ARCHES

a gaze on Central European highway structures

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IBDiM
The main goal of NMS’s administration is constructing a new roads - mainly motorways.

Insufficient resources for the conservation of existing infrastructure.
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]

- Poland: 364,697 km
- Hungary: 159,568 km
- Czech Republic: 127,204 km
- Lithuania: 77,148 km
- Latvia: 60,472 km
- Estonia: 55,944 km
- Slovenia: 42,970 km
- Slovakia: 44,033 km
- Bulgaria: 20,250 km
- Cyprus: 13,943 km
- Malta: 2,222 km
- Romania: 198,817 km
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
FEHRL project clustering
The Arches Genesis
1st of September 2006

Official start of the ARCHES Project
The ARCHES partners
Road and Bridge Research Institute
Slovenian National Building and Civil Engineering Institute
Transport Research Centre
Ecole Polytechnique Fédérale de Lausanne
University College Dublin
Forum of European National Highway Research Laboratories (and its allies)
Leggedoor Concrete Repair
Autostrade per l’Italia
University of Zagreb
Salonit Anhovo
Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek
TNO
The ARCHES partners

Road and Bridge Research Institute  
Slovenian National Building and Civil Engineering Institute  
Transport Research Centre  
Technical University of Catalonia  
Ecole Polytechnique Fédérale de Lausanne  
University College Dublin  
Europe's National Road Research Centers  
Leggedoor Concrete Repair  
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University of Zagreb  
Salonit Anhovo  
Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek

Poland  
Slovenia  
Czech Republic  
Spain  
Switzerland  
Ireland  
Belgium  
Holland  
Italy  
Croatia  
Slovenia  
Holland
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

WP2: Avoid intervention

WP3: Prevent corrosion

WP4: Strengthen the structure

WP5: Harden to last

Maximise Use of Existing Infrastructure

Minimise Cost & Societal and Environmental Impact

Bridge the Gap
Workpackage 2

Structural Assessment

The main objective is to develop CEEC-appropriate techniques for optimal bridge assessment
Bridge structures
load testing
Bridge structures monitoring
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
Prevent corrosion !!!
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 news
Load test Internet data base
Load test Internet data base
Load test Internet data base
Steel bar corrosion investigation
Cathodic Protection pilot test - Slovenia
UHPFRC Achievements of first 18 months

- Technology transfer for processing of UHPFRC and test methods – Slovenia - Poland
- Determination of a general methodology for the tailoring of UHPFRC matrix components to locally available products
- Dissemination of conceptual approach and contacts with local road authorities in Slovenia and Poland

- Design of a first full scale application in Poland – Krolowy Most bridge + on site works ongoing
- Full scale applications foreseen in Slovenia for 2008
Protective functions

<table>
<thead>
<tr>
<th>Reference</th>
<th>Air permeability $[10^{-16} \text{ m}^2]$</th>
<th>Capillary water absorption coefficient $[\text{g/m}^2\cdot\text{h}^{0.5}]$</th>
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<tbody>
<tr>
<td>UHPFRC</td>
<td></td>
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<tr>
<td>Reference</td>
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<tr>
<td>Bad concrete</td>
<td>2</td>
<td>1200</td>
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<tr>
<td>Good concrete</td>
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<td>400</td>
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<tr>
<td>CM23 (ref.)</td>
<td>0.003</td>
<td>45 (EPFL meas.)</td>
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<tr>
<td>CM24</td>
<td>0.008</td>
<td>53 (EPFL meas.)</td>
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<tr>
<td>CM27</td>
<td>n.a</td>
<td>23 (ZAG meas.)</td>
</tr>
<tr>
<td>CM29</td>
<td>n.a</td>
<td>23 (ZAG meas.)</td>
</tr>
</tbody>
</table>

Recipes CM24, CM27 and CM29 with Slovenian components exhibit excellent protective properties comparable to reference mix CM23 (project SAMARIS).
Mechanical performance

Recipe CM24 with Slovenian components exhibits excellent mechanical performance comparable to the reference mix CM23.

- Flexural response under 4 PT bending
- Plates 50 x 20 x 3 cm
- Span 42 cm
- Average curves on 5 to 10 specimens
Full scale applications

Krolowy Most bridge – Poland – spring 2008
Widening + application of UHPFRC with polish components
Full scale applications - Poland

Krolowy Most bridge – Poland, Cross section before rehabilitation
Full scale applications - Poland

Krolowy Most bridge – Poland, Cross section after widening

- UHPFRC overlay 3 cm
- Prefabricated UHPFRC kerbs
Full scale applications - SLOVENIA

Log Cezsoski bridge – Soca river, application foreseen for 2008
- rehabilitation of the sidewalk,
- rehabilitation of the deck – if needed,
- replacement of the dilation,
- repair of concrete cover of the pillar
- widening of the bridge at the left bank.
31st August 2009

The end of ARCHES Project
The ARCHES website

http://arches.fehrl.org/