



UNIVERSIDADE
DE VIGO



duratiNet



Project nr 2008-1/049

7th Trans-national Workshop
Lisboa • LNEC • 30th May 2012

Activity 6
**“Green” and smart structural materials
repair products and systems**

X. Ramón Nóvoa



European Union
European Regional
Development Fund


Investing in our common future



ATLANTIC AREA
Transnational Programme

duratiNet

7th Trans-national Workshop
Lisboa • LNEC • 30th May 2012



UNIVERSIDADE
DE VIGO


Working Parties and coordinators

A6.1 Concrete mixes with sub-products and recycled aggregates
(Univ. Bordeaux) (Fr)

A6.2 Rebars more resistant to corrosion (SS, fibers)
(Univ. Vigo) (Es)


A6.3 Smart structural materials (Coatings, Permanent monitoring)
(QUB) (UK)

A6.4 New materials and systems for steel protection
(LNEC) (Port)



ATLANTIC AREA
Transnational Programme

Investing in our common future



European Union
European Regional
Development Fund

duratiNet

7th Trans-national Workshop
Lisboa • LNEC • 30th May 2012

UNIVERSIDADE DE VIGO

Objective

sustainable structures

Critical review on:

- **Green concrete mixes for new or repaired structures.**
- **Structural materials with improved durability.**
- **Intelligent structural materials with active properties:**
 - self cleaning concrete
 - coatings
 - monitoring systems

