PROJECT

ARCHES

Assessment and Rehabilitation of Central European Highway Structures

Funding: European (6th RTD Framework Programme)
Duration: Apr 2006 - Aug 2009
Status: Complete with results
Total project cost: €2,942,413
EU contribution: €1,799,930

Call for proposal: FP6-2005-TRANSPORT-4
CORDIS RCN: 91822

Background & policy context:

Since 1 May 2004, the European Union road network, and accordingly the stock of highway structures, has increased significantly. Ten new Member States have brought nearly 924 500 kilometres of roads into the European network. These countries have huge numbers of highway structures, which, mainly due to their history, do not constitute a solid and trouble-free infrastructure. Structures have been affected by a lack of maintenance, regular overloading and even by the use of poor quality materials for construction.

In the near future, the same structures have to face increasing volume and weight of traffic and will therefore have to be reliably assessed and, if necessary, improved or replaced. All these processes will take time and have to be realised in a sustainable way for the economy, for society and for the environment.

No doubt the majority of European road infrastructures have reached an age where improvement costs (several billion euros annually) constitute a major part of infrastructure spending. This is hindering the development of the network by absorbing much-needed funds. This project develops new construction concepts for conservation (assessment, improvement and preventative maintenance) of highway structures.

Objectives:

The overall goal of the project was to develop ways to raise the standard of the highway structures of New Member States (NMS) and Central and Eastern European Countries (CEEC) to the level necessary for their full economic integration into the EU and for the future development of the European Union.

Another important objective of this project is to help society and politicians to understand the need for sustainable maintenance of their road networks, together with their engineering infrastructure, and to help infrastructure managers spend their resources in a more effective way.

Methodology:

To achieve its scientific and technological objectives, this project focuses on structural assessment and monitoring strategies to prevent deterioration and optimum improvement of highway structures through complementary techniques.

The project was organised in four groups of activities, with the following conceptual approach:

- optimising the use of existing infrastructure through better safety assessment and monitoring procedures which will avoid interventions (i.e., avoid unnecessarily replacing or rehabilitating structures that are in fact perfectly safe);
- monitoring and preventing corrosion of existing reinforcement and develop new innovative reinforcement materials that are highly resistant to corrosion;
strengthening the infrastructure of bridges by means of bonded reinforcements;
hardening highway structures with Ultra High Performance Fibre Reinforced Concretes applied in severely exposed zones to dramatically increase their durability.

**Parent Programmes:**
[FP6-SUSTDEV-3 - Global Change and Ecosystems](#)

**Institute type:** Public institution  
**Institute name:** European Commission  
**Funding type:** Public (EU)  
**Other funding sources:** International

### Lead Organisation:

**Instytut Badawczy Drog i Mostow / Road And Bridge Research Institute**

**Address:**  
80, JAGIELLONSKA Str.  
WARSAW  
Poland

**Organisation Website:**  
[http://www.ibdim.edu.pl](http://www.ibdim.edu.pl)

**EU Contribution:** €0

### Partner Organisations:

**Centrum Dopravnihho Vyzkumu V.v.i.**

**Address:**  
Lisenska 33a  
636 00 BRNO  
Czech Republic

**Organisation Website:**  
[http://www.cdv.cz](http://www.cdv.cz)

**EU Contribution:** €0

**European Virtual Institute For Integrated Risk Management Eu Vri Ewiv**

**Address:**  
Haus Der Wirtschaftwilli-Bleicher-Strasse 19  
70174 Stuttgart  
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**Organisation Website:**  
[http://www.fehrl.org](http://www.fehrl.org)

**EU Contribution:** €0

**Nederlands Organisation For Applied Scientific Research**

**Address:**  
Schoemakerstraat 97  
6060 DELFT  
Netherlands

**Organisation Website:**  
[http://www.tno.nl](http://www.tno.nl)

**EU Contribution:** €0
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Organisation Website:
http://www.autostrade.it
EU Contribution: €0

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EU Contribution: €0

Salonit Anhovo, Building Materials, Joint Stock Co.

Address:
Vojkova 1
DESKLE
Slovenia

Organisation Website:
http://www.salonit.si
EU Contribution: €0

Technologies:

- Road structures
- Ultra High Performance Fibre Reinforced Concretes
  Development phase: Research/Invention

- Road structures
- Localised cathodic protection
  Development phase: Research/Invention

- Road structures
- Advanced road materials with very low permeability and high ductility
  Development phase: Research/Invention

Key Results:

WP2 results: Traffic data was gathered for the Netherlands, Poland, Slovenia, Slovakia and the Czech Republic. This traffic data has been analysed and used to obtain, via simulation, the characteristic values of the traffic action for these aforementioned countries.

The results showed that the traffic action is significantly lower for all NMS when compared to Western-European countries. In the case of new designs, it is advised that actual traffic loads in the Eurocode can be non-conservative if the presence of very heavy trucks (cranes and low-loaders) is not well controlled into the traffic flow. In the case of the assessment of existing bridges in CEEC, the final result has been the calculation, via simulation, of the characteristic load effects and the reduction factors by bridge class to be considered.

Load tests on bridges have shown that in many cases bridges may resist much higher load than predicted by analytical assessments.

A complete set of proof load factors for the analyzed countries have been calculated based on the actual traffic conditions in these countries as obtained by WIM techniques developed within ARCHES. They have been obtained from a calibration process based on a reliability-based approach taking into
account the uncertainties involved in loads and resistances. The following variables have been considered in the calibration process: safety level, span length, bridge type, traffic action, permanent additional load and available bridge documentation.

WP3 results: Within the ARCHES project a new form and production process for manufacturing the stainless steel ER probes was developed at ZAG Ljubljana. The stainless steel ER probes were made of the most commonly used type of stainless steel AISI 304 (1.4301), of which the chemical composition and mechanical properties are very similar to those of the re-bars of the same grade of steel.

WP4 results: Recommendations for the prestressed externally glued FRP strips were prepared. The recommendations contained in the guidelines mainly cover the structural strengthening of bridge components of on-shore structures, using prestressed carbon fibre reinforced plastics (CFRP). The recommendations give advice on the selection of laminated materials, analysis, design and implementation of strengthening. In some cases it may be advantageous to bond the external FRP reinforcement onto the concrete surface in a prestressed state. Both laboratory and analytical research shows that prestressing re

Documents:
- Final Activity Report (Other project deliverable)

STRIA Roadmaps: Infrastructure
Transport mode: Road transport
Transport sectors: Passenger transport, Freight transport Safety/Security, Societal/Economic issues,
Transport policies: Decarbonisation
Geo-spatial type: Other