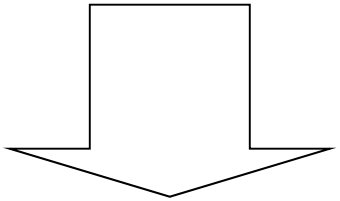
ARCHES

a gaze on Central European highway structures

Project presentation

Tomasz Wierzbicki
IBDiM

The main goal of NMS's administration is constructing a new roads - mainly motorways



Insufficient resources for the conservation of existing infrastructure

Road transport

the primary means of mobility for European people and goods

Pan-European corridors

May 1st 2004

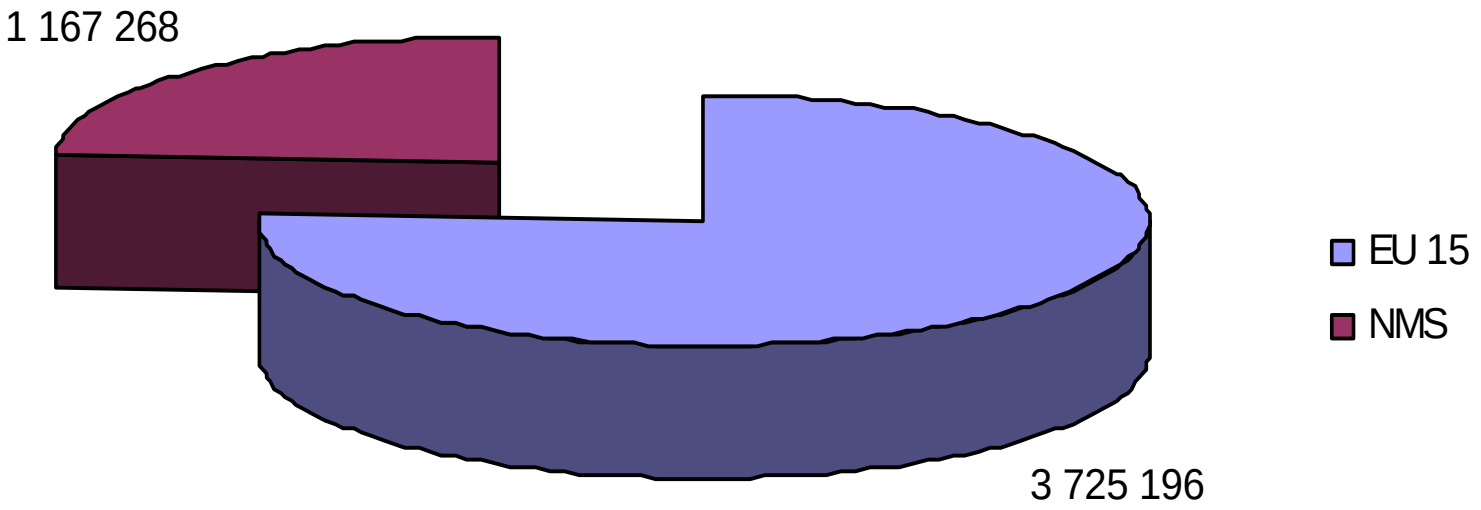
1st European Union Enlargement

10 new road networks in system

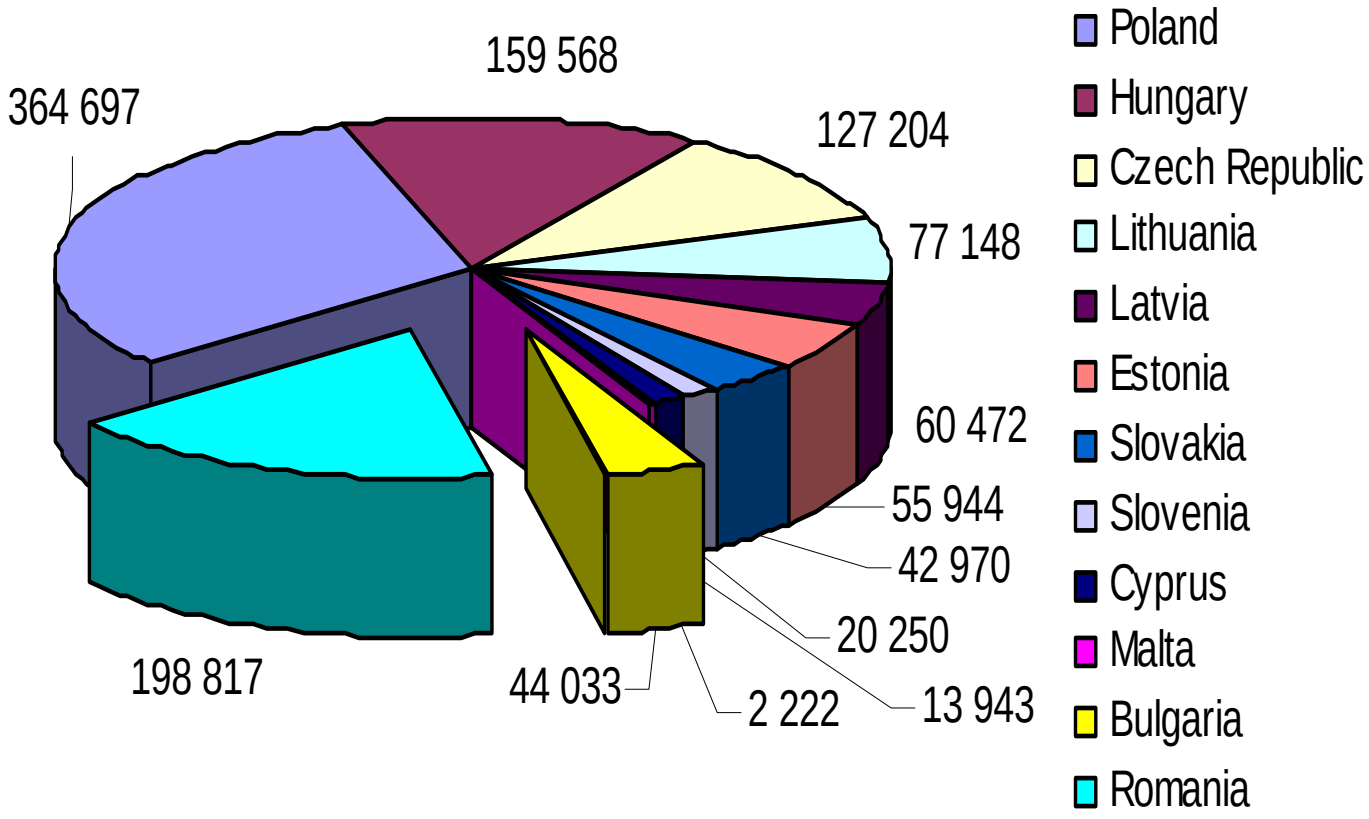
December 31st 2007

2nd European Union Enlargement
2 new road networks in system

Road system distribution between EU15 and NMS [km]



Road network in new Members States [km]



Conclusion:

