Innovation in road research

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Forever Open Road
• Who is behind and what is driving us
• What is Forever Open Road
• The Adaptable Road
• The Automated Road
• The Resilient Road
• Strategies to enable the FOR
• Projects
• Created in 1989 as the European Centre of Excellence in Road Research
• Formed as the organisation of National Road Research Centres
• Currently consists of over 40 institutes – with a public service orientation
• Platform for national technical centres
Why innovation?

In addressing the Global challenges.....

– Financial Crisis
– Globalisation
– Climate Change
– Social/Demographic Changes
– Energy and Resources security

….We need infrastructure to be more efficient:

– Much cheaper – 30% less cost
– Ensuring much more reliable traffic
– Much safer and more secure
– Minimal footprint
– Fully ICT integrated
– Enhancing new mobility concepts
– Enhancing social inclusion/accessibility
– Resilient to climate change effects

…… to be Forever Open …..
Putting the WOW back in roads

- Past WOW! Factors?
  - 1st generation – the bridge?
  - 2nd generation - the paved road?
  - 3rd generation - the smooth road?
  - 4th generation - the continuous road/motorways?
  - What will the 5th generation be like?

- We need to start to develop the 5th Generation Road!
  - Solves existing and future problems
  - Achievable through new technology

- Stakeholders need to be convinced that there’s a workable concept!
  - Must be a long-term multi-national solution
  - Must have lots of costs savings and benefits
What is Forever Open Road

Who & Why

• A combination of national and multi-national activities implemented as of 2011
• Involving a wide range of partners from public and private sectors
• A new concept for roads that are **adaptable**, **automated** and climate change **resilient**
• A tool box with proven solutions/products from an integrated systems approach
The Adaptable Road

- Porous, low noise surfacing, light reflecting for night time driving.
- Adaptable to freight transport communications, location and monitoring requirements.
- Flexible, durable surface, self repairing/self-cleaning and instant crack repair.
- In-built sensors for traffic monitoring/control and condition monitoring.
- In-built lane control/vehicle guidance.
- In-built power system for electric vehicles.
- Energy harvesting grid and storage/use of solar energy to power lighting, signs and sensors.
- In-built system for replacing and adding lanes/infrastructure, eg barriers, signs and sensors.

- Removable/self-cleaning drainage reservoirs feeding carbon capture planting.
- Adaptable/removable communication/power channels for lane control, traffic monitoring, driver information and condition monitoring.
- Low carbon sub-base and pavement.
- Pre-fabricated inter-locking, sub-base with integrated drainage, services and communications channels.

FEHRL
The Adaptable Road

Who & Why

FOR

Adaptable

Automated

Resilient

What now?

Projects

• Fully adaptable to changes in demand
• Based on a pre-fabricated/modular system that can gradually be implemented across Europe’s motorway, rural and urban road networks
• It will adapt to increasing travel volumes and to changes in demand for public transport, cycling and walking
• It will power vehicles, harvest solar energy, measure its own performance and even repair itself
The Automated Road

- Fully integrated with the user, vehicle, services and operations
- Will incorporate a fully integrated information, monitoring and control system
- Will support a co-cooperative vehicle-highway system that will manage travel demand and traffic movements
- Will measure, report and respond to its own condition, providing instant information on weather, incidents and travel information

Who & Why
FOR
Adaptable
Automated
Resilient
What now?
Projects
The Resilient Road

- Fully adaptable to extreme weather conditions
- Will adapt itself to the impacts of extreme weather conditions and climate change
- Will monitor flooding, snow, ice, wind and temperature change, and mitigate their impacts through integrated storm drainage, automatic heating and cooling
- Will be linked to the integrated information system for travelers and operators
Strategies to enable FOR

Who & Why
FOR
Adaptable
Automated
Resilient

What now?

Projects

• Building up the project portfolio
• On-going technology trials and system proving tests
• Newly funded projects (from EC, CEDR, National, …)
  – E.g. EXPECT, MIRIAM, TRIMM, INROADS
• Links to national programmes
  – R21C (DE), R5G (FR), Coast Highway Route E39 (NO), EAR (USA)

• New initiatives to pool research funds INFRAVATION
• Knowledge transfer to the sector
Roadmaps towards implementation

Who & Why
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What now?
Projects

http://www.foreveropenroad.eu/
SAMARIS, ARCHES projects

UHPFRC for rehabilitation of bridges - a spreading technology!
SAMARIS, ARCHES projects

UHPFRC, characterised by a
- very low water/binder ratio,
- high binder content and
- an optimised fibrous reinforcement,
provide the structural engineer with a unique combination of extremely low permeability, high strength and tensile strain hardening.
SAMARIS, ARCHES projects

UHPFRC are perfectly suited to the rehabilitation of reinforced concrete structures in critical zones subjected to an aggressive environment and to significant mechanical stresses, to provide a long-term durability and thus avoid multiple interventions on structures during their service life.
SAMARIS, ARCHES projects

- Liquid water + Cl\(^-\) = XD2, XD3
- Most aggressive for structures!

