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Guidance for repair/rehabilitation of concrete transport infrastructures (CTIS)

Lead partner: Queens University Belfast (QUB)
Sub task leaders: U. Rochelle, U. Bordeaux, LNEC
Other partners:
LCPC, U. Nantes, TCD, NRA, EP, REFER, BEL & CG-17

 European Union
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 ATLANTIC AREA
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1ST Transnational Workshop
Lisboa- LNEC, 19th February 2009



Aim of the Activity

To make a critical review concerning the main subjects involved in CTIS damage, assessment and repair techniques

- Exposure variations
- Types of structures
- Causes of deterioration
- Material degradation models
- Impact of degradation on structural performance
- Decision on time of intervention
- Establishment of performance requirements
- Repair strategy – methods and materials
- Assessment of performance of repair & structure

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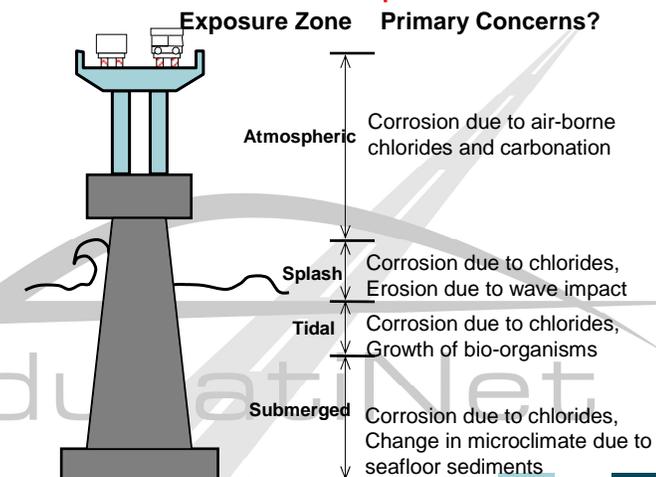


Action Plan

- > Action 3.1 Review of requirement of durability of structures (QUB)
- > Action 3.2 Mechanisms of damage (U. Rochelle)
- > Action 3.3 Assessment of structural condition (U. Bordeaux)
- > Action 3.4 Available repair techniques (LNEC)
- > **Expected outcomes**
Guidelines book and short version for web

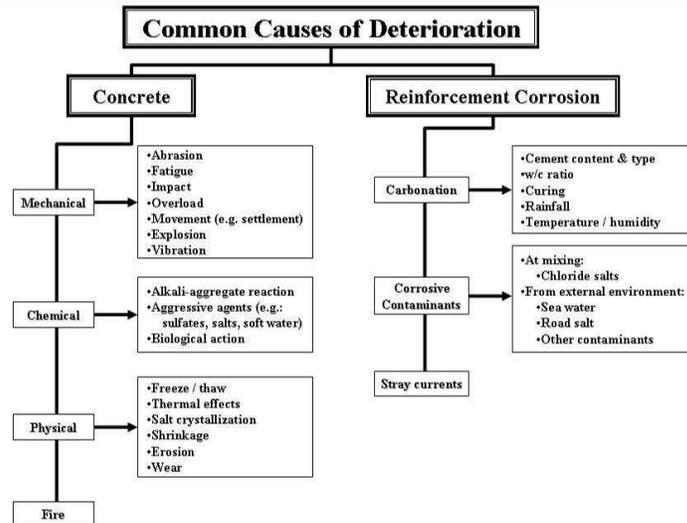


Action 3.1 Review of requirements for concrete durability and methods of their specification





Causes of Deterioration



Action 3.1 Review of requirements for concrete durability and methods of their specification



Need to consider:

- Environmental penetrations
- Action of these on materials
- Rate of action and consequence
- Extent of the action

Limit states for durability



Current practice of specifying the durability

	Design	Practice	Control
Cover Thickness	Specify Minimum Cover ☺	Careful placement and fixing	Covermeter survey ☺
Quality of Cover (= Transport Properties)	$f'c$ Min. CC Max. w/c ☹	Concrete production	Tests on standard cubes/ cylinders ☺
		Execution <ul style="list-style-type: none"> • Placement • Compaction • Finishing • Formwork removal • Curing • Surface treatments 	Core tests ☹ Site Tests? Permeability, sorptivity, ion migration? ☹