¼ of European roads located in CEEC

Critical for E/W and N/S corridors

SIXTH FRAMEWORK PROGRAMME

PRIORITY 1.6.2

Sustainable Surface Transport

Call 3B

FEHRL
Forum of European National Highway Research Laboratories

the initiative body of the proposal

The Arches Genesis

BRIME
BRIdge Management in Europe

COST 345

SAMCO

SAMARIS

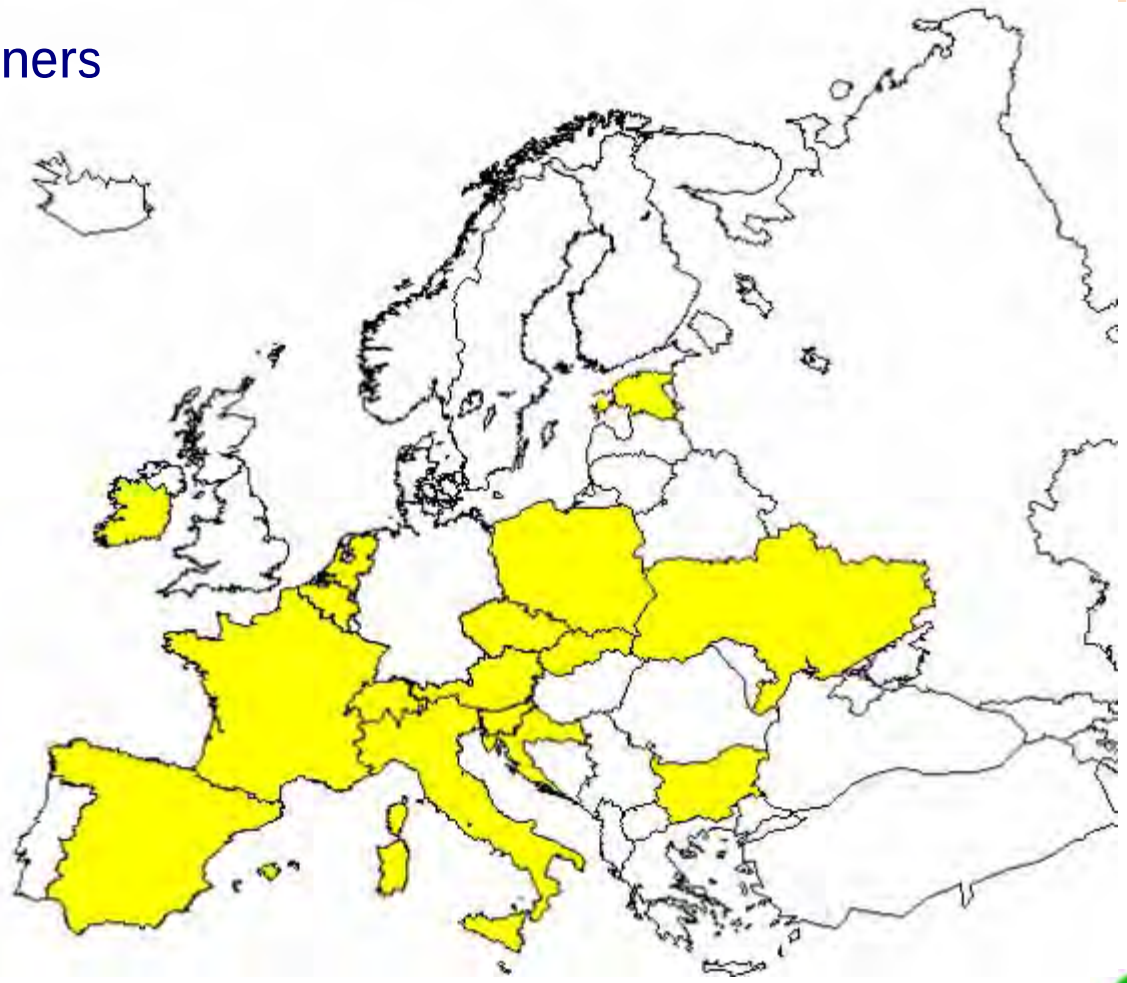
