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Roadscanners Group

ROADEX Projects 1998-2012 – Bringing new solutions for low traffic volume road condition management
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Contents:
• What is the ROADEX project?
• Why ROADEX?
• Key Findings
• The ROADEX toolbox for road condition management
WHY RURAL ROADS MANAGEMENT?

ROAD NETWORK IN ROVANIEMI

- Main roads: 393 km
- Regional roads: 200 km
- Connecting roads: 669 km
- City streets: 311 km
- Private roads: 4,316 km
The ROADEX Projects 1998 - 2012:

www.roadex.org
The ROADEX I-IV projects 1998 - 2012
ROADEX Network 2013 -
The ROADEX partner areas
## The ROADEX Partners

<table>
<thead>
<tr>
<th>Country</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden</td>
<td>Lead Partner, The Swedish Transport Administration Northern Region, The Swedish Forest Agency</td>
</tr>
<tr>
<td>Finland</td>
<td>Centre for Economic Development, Transport and the Environment, Lapland region</td>
</tr>
<tr>
<td>Greenland</td>
<td>The Government of Greenland</td>
</tr>
<tr>
<td>Iceland</td>
<td>The Icelandic Road Administration</td>
</tr>
<tr>
<td>Norway</td>
<td>The Northern Region, Norwegian Public Roads Administration</td>
</tr>
<tr>
<td>Scotland</td>
<td>The Highland Council, Forest Enterprise, Comhairle Nan Eilean Siar</td>
</tr>
<tr>
<td>Ireland</td>
<td>National Roads Authority, Department of Transport, Ireland</td>
</tr>
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</table>

Project main consultant: Roadscanners Oy, Finland
The “ROADEX” co-operation

- A “trans-national” network of Northern Periphery roads organisations committed to:
  - Share best practice
  - Research and develop new knowledge
  - Implement and test new solutions

- Running for 12 years over 4 projects
- Supported by EU funding from the Interreg IIIb Northern Periphery Programme.
**Why collaborate?**

**Why ROADEX?**

All Partners have the same problems:

- Reducing budgets for roads
- Increasing road user expectations
- Increasing traffic & truck sizes/weights
- Increasing environmental awareness
- Searching for "best value"

⇒ need for **MORE** from **LESS**
The ROADEX Knowledge Centre 1998-2012-2015
ROADEX Solutions

- **New survey methods** to help designers focus on problem sections and make correct diagnoses;
- **New risk assessments methods** for heavy traffic on public and forest roads;
- **New models** for designing road structures against permanent deformation;
- **New guidance** for rehabilitating low volume roads;
- **New training packages** for in-house & external staff;
- **New techniques** for real time road condition monitoring;
- **New information** for political decision makers regarding the importance of rural road conditions;
- And many others .....
The ROADEX website: www.roadex.org
ROADEX Network Implementing Accessibility

ROADEX E-Learning packages

Latest News: 13 August 2006. After being tested for a few months on a temporary web site the e-learning package is now running directly from the ROADEX web site's server.

E-Learning

An extension of the e-learning project. This permits the production of additional educational material and graphics to make the package more complete and attractive to users.

Lesson 1: Permanent Deformation
The importance of the road network to a society can be compared with the vascular system of a human body.

Lesson 2: Road Construction Over Peat
The importance of the road network to a society can be compared with the vascular system of a human body.

Lesson 3: Drainage of Roads
The importance of the road network to a society can be compared with the vascular system of a human body.

Lesson 4: Environmental Considerations for Low Volume Roads
This importance of the road network to a society can be compared with the vascular system of a human body.
ROADEX TOOLBOX FOR EFFECTIVE AND SUSTAINABLE RURAL ROAD CONDITION MANAGEMENT

1. DO BETTER MAINTENANCE

2. APPLY TARGETED REHABILITATION

3. USE ROAD FRIENDLY TRUCKS

4. MONITOR ROAD CONDITION
Economic Importance of a Good Drainage System

What is Pavement Life Time?

- rehabilitation measures need to be taken when more than 10% of the rutting or roughness values are higher than the trigger value

What is Common for these critical sections?
ROADEX Projects have so far shown:

Drainage is a **Major Problem** on Northern Periphery Roads!
FOCUS – UNDERSTAND - INNOVATE

OPPORTUNITIES & SOLUTIONS

Focused Drainage Management in Maintenance Contracts

Average Rut Depths in Each Road Class and Drainage Class

Annual savings 10 – 40%
Pavement Lifetime Factor: N59, Ireland
Ditch condition is also a problem on main roads - Example of HW4

- Surface height
- IRI
- Rut depth right
- Rut depth left
- Left ditch
- Structure thickness vs. ditch bottom

Cross section
EFFECT OF DITCH DEPTH VS. ROAD STRUCTURE THICKNESS ON ROAD CONDITION

RUT medians. Road 353. Thickness 0.6-1.0. DRA >= 2

Critical 10%

1. 2. 3. 4.

2.72 3.08 3.96

Ditch bottom level

Road structures

Level: +0.3 m
Level: 0 m
Level: −0.3 m

ROADEX Network Implementing Accessibility
We have been fixing symptoms instead of reasons!
Demonstrations of design against rutting
(Tampere University of Technology)
Drainage maintenance key issue!

