessment

Part III - Steel Structures

Part IV - Concrete Structures

An extended version of TG was prepared for a book series (ISBN978-972-42-2237-9) and also for CD-Rom digital support (ISBN 978-972-49-2238-6)

An interactive version especially designed for a web application, which has the address **<http://www.duratinet.org/techguide>** was also delivered. This TG web version contains a general organization similar to the extended version but the several subjects are presented in a synthetic and interactive format adequate to an internet application.

7.2 Technical reports

The ten technical reports were prepared inside the WG's 5, 6 and 7 concerning different specific topics:

- TR 5.1: Repair materials
- TR 5.2: Execution of repair works
- TR 5.3: Reinforced concrete structures rehabilitation in maritime environment - Quality control
- TR 6.1: Repair and green concrete
- TR 6.2: Fiber reinforced polymer composite materials used in civil engineering
- TR 6.3: Stainless steel rebars
- TR 6.4: Smart structural materials with permanent monitoring system for concrete: novel sensors for monitoring the durability of concrete structures
- TR 6.5: Corrosion monitoring systems installed in portuguese structures
- TR 7.1: Repair systems in structures practical cases
- TR 7.2: Repair systems in small scale samples exposed in experimental sites

8 FINAL CONSIDERATIONS

The knowledge transfer was a key aspect in the project development and the solutions created for internal and external communication within the network have been highly efficient.

The project results achieved fully comply with the established objectives and the indicators defined for those results were also satisfied.

The strategy adopted for project dissemination allows a wide dissemination of project results and of all information created by the network to our stakeholders and end users.

The different forms of project results presentation and the communication tools created not only have given the appropriate results visibility during the project implementation, but also assure the maintenance of this visibility beyond the project conclusion.

The communication tools created in the project have proven to be excellent to easily ensure the network continuity and the generation of new projects maintaining the network alive.

It is important to note that the project management methodology implemented by the Managing Authority of Atlantic Area Programme, after an initial adaptation phase of the different parts involved, has proven to be effective and facilitate the administrative and financial management issues, according to the program rules.

We also highlight the cordial relationship established by the JTS with the project leader and partners which was decisive for the resolution of all administrative and management issues and for the successful implementation of project management tasks.

ACTIVITY SUMMARY REPORT

DURATINET PARTNERS

PORTUGAL

Laboratório Nacional de Engenharia Civil, I.P. (LNEC)
Estradas de Portugal, SA (EP)
REFER, E.P.
TEIXEIRA DUARTE – Engenharia e Construções, S.A.
Administração do Porto de Lisboa (APL)
Fundo para o Desenvolvimento das Ciências da Construção (FUNDICIC)

FRANCE

Institut français des sciences et technologies des transports, de l'aménagement et des réseaux (IFSTTAR)
Université de Bordeaux
Université de Nantes
Université de La Rochelle
Conseil General de la Charente-Maritime (CG-17)

IRELAND

Dublin University- Trinity College (TCD)
National Roads Authority (NRA)

SPAIN

Universidade de Vigo (UV)
Porto de Vigo
Xunta da Galiza

UNITED KINGDOM

Queen's University Belfast (QUB)