ARCHES
CERTAIN

1 st of September 2006

Official start of the ARCHES Project

The ARCHES fact file

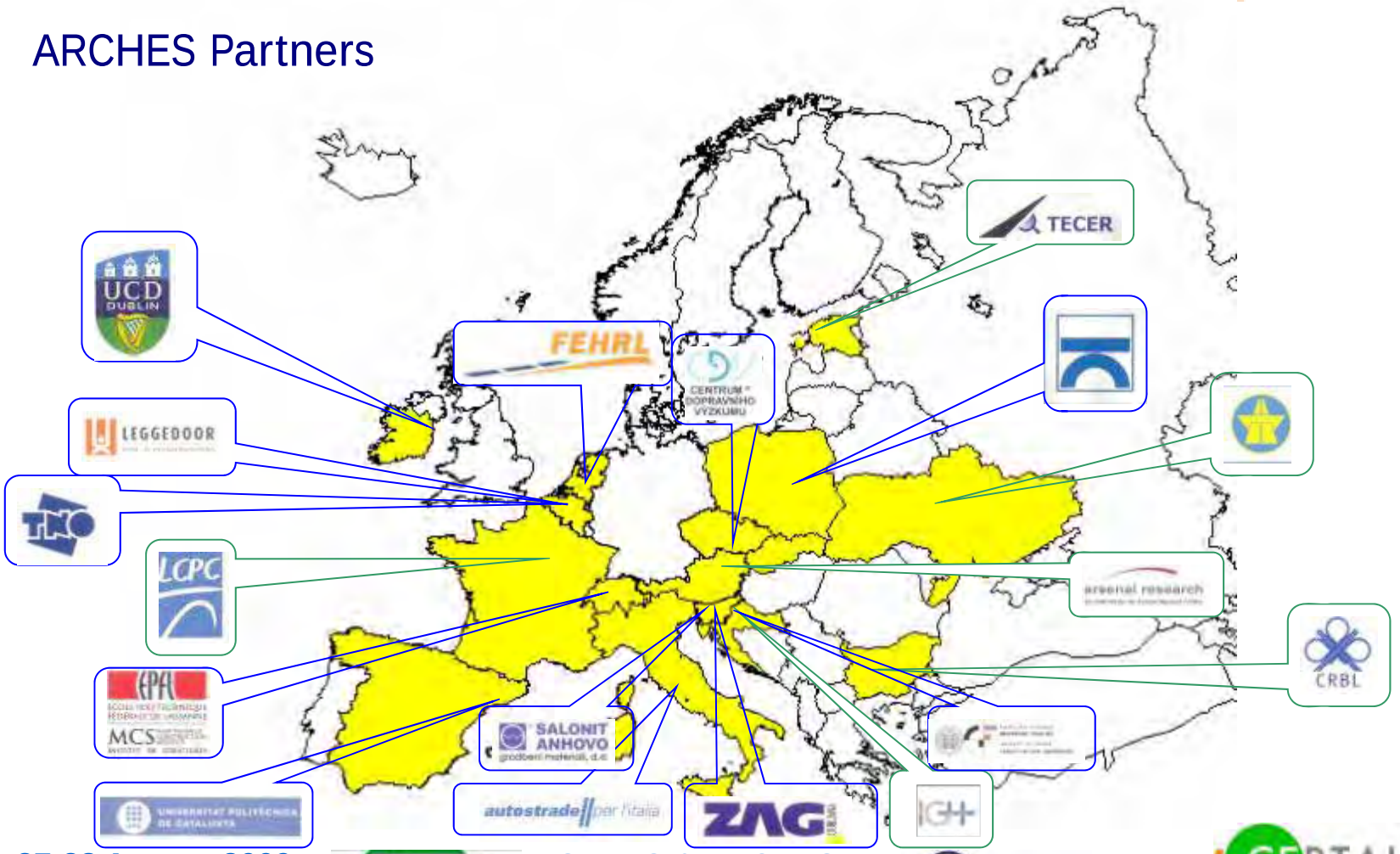
ARCHES Partners



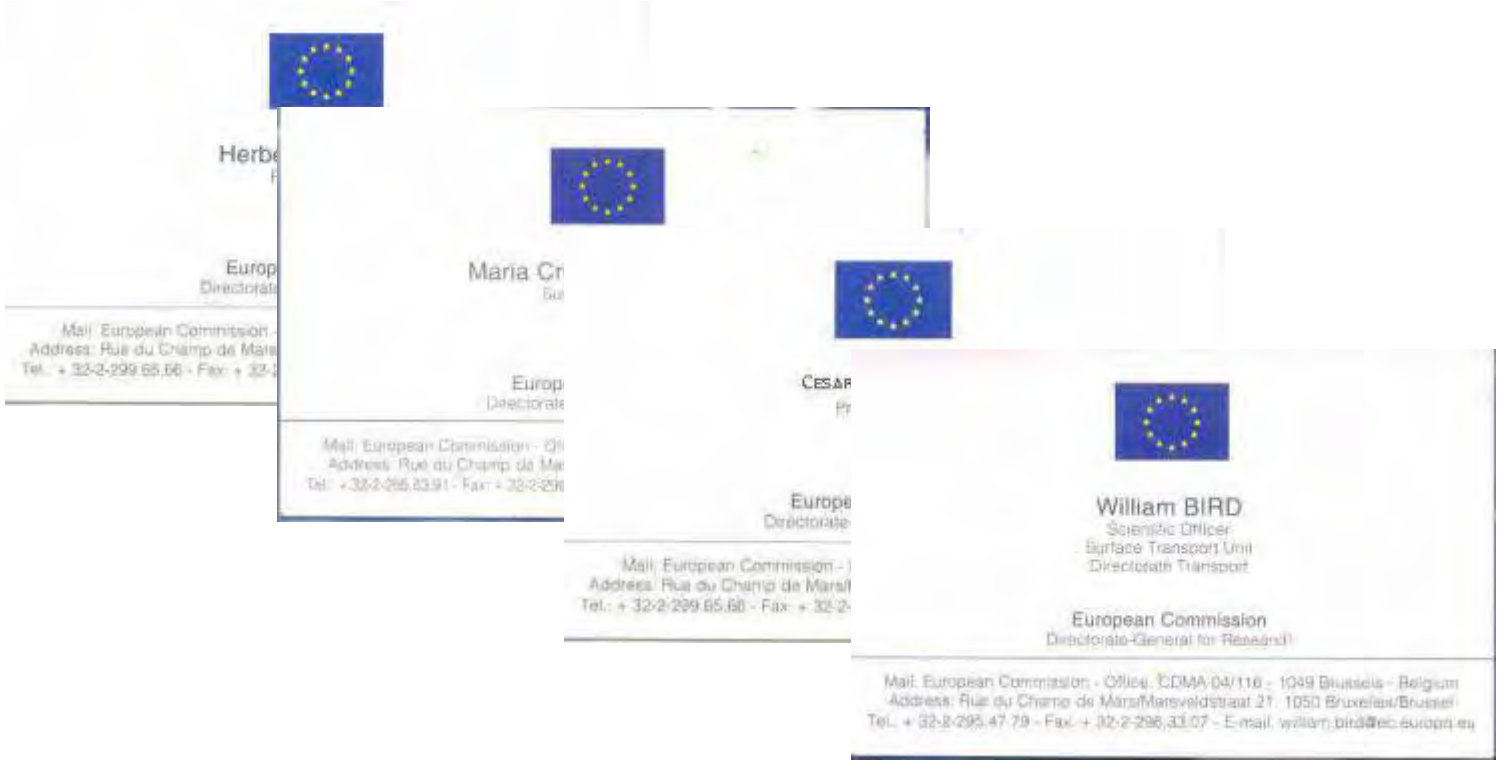
The ARCHES partners

Road and Bridge Research Institute	Poland
Slovenian National Building and Civil Engineering Institute	Slovenia
Transport Research Centre	Czech Republic
Technical University of Catalonia	Spain
Ecole Polytechnique Fédérale de Lausanne	Switzerland
University College Dublin	Ireland
Forum of European National Highway Research Laboratories	Belgium
Leggedoor Concrete Repair	Holland
Autostrade per l'Italia	Italy
University of Zagreb	Croatia
Salonit Anhovo	Slovenia
Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek (TNO)	Holland