 ATLANTIC AREA
Transnational Programme

Investing in our common future

 European Union
European Regional Development Fund

duratiNet

7th Trans-national Workshop
Lisboa • LNEC • 30th May 2012

UNIVERSIDADE DE VIGO


sustainable structures

**Reduced consumption of:
cement, arid, water**


Re-use of industrial wastes

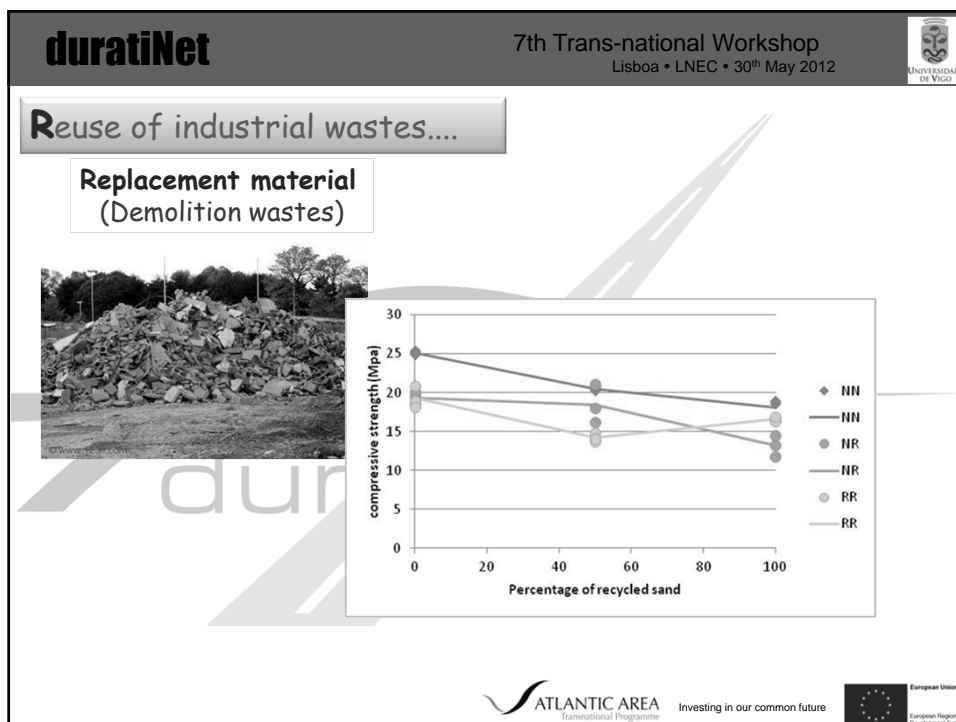
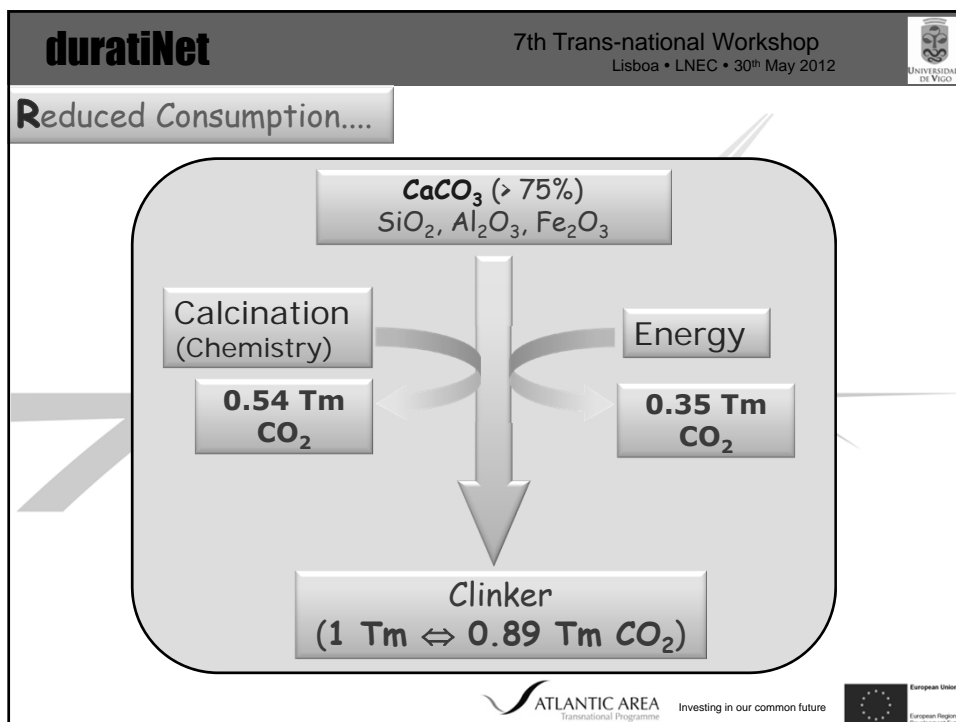
Increased service life

Increased performance

 ATLANTIC AREA
Transnational Programme


Investing in our common future

 European Union
European Regional Development Fund



duratiNet

7th Trans-national Workshop
Lisboa • LNEC • 30th May 2012



Reuse of industrial wastes....

**Replacement material
(Demolition wastes)**



Corrosion inhibitors



Granite cutting slurries






Red Muds

Hungary,
2010-10-05



ATLANTIC AREA
Transnational Programme


Investing in our common future



European Union
European Regional Development Fund

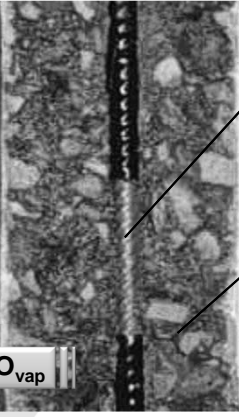
duratiNet

7th Trans-national Workshop
Lisboa • LNEC • 30th May 2012



Increased Service life....