- Apply protective watertight UHPFRC overlay
- Improve durability and load carrying capacity
SAMARIS, ARCHES projects

- 1\textsuperscript{st} validation during the SAMARIS FP5 project
- The FP6 ARCHES project showed implementation of technology with local components in Slovenia and Poland was possible and fostered the use of cost-effective (ECO) UHPFRC mixes with reduced clinker content.
- By May 2014, more than 25 applications of cast-on site UHPFRC to protect or reinforce bridges or slabs in industrial buildings, alone or combined with reinforcing bars (rebars), have been performed successfully since 2004 in Switzerland and one in Slovenia
Full scale application – SLOVENIA

Log Čezsoški bridge – Soča river, July 2009 - Owner: Municipality of Bovec

⇒ Rehabilitation of the sidewalk, and deck with Slovene UHPFRC

Challenges
- Limit site duration (12.7 km detour for cars)
- Increase durability and efficiency of rehabilitation
Concrete plant mixer
Batches of 320 litres
Mixing time = 12 minutes
2 or 3 batches per truck
The bridge after rehabilitation
TRIMM is supported by funding from the 7th Framework Programme Call: SST 2011.5.2-2. Theme: Advanced and cost effective road infrastructure construction, management and maintenance.

EC FP7 project

http://trimm.fehrl.org/

Tomorrow’s Road Infrastructure Monitoring & Management
What is the essence of TRIMM?

- A selection of very promising advanced monitoring techniques are developed and assessed

- Facilitating implementation of monitoring:
  - Identify barriers to implementation
  - Address stakeholder needs
  - Development and use of indicators – make sense of data
  - Support road infrastructure managers when designing monitoring schemes
Overall approach

- Develop, test and validate selected advanced monitoring technologies
- Show how the advanced monitoring methods can be implemented through indicators
- Develop complimentary, accurate and relevant technical parameters and indicators to enable utilisation of advanced monitoring data
- Investigate added value of monitoring and provide method for assessment
Task 5 – Recommendations and guidelines for advanced monitoring

Task 4 – Methodology and support for assessment of monitoring schemes

Task 3 – Reliability based societal cost – benefit method

Task 2 – Relate condition indicators to performance and impact

Task 1 – Condition indicators
Bridge monitoring

- Automated 3D visual bridge inspection
- Traffic load monitoring
- Acoustic monitoring
- Corrosion monitoring
- Monitoring of joints and bearings
- Integrated Bridge monitoring method
Road monitoring

- Monitoring road functionality in real time with data collected from vehicles.
- Monitoring of Road Inventory
- Identification of Potential Water Ponding
- Monitoring of structural condition
  - TSD – Traffic Speed Deflectometer
  - GPR – Ground Penetrating Radar
- Monitoring of surface condition
  - Ravelling
  - Cracking
EU Ecolabel for materials

EU ECOLABEL is a voluntary system for environmental rating to identify and certificate products or services according to ISO 14024 provided by a third party or certifying agency.

There are already more than 17000 EU Ecolabelled products on the market but no references for road products and infrastructures.
The main objective of the project is to develop a new, green, holistic and EU-harmonised ecolabeling methodology for road products and infrastructures, integrating by a Life Cycle Engineering (LCE) approach the following aspects:

- Environmental
- Economic
- Social
- Technical

Development of a novel ECO-LABELing EU-harmonized methodology for cost-effective, safer and greener road products and infrastructures
ECOLABEL will be focused on pavements including soilworks. Consideration will be given to new construction and maintenance and rehabilitation works.

- ECOLABEL will be a scoring label, mandatory and government driven, certified by 3rd parties.

Development of a novel ECO-LABELing EU-harmonized methodology for cost-effective, safer and greener road products and infrastructures
Summary

• FEHRL; platform for national technical centres
• Innovation is needed to address the global challenges
• Forever Open Road; vision of future
• Forever Open Road; toolbox of solutions
In the words of J.F. Kennedy...

We choose to develop the Forever Open Road programme. We choose to develop the Forever Open Road in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organise and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone.
Thank you for your attention!

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