ARCHES Partners



56 researchers and technicians involved

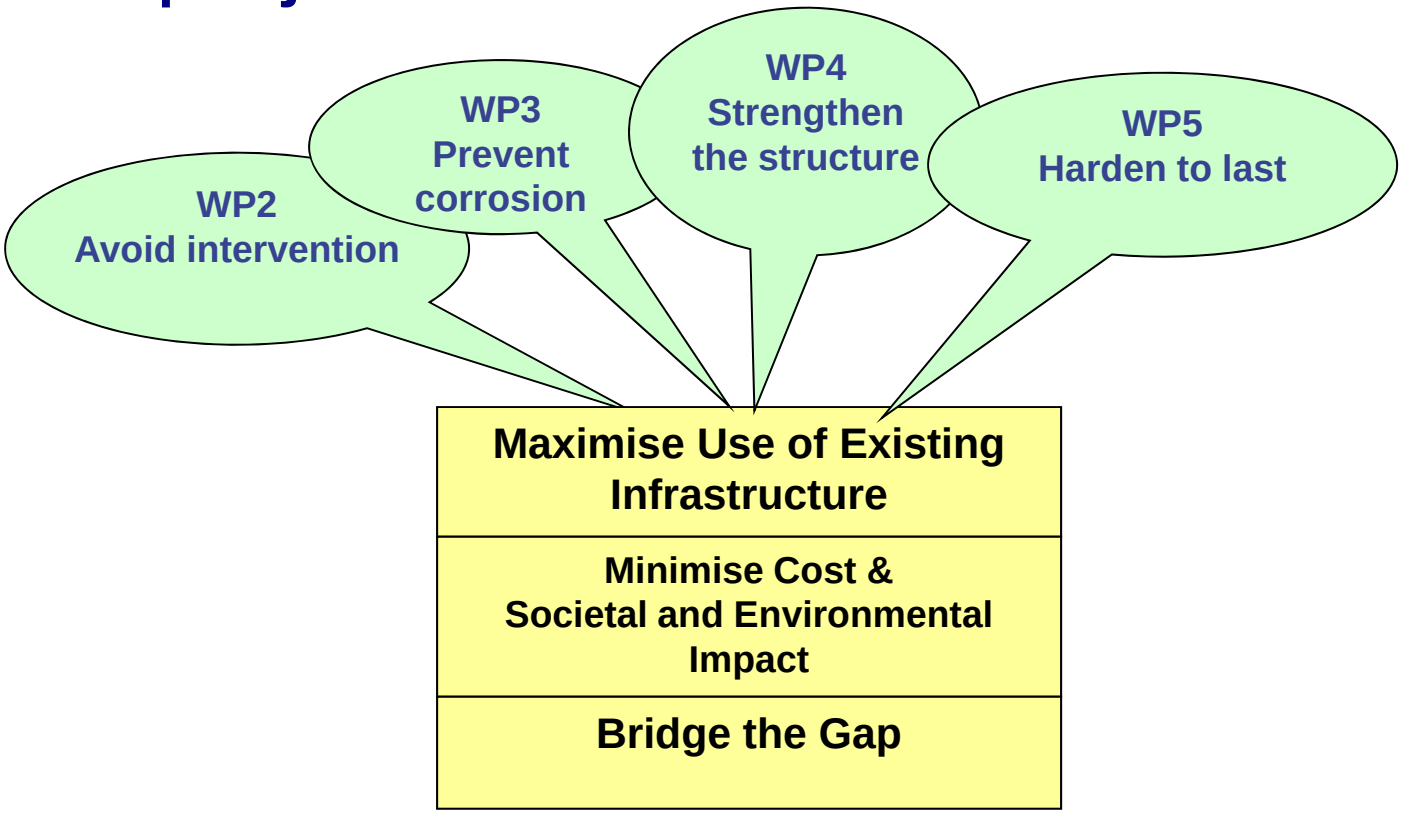

William BIRD
Scientific Officer
Surface Transport Unit
Directorate Transport
European Commission
Directorate-General for Research

The Project main goal

to reduce the gap
in the standard of highway infrastructure between
Central and Eastern European Countries (CEEC)

and the rest of the EU

The project structure and its main aims



Workpackage 2

Structural Assessment

The main objective is to develop CEEC-appropriate techniques for optimal bridge assessment

Structural Assessment objectives

➔ Assess real traffic loads and bridge performance in most efficient way, in CEEC

➔ Validate soft load testing (normal traffic) = more efficient, no road closures

➔ Propose a methodology of proof load testing for assessment

➔ Validate values of reduced dynamic amplification factor (DAF) from SAMARIS

➔ Validate algorithms for decision making processes associated with Bridge Management Systems (BMS) adapted to CEEC

Workpackage 3

Prevention of Corrosion

The objective - to provide techniques that will arrest corrosion in existing concrete structures and to develop new cheap reinforcing materials that are highly resistant to corrosion

Prevention of Corrosion objectives

➔Study applicabilityjinterest of low-alloyed (and stainiess) steels for CEEC road bridges

➔Develop and apply new smart Cathodic Protection systems applied in targeted locations

➔ Develop and validate smali electrical resistance (ER) corrosion probes and apply with black and low-alloyed steels to structures

Workpackage 4

Strengthening of Highway Structures

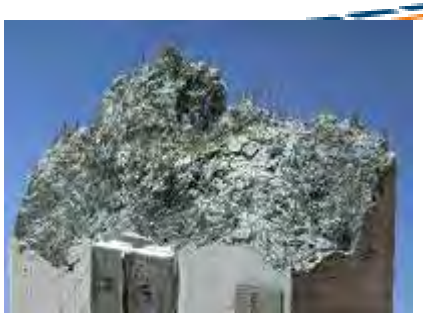
The objective – to develop techniques for bridge strengthening with *Fibre Reinforced Polymer*

