Climate adaption for Icelandic roads

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On behalf of the Icelandic Road Administration, ICERA

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General information on Iceland

- Population 0.3 million
- Climate: Maritime
  - cool summers
  - mild winters
- Passenger cars pr. 1000 inhabitants: 599
- Strong road transport dependence:
  - No railway
  - No short sea shipping
Road traffic

Oslo, March 31. – April 1. 2009
Annual temperature since 1800
Possible temperature development towards 2100

Oslo, March 31 – April 1, 2009

Road Owners Adapting to Climate Change
Scenario

• A possible temperature increase of 1,4° - 2,4° by year 2100 (scenarios B1 – A2)
  – Different scenarios and model results
  – More increase in the winter than in the summer

• Indications for a 4 – 8 % increase in precipitation for each degree in temperature increase
  – More increase in summer than in winter
  – Indications for more frequent and larger extreme precipitation events

• More frequent freeze-thaw cycles in winter
• More winter storms
Main challenges for ICERA

• Glacier retreat and river channel changes
• Frequent freeze-thaw cycles
  – Bearing capacity of roads
• River flooding
  – Special attention to sudden thaw periods with extreme precipitation in winter (on frozen ground)
• Winter service
  – Increasing traffic and service demand may be the critical factor for service development
  – Snow ploughing on mountain passes
Uncertain impacts

• Snow avalanche, slush flow, mud slide
  – More and more exposed sites are being bypassed by tunnels
• Groundwater levels and water in the road structure
• Sea level rise, +50 cm already accounted for
Glacial river changes
Oslo, March 31. – April 1. 2009

Road Owners Adapting to Climate Change
Frequent mid-winter axle-load restrictions, December - April
Real-time freeze-thaw measurement
New freeze-thaw forecast model

Ice layer in the road

Ice free!

Past (measurements)  Future (prognosis)

For more information visit  http://www.dotnetcharting.com
Change in pavement life if 20% increase in precipitation

Sub-ground bearing capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
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<tbody>
<tr>
<td>-2.4</td>
<td>-2.0</td>
<td>-1.1</td>
<td>-0.7</td>
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<tr>
<td>-2.4</td>
<td>-0.5</td>
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<td>-0.1</td>
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Spring-thaw flooding
Adaptation strategy for ICERA

• The consultant has observed that responsible units react autonomously when faced with the challenges
  – “Business as usual” strategy does not mean status quo
  – This has happened long before the CC adaptation projects and strategies became “popular”

• However, a structured approach is sought
The role of the adaptation coordinator

• Raise awareness and educate
• Circulate best practice information and research results
• Identify missing data and the need for new data collection
  • New weather stations for long term monitoring
  • Registration of disruption
The role of the organisation

- Motivate staff
- Move from “static” to “dynamic” thinking
- Update procedures
- Update design values when appropriate
<table>
<thead>
<tr>
<th>New structures</th>
<th>Existing structures</th>
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</thead>
<tbody>
<tr>
<td>Planning, design, dimensioning</td>
<td>Maintenance, operation, service</td>
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<tr>
<td>Road structure, pavements</td>
<td>Identify responsible unit</td>
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<td>Identify current procedures</td>
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<td>Evaluate</td>
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<td></td>
<td>Adopt new routines</td>
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<td>Winter service</td>
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<td>Bridges, waterways</td>
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<td>Coastal structures</td>
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