**Problem:** Deformation in right wheel track - 2002

**Solution:** Clearing the ditch and reinforce the road structure - 2003

LCC Calculations (Norway, Finland): Drainage improvement could be carried out every second year and it would be still profitable for road owners!! *(Berntsen & Saarenketo 2005, Roadex II)*
FOCUS – UNDERSTAND - INNOVATE

OPPORTUNITIES & SOLUTIONS

The Problem: Current design and dimensioning methods are made for high traffic volume roads

Elastic response

Permanent deformation
THE PROBLEM: WE IGNORE SEASONAL CHANGES

- All evaluations are based on tests & surveys made during the summer

Only 2% of the pavement damage happens during the summer months.
Solutions: NEW DIAGNOSTICS FOR ROAD RUTTING

DIFFERENT RUTTING MODES - ROADEX project

In addition, a diagnosis should also cover:
- frost damages
- geotechnical problems
- drainage related problems
- construction faults
Mode 1 Rutting
Permanent Deformation and Repeated Loading

- Stress \( \tau \) vs. Strength of material
- Failure limit
- Rut depth vs. Loading
- Permanent deformation is stabilizing
- Permanent deformation accumulates continuously
Remedies for Mode 1 rutting

Decreasing the stress level on the top part of structure

Vuorenmaa unbound base course aggregate

Number of loading pulses

- 934_8 (100 kPa)
- 934_8 (250 kPa)
- 934_9 (150 kPa)
- 934_9 (300 kPa)
Remedies for Mode 1 rutting

Loading can be spread and the stress level decreased by using better quality aggregates on the top of the structure or with stabilisation or removing the problematic aggregates.

100 MPa

250 MPa
Remedies for Mode 1 rutting

Tyre Pressure Control Systems

<table>
<thead>
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<th>Pressure</th>
<th>Module (MPa)</th>
<th>Thickness (cm)</th>
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<td>Super Single</td>
<td>800</td>
<td>550</td>
<td>20</td>
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<td>Dual</td>
<td>550</td>
<td>200</td>
<td>40</td>
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<td></td>
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Stress distribution (max) - [values] MPa

Strain - [values] microstrain

Osmax bearing capacity (MPa) - [values] MPa
Remedies for Mode 1 rutting

Thicker Pavements / Bound Layers
ROADEX Mode 1 Design software tool available at: www.roadex.org
Mode 2 Rutting
Remedies for Mode 2 rutting

The loading can be spread over a wider area by building thicker structures.
Solution for Modes 2 Rutting Problems

Steel Grids can also be a Good Option
New ROADEX Mode 2 Design Method Against Mode 2 Rutting

5KPa reduction in subgrade shear strength means 100 mm extra aggregate thickness
FOCUS – UNDERSTAND - INNOVATE

OPPORTUNITIES & SOLUTIONS:
New Road Survey Technologies Enable a Focus on Weak Sections

Savings: 20-50 %

ROADEX road user interview: "The road is a catastrophe when 35 % of the road length has severe damages” But 65 % of the road can still be ok!
Example of Road Strengthening Design:
Karsikkoneva - Haapajarvi, Finland
Karsikkoneva Road Diagnostics

Subgrade moduli (Mode 2 rutting)
Design with ROADEX methodology

After

Before
Basic design: 50mm new pavement only
The Amount and Time for the Investments with Different Options:

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
<th>Costs [SEK]</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>No improvements</td>
<td></td>
</tr>
<tr>
<td>0+</td>
<td>New pavement 50mm on whole road, repaving on whole road</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>New pavement 100mm on whole road</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Milling of old pavement, 100mm of new base course gravel, 100mm of new pavement on whole road</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Milling of old pavement, 200mm of new base course gravel, 100mm of new pavement on whole road</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Improve risk class 5 road sections up to risk class 4 (bearing capacity ~215MPa) with rest of road given 50mm new pavement</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Improve risk class 4 &amp; 5 road sections up to risk class 3 (bearing capacity ~240MPa) with rest of road given 50mm new pavement</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Improve risk class 3, 4 &amp; 5 road sections up to risk class 2 (bearing capacity ~275MPa) with rest of road given 50mm new pavement</td>
<td></td>
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<tr>
<td>7</td>
<td>Improve risk class 2, 3, 4 &amp; 5 road sections up to risk class 1 (bearing capacity ~300MPa)</td>
<td></td>
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<tr>
<td>8</td>
<td>New pavement 50mm on whole road, later 1-2 repaving on the weakest sections</td>
<td></td>
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</tbody>
</table>

Repaving = 50 mm new pavement
FOCUS – UNDERSTAND - INNOVATE

OPPORTUNITIES & SOLUTIONS:

Computer Controlled Tyre Inflation Systems

Savings (~10 – 30 %): • roads • tyres • transportation costs

+ Improved Truck Drivers Health!
ROADEX RECOMMENDATIONS:

Increase/Encourage the use of new Road Friendly Trucks

- Favour Tyre Pressure Systems
- Avoid the Use of Super Single Tyres!
FOCUS – UNDERSTAND - INNOVATE

OPPORTUNITIES & SOLUTIONS:

Road Condition Monitoring Systems for:

a) Proactive maintenance
b) Seasonal changes
Tools for Savings:

- better maintenance practices,
- focused rehabilitation design,
- monitoring of road condition and seasonal change,
- the use of road friendly vehicles
Thank you

www.roadex.org