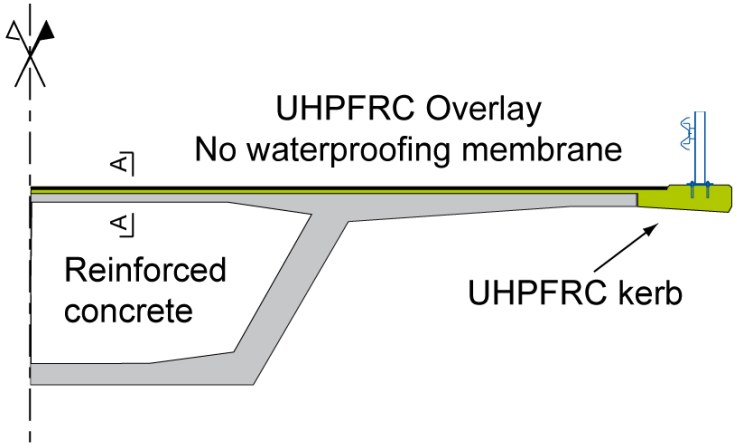
Workpackage 5

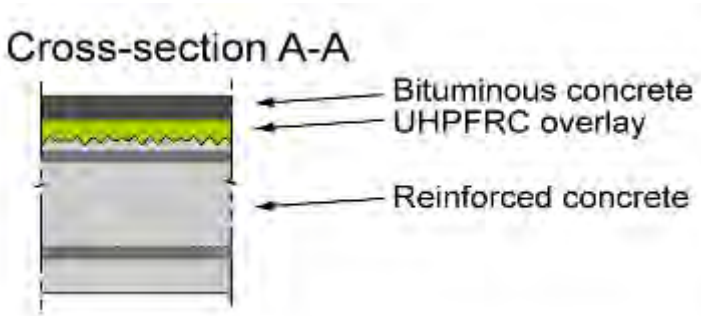
Hardening of Highway Structures

The objective – to develop techniques for hardening structures in zones of severe environmental and mechanical loading with the use of *Ultra High Performance Fibre Reinforced Concretes*

➔ ***Goal 1: Development of UHPFRC recipes from local materials in Slovenia and Poland.***







➔ ***Goal 2: Full scale applications of UHPFRC for rehabilitation in Slovenia and Poland***

The ARCHES achievements

1	D 06	Recommendations for the tailoring of UHPFRC recipes
2	D 07	Internet database of load test results and analytical calculations
3	D 08	Recommendations on the use of results of monitoring on bridge safety assessment and maintenance
4	D 09	Recommendations on systematic decision making processes associated with maintenance and reconstruction of bridges
5	D 10	Recommendations on dynamic amplification allowance in assessment of bridges
6	D 11	Recommendations for the use of low-alloy steel
7	D 12	Recommendations for the use of Cathodic Protection systems
8	D 13	Recommendations for prestressed externally glued FRP strips
9	D 14	Recommendations for the use of UHPFRC for composite structural members
10	D 16	Recommendations on the use of soft, diagnostic or proof load testing

Barcza viaduct load testing

Barcza viaduct load testing

Preliminary diagnostic (January 2008)

Diagnostic (November 2008)

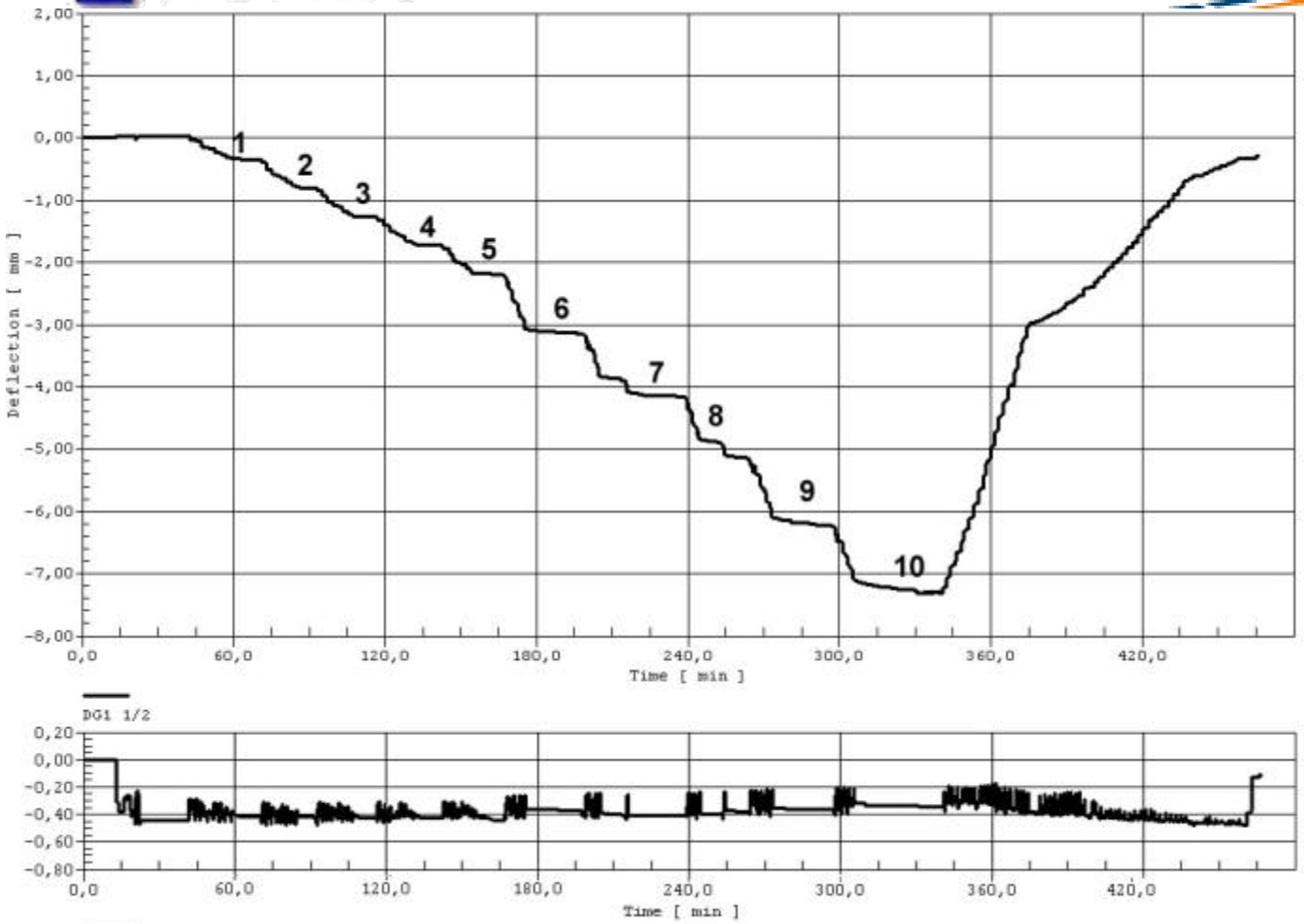
Proof (November 2008)