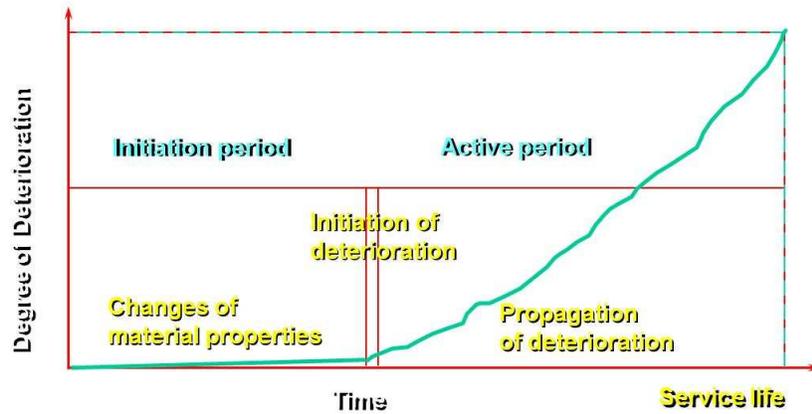


Change of practice in specifying the durability?

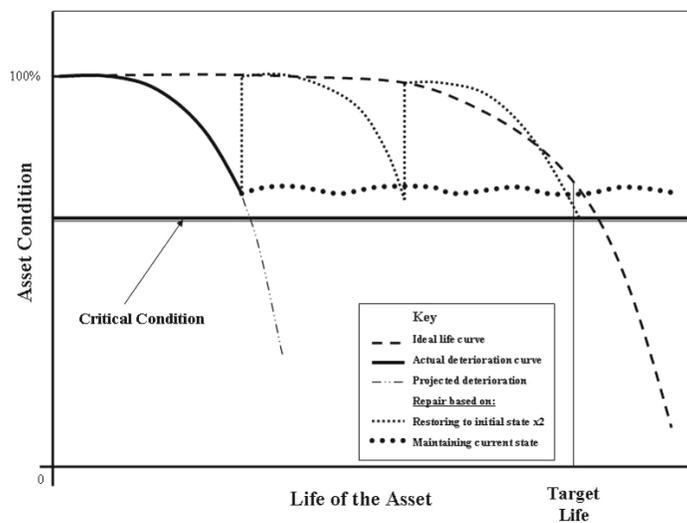
	Design	Practice	Control
Cover Thickness	Specify Minimum Cover ☺	Careful placement and fixing	Covermeter survey ☺
Quality of Cover (= Transport Properties)	Specify Concrete Class and k_{max} ☺	Concrete production	Tests on standard cubes/ cylinders ☺
		Execution <ul style="list-style-type: none"> • Placement • Compaction • Finishing • Formwork removal • Curing • Surface treatments 	Core tests (Optional) ☺ Site Tests: permeability, sorptivity & ion migration ☺



Degradation models and impact of degradation on structural performance



Decision on Time of Intervention





Discussion on Action Plan 3.1 (QUB)

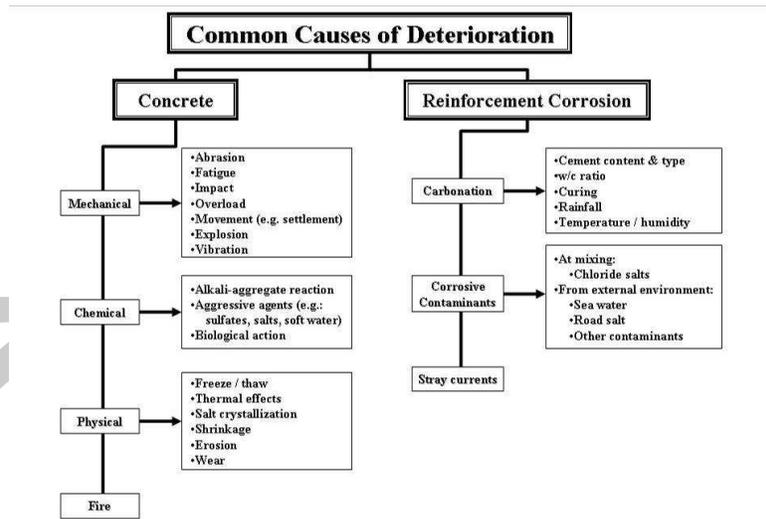
Review of requirements of durability of structures

