International Symposium on Non-Destructive Testing for Design Evaluation and Construction Inspection

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Existing and emerging technologies and techniques

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Presented by Christian Cremona
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On behalf of FEHRL (the Forum of European Highways Research Laboratories)
NDT needs in renewal projects (1)

We have considered these in terms of:

- Design
- Construction activities
- Performance monitoring

For the following construction components:

- Pavements – flexible and rigid
- Bridges
- Earthworks
- Tunnels (and other structures?)
### NDT needs in renewal projects (2)

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NDT needs in renewal projects (3)

We have also tried to keep in mind the overall objective of the SHRP2 Renewal project:
The research objective of SHRP 2 highway renewal is to achieve renewal that is performed rapidly, causes minimum disruption, and produces long-lived facilities
Whilst considering Tactic 3:
- Perform Faster Construction Inspection and Monitoring.
  Develop innovative, high-speed construction inspection processes that can be used to make sure that the overall quality is obtained without delaying the project.
And meeting the objectives of the Research Project R06:
A Plan for Developing High-Speed, Non-destructive Testing Procedures for Both Design Evaluation and Construction Inspection
Status of Technologies and Techniques

• Production models in routine use
• Pre-production models
• Several road prototypes

• Single road prototype
• Research version
• No known current solution
Status of Technologies and Techniques

Existing and emerging technologies and techniques

• Production models in routine use
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Unfulfilled needs based on current and emerging technologies and techniques

• Single road prototype
• Research version
• No known current solution
## Examples of existing technologies

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Pavement subgrade support

Lightweight FWD
(Rapid but discrete measurement of bearing capacity of granular layers.)

Portancemètre/ dynaplaque
(Continuous measurement of bearing capacity of capping layers at 3.6km/h)

These tools have a role both in assessing the design and the construction quality
Pavement construction thicknesses

High speed GPR for
• thickness
• construction changes

GPR has a role both in assessing construction quality and in performance monitoring, particular as an input to the assessment of structural condition.

Distance along the pavement

Depth (metre)

IBDIM, Poland, LCPC, FR
TRL, UK
Surface ravelling

The main purpose of measuring ravelling/fretting is for performance monitoring and assessing maintenance need.

DVS, The Netherlands and TRL, UK
Static and dynamic testing of bridges

Types of load test:
- proof
- diagnostic
- soft
- dynamic

Could be used for assessing construction quality or more usually performance monitoring.
Acoustic emission testing of bridges

This technique is used for performance monitoring

TRL, UK and LCPC, France
But also...
And also………

UK GPR tunnel assessment

3D laser tunnel scan

FEHRL Comparisons and UK Accreditation trials
In summary……..

Do these examples of existing NDT solutions meet the main criteria of the project? i.e. minimises disruption.

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Some examples of recent publications that summarise the latest NDT position in Europe:

1. European Project “FORMAT” including a review of pavement condition monitoring techniques published in 2005

2. A French review of NDT testing of concrete structures in France – 2005

3. The latest UK Government advice on NDT testing of Highway Structures and pavement assessment in their Design Manual for Roads and Bridges - 2006


5. European Project “Sustainable Bridges” including review and development of bridge condition assessment and monitoring published in 2007
(1) FORMAT Report

Project funded by the European Community under the ‘Competitive and Sustainable Growth’ Programme (1998-2002)

Fully Optimised Road MAintenance (FORMAT)

Work Package 6 : Monitoring Deliverable Reports

D6 - Optimised pavement condition data collection procedures

D12 - Assessment of high speed monitoring equipment

D17 - Application of high-speed equipment in pavement maintenance planning

Issued 2005, 250p in total
NDT of concrete structures

State of the art (2005, 555p)

- mechanical waves (ultrasons-transmission mode-, impact écho, acoustic emission, tomography, surface waves)
- electromagnetic methods (BF, radar, capacité),
- Infrared thermography
- electric methods (resistivity, corrosion rate, corrosion potentiel)
- radiography (gamma, X)
- optic methods (shearography, holography, fringe projection)

Method currently applied in France
(3) UK Advice on NDT of Highway Structures

Design and Maintenance of Roads and Bridges

Volume 3

Highway Structures

Section 1 Inspection

Part 7 BA 86/06

Advice Notes on the Non-Destructive Testing of Highway Structures

Published 2006, 250p
(4) UK Advice on Pavement Assessment

Design and Maintenance of Roads and Bridges

Volume 7

Pavement Design and Maintenance

Section 3 Pavement Maintenance Assessment

Part 2 HD28/04 and HD29/08

Skidding resistance and Data for Pavement Assessment
(5) Sustainable bridges project

Project funded by the European Community under the ‘PRI ORITY 6 SUSTAI NABLE DEVELOPMENT GLOBAL CHANGE & ECOSYSTEMS’ Programme (2003-2007)

Dedicated to railway bridges

Work Package 3: Condition Assessment and Inspections

Work Package 6: Monitoring

Deliverable Reports: guidelines
http://www.sustainablebridges.net
Thank you for listening!

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