**Coatings
Waterproofing**



**Green Inhibitors
Stainless Steels
Galvanised steel**


MONITORING
 E_{corr} , RH%, p, Cl⁻

$4Fe + 3O_2 + 2H_2O \longrightarrow 4FeO(OH)$



ATLANTIC AREA
Transnational Programme

Investing in our common future



European Union
European Regional Development Fund

duratiNet

7th Trans-national Workshop
Lisboa • LNEC • 30th May 2012





Interstate Highway 35W
bridge in Minneapolis,
Minnesota, 40-y old,
On August 1, **2007**

Rush hour horror

< 1 2 3 4 5 6 7 8 >



Hindsight

SHOW CAPTION

< 1 2 3 4 5 6 7 8 9 10 11 12 13 >


**ATLANTIC AREA**
International Programme

Investing in our common future

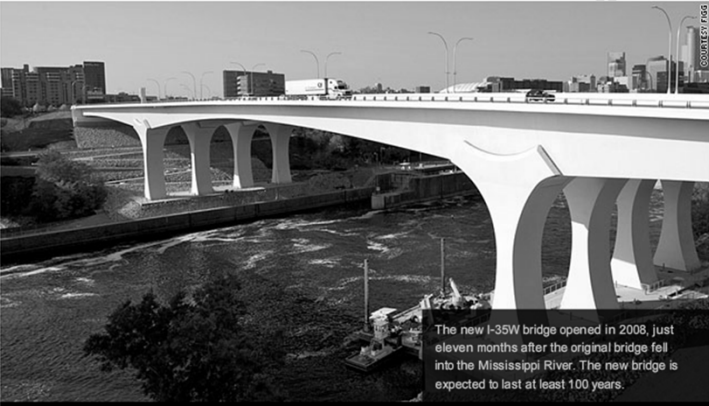
European Union
European Regional
Development Fund

duratiNet

7th Trans-national Workshop
Lisboa • LNEC • 30th May 2012



3 years later....




The new I-35W bridge opened in 2008, just eleven months after the original bridge fell into the Mississippi River. The new bridge is expected to last at least 100 years.

New I-35W bridge: Minneapolis, Minnesota


HIDE CAPTION

1 2 3 4 5 6 7 8 9 10 11 12 13 >

<http://edition.cnn.com/2010/TECH/innovation/07/30/minneapolis.bridge.sensors>

**ATLANTIC AREA**
International Programme

Investing in our common future

European Union
European Regional
Development Fund

duratiNet

7th Trans-national Workshop
 Lisboa • LNEC • 30th May 2012



The new bridge sensors built into vibrating wire still changes in the

'Smart bridge' sensors



Smart Bridge
323 sensors

Cost: \$233.8 M
 (sensors 1 M, 0.4%)



SHOW OPTION

Anti-corrosion sensors

<
1
2
3
4
5
6
7
8
9
10
11
12
13
>

ATLANTIC AREA
Transnational Programme

Investing in our common future


European Union
 European Regional Development Fund

duratiNet


7th Trans-national Workshop
 Lisboa • LNEC • 30th May 2012

Increased performance (FRP)....

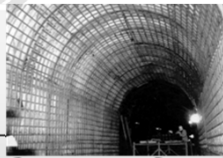
FIBER REINFORCED POLYMERS




Repair



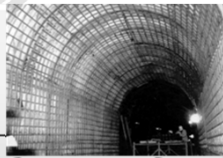
Strengthening



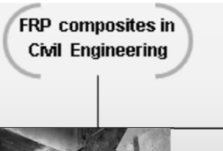
Seismic retrofit



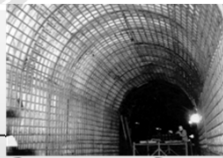
Structural elements



Concrete reinforcement



FRP composites in
Civil Engineering



New construction

ATLANTIC AREA
Transnational Programme

Investing in our common future

European Union
 European Regional Development Fund



duratiNet

7th Trans-national Workshop
Lisboa • LNEC • 30th May 2012

Activity 6
“Green” and smart structural materials
repair products and systems

X. Ramón Nóvoa

Thank you

 UNIVERSIDADE DE VIGO

 ACCESSIBILITY & TRANSPORTS
Project nr 2008-1/049

 European Union
European Regional Development Fund
Investing in our common future

 ATLANTIC AREA
Transnational Programme