Topics to be included	- Physical properties - Transport properties
Duration of the activity	- 12 months
Deadline for end product	- 31 January 2010
Dissemination	- Report/web summary
Information for web platform	- As above

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Action 3.2 Mechanism and types of damage in RC structures (U Rochelle)





Action 3.2 Mechanisms of damage (U. Rochelle)

- Review of mechanisms
- Damage due to mechanisms and degradation models
- Classification of damage
- Structural significance & consequences
- Time of intervention

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Discussion on Action Plan 3.2 (U Rochelle) Mechanism and types of damage of RC structures

Topics to be included	- All mechanisms?
Duration of the activity	- 12 months
Deadline for end product	- 31 January 2010
Dissemination	- Report/web summary
Information for web platform	- As above

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Action 3.3 Inspection techniques for *in situ* condition evaluation of RC structures (U Bordeaux)

- > Data collection for correct/safe action
- > Methods to identify primary cause
- > Quantify the effect
- > Future deterioration/prediction
- > Structural implication and acceptable performance



Discussion on Action Plan 3.3 Inspection techniques for *in situ* condition evaluation of RC structures

Topics to be included	- All relevant methods
Duration of the activity	- 12 months
Deadline for end product	- 31 January 2010
Dissemination	- Report/web summary
Information for web platform	- As above



Action 3.4 Repair techniques for concrete structures (Application of EN 1504) (LNEC)

- > Based on EN1504 for concrete repair
- > Advantages/disadvantages of repair techniques
- > Why would a repair technique fail?
- > Methods of assessing the performance of repair

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Repair Strategies

Defects in Concrete

1. Protection against ingress
2. Moisture control
3. Concrete restoration
4. Structural strengthening
5. Physical resistance
6. Resistance to chemicals

Reinforcement corrosion

7. Preserving or restoring passivity
8. Increasing resistivity
9. Cathodic control
10. Cathodic protection
11. Control of anodic areas

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Discussion on Action Plan 3.4

Repair techniques for concrete structures

Topics to be included	- All relevant methods
Duration of the activity	- 12 months
Deadline for end product	- 31 January 2010
Dissemination	- Report/web summary
Information for web platform	- As above

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Plan of action

Publication Activity		Initial consultation	Completion of Review
3.1	Requirement of durability	Feb 2009	31 Jan 2010
3.2	Mechanisms of damage	Feb 2009	31 Jan 2010
3.3	Assessment of condition	Feb 2009	31 Jan 2010
3.4	Inspection techniques; equipments; understanding results; interpretation of data	Feb 2009	31 Jan 2010

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Time plan for deliverables

Publication Activity	Case study	Final Report
3.1 Requirement of durability	1 Feb 2010	31 Dec 2010
3.2 Mechanisms of damage	1 Feb 2010	31 July 2010
3.3 Assessment of condition	1 Feb 2010	31 Jan 2011
3.4 Inspection techniques; equipments; understanding results; interpretation of data	1 Feb 2010	31 Dec 2011

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Short term plan for deliverables

action	Deadline
Table of content from lead partner to other partners	End of 1st month
Comments/contribution by partners to lead partner	Middle of 2nd month
Agreement on division of contribution	End of 2nd month
First draft	End of 6th month
Distribution & Comments/Amendments	End of 7th month
Final draft	End of 12th month



Deliverables

- > **Description of inspection techniques**
- > **Detail of equipments for testing/inspection**
- > **Details on the technical skills requirement**
- > **Understanding the results and interpretation**
- > **Examples of repairs**



Meetings in Belfast

- | | |
|----------------|---|
| June 2009 | International workshop
Partner meeting
Steering Committee meeting |
| September 2011 | Local workshop |

Thank You