Proof load testing

Test load

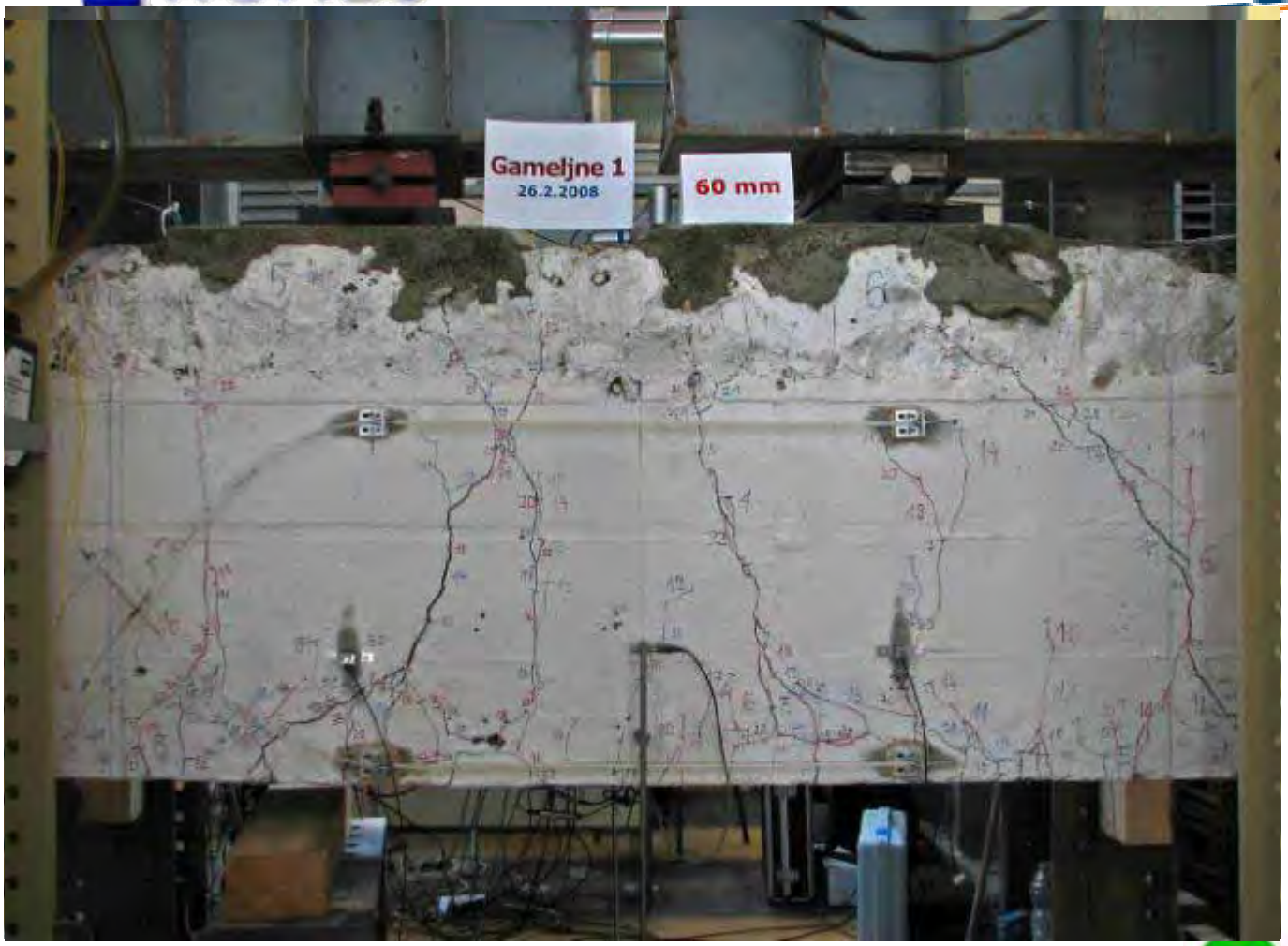
Diagnostic and proof load testing

Proof load testing - Test results - Deflections/Time

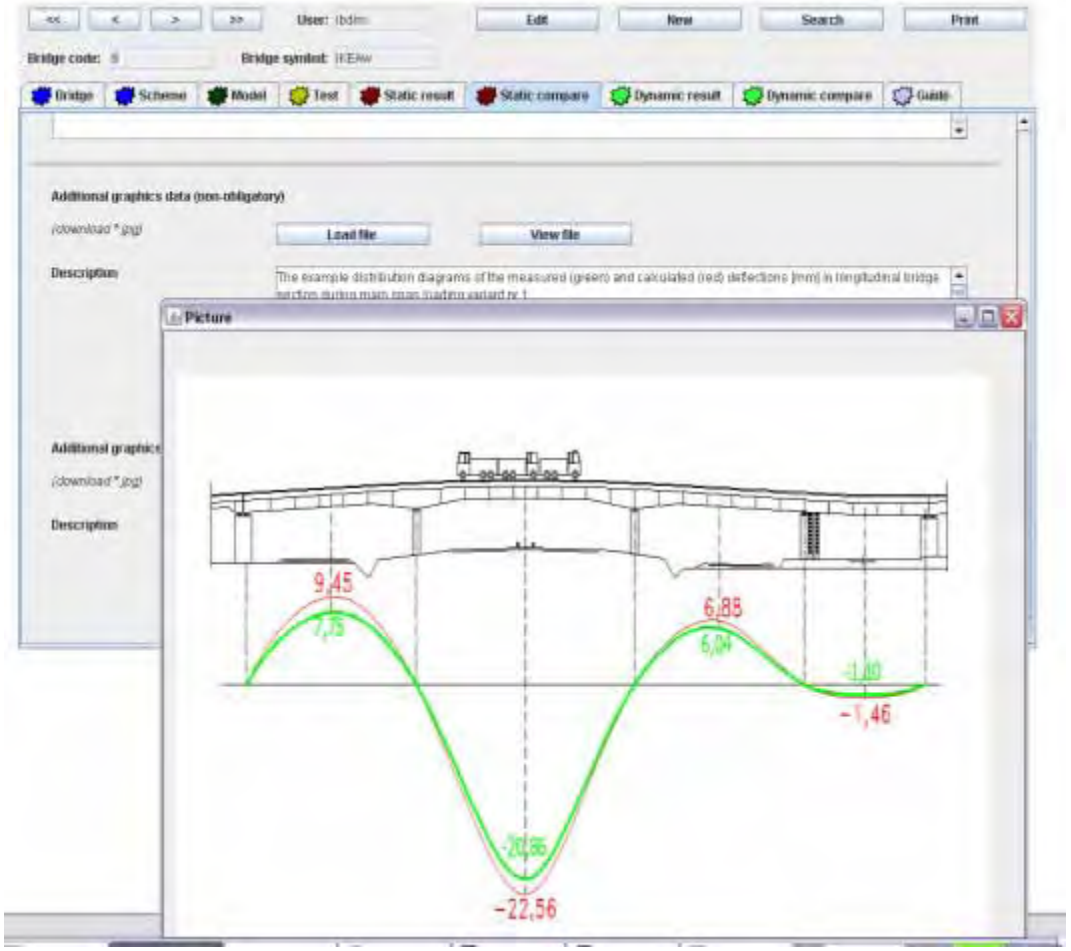


Gameljne bridge proof-load test

Gameljne bridge girder lab test


Gameljne 1
26.2.2008
60 mm

Load test
Internet data base



Low-alloyed steel

Testing program

...**in simulated pore water with different Cl concentrations**

polarization resistance,
potentiodynamic measurements,
electrochemical impedance spectroscopy,

...**concrete specimens**

chosen low-alloy steels embedded in them.
Corrosion induced by wetting and drying with chloride solution.
Specimens tested with electrochemical measurements

...**an exposure site** will be established in the real **marine environment**

ER (electrochemical resistance) probes for corrosion monitoring developed in the third task of WP 3 will be embedded in concrete specimens.

HES

Cathodic Protection pilot test – Slovenia

Cathodic Protection pilot test – Poland

Prestressed externally glued CFRP strips in Seroczyn Bridge

Prestressed externally glued CFRP strips in Seroczyn Bridge

SALONIT field trial – October 2008

300 litres batches

Total 900 litres

Loss = 50 litres

Slopes of 5^{+} % can be cast without difficulties

Application time:

10 m^2 = 10 minutes

Full scale applications – SLOVENIA

Log Cezsoski bridge – Soca river,
-rehabilitation of the sidewalk and deck with UHPFRC,
-replacement of the expansion joint

Log Cezsoski bridge – Soca river

Log Cezsoski bridge – Soca river

Log Cezsoski bridge – Soca river

Log Cezsoski bridge – Soca river

Log Cezsoski bridge – Soca river

Królowy Most bridge

Królowy Most bridge

Królowy Most bridge

Conclusions

➔ Project ARCHES targeted to CEEC/NMS
➔ From the laboratory to the site, strong emphasis on in-situ applications
➔ Validation of several new methods of optimised assessment, tailored to CEEC
➔ Implementation of new, easier methods to monitor and prevent/arrest corrosion
➔ Implementation in CEEC of newest methods of structural rehabilitations to decrease costs and duration of sites

The end in four days

31s[illegible]

[illegible]CHES Project

The ARCHES website

http://arches.fehrl.org/