The effect of better maintenance to the pavement life time

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The effect of better maintenance to the pavement life time

1. PEHKO 2015-2025 project experiences
2. De-icing salt and pavement durability
3. New technologies in maintenance monitoring

The dilemma between daily maintenance and pavement maintenance
ROADSCANNERS 2018
Challenges with Asset Management of Paved Finnish Public Roads

- 60,000 km of paved roads
- Paving budget in 2015 was 140 mill €
- As an average we have 2.25 €/m / year

Is this enough?

- According to recent studies/opinions the backlog is 100 - 300 mill €/year
ROADEX

Tools for Savings:

• better maintenance practices,
• focused rehabilitation design,
• monitoring of road condition and seasonal change,
• the use of road friendly vehicles
Final goal:
In 2025 the paved road network will be in better shape and annual paving costs will be 50% lower level compared to current cost level.

Future annual paving cost goal:
140 mill€+120 mill€ backlog= 260 - (50%) = 130 mill €/year
(not including backlog repair costs and slightly increased maintenance costs)
PEHKO ROAD SURVEY METHODS

Road Doctor Survey Van
- Ground Penetrating Radar
  - Structures, moisture, etc
- Laser Scanner
  - Point cloud model, rutting, ditch depths,
- 3D Accelerometer
  - Roughness, cross fall
- Digital videos

Traffic Speed Deflectometer
- Deflections
  - Bearing capacity indexes
  - Strains
  - Subgrade moduli
THE DILEMMA WITH ROAD MONITORING IN THE ASSET MANAGEMENT PROCESS

1. We have only monitored surface condition (=symptoms)

2. Instead we should investigate root causes of the surface condition problems (diagnostics)

The root cause is a clogged access road culvert!
Calculating / Presenting Rutting Increase

Rut depths 2017

Rut depth growth 2016-2017

> 5mm/year
PEHKO RESULTS: ANNUAL RUT INCREASE IN KARSTULA AND LAPLAND PEHKO AREAS / ANNUAL PAVING COSTS

KARSTULA - CENTRAL FINLAND

LAPLAND

These ~ 10% are taking 30-40% share of the annual paving costs (most of the backlog)
PEHKO FINDINGS:
ANNUAL RUT INCREASE IN KARSTULA AREA

Expensive "backlog" sections are scattered all around the road network
PEHKO Findings: 7 Key Reasons Behind the Paving Backlog in Finland

1. Heavy trucks and weak subgrade
   • Big problem. Sections mainly where subgrade is peat.

2. Heavy trucks and thin pavements (<150 mm)
   • Fast increasing problem with heavier trucks and new tyre types

3. Pavement quality in some areas
   • Also with thicker pavement, reason: aggregate quality, creep, paving type, patching, etc.

4. Drainage problems: private access road junctions
   • Really big problem but cheap to fix. Rut increase can be > 7 mm/v.

5. Drainage problems: side ditches
   • Clogged and shallow ditches - impact 4-5%

6. Winter drainage problems - delayed removal of snow walls
   • Great impact on shoulder deformation and roughness

7. Extensive use of deicing salt and thin pavements
   • New and very interesting finding - big problem on high volume roads?
Drainage Problems – Private Access Roads
Private Access Roads Drainage Analysis
Results from Karstula Area

- Around the 100 worst culvert, the rut increase is 7 mm/year
- Around the 500 worst culverts the rut increase is still 3,6 mm/year
Drainage Problems - Side Ditches

Clogged ditch can cause 3-5 mm/year rut increase
MAPPING DEPTH OF SIDE DITCHES – KARSTULA AREA

Side Ditch Depth (m)
DRAINAGE PROBLEMS - SIDE DITCHES AND RUT INCREASE
IRI VS DITCH DEPTHS IN LAPLAND PEHKO ROADS - DIRECTION 1
DRAINAGE CLASS VS ANNUAL RUT INCREASE IN KARSTULA AREA
Targeting: Winter Drainage Problems - Delayed Snow Removal
Delayed Snow Removal and Pavement Deformation

1.
2.
3.
4.
MYÖHÄSTYNYT PALTEEN KAATO JA SOHJO-OJEN TEKO AIHEUTTAA VEDEN IMEYTYMISEN PÄÄLLYSTEEN REUNAN ALLE...
Snow Removal in PEHKO Areas in 2017

- Snow walls lowered to level of 20 cm by the end of January
- Total snow removal by the end of February
Snow Removal Around Reflecting Poles
Snow Removal Around Reflecting Poles
KARSTULA ANNUAL PAVING COST DEVELOPMENT 2015-2016 AND 2016-2017

Main Roads

€

2015-2016

2016-2017

pehko
## KARSTULA ANNUAL PAVING COST DEVELOPMENT 2015-2016 AND 2016-2017

### Annual paving cost improvement (€/m/year):  

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<th>Lapland €/m</th>
<th>Lapland €/m</th>
<th>improvement</th>
<th>Central-Finland €/m</th>
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<td></td>
<td>2015-2016</td>
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WINTER MAINTENANCE PROBLEMS LEADING TO INCREASED ANNUAL PAVING COSTS

Frozen or clogged private access road culverts leading to deformations.
Annual cost effect: ~5-10%

Delayed snow removal from road shoulders leading to water infiltration under the pavement and permanent deformations.
Annual cost effect: 13 - 17%

With better winter maintenance it is possible to cut about the 50% of the annual paving backlog in Finland (50-60 mill€)
DEICING SALT RELATED DAMAGES IN PAVEMENT

E4 - Vid Höga Kusten: Salt related asphalt damages 1998
Salt Related Problems on Asphalt Covered Dikes in The Netherland

The problem does not appear with sweet water dikes

The problem cannot be related with loading
Effect of the Extensive use of De-icing Salt on Roads with Thin Pavements

Winter 2016-2017: maintenance class was raised to: 1S - more salt 25g/m2

Annual rut increase 2016-2017(mm/year)

Annual rut increase 2015-2016(mm/year)
Effect of the Extensive Use of De-Icing Salt on Roads with Thin Pavements

Annual rut increase mm/year

- < 2 mm/vuosi
- 2-3 mm/vuosi
- 3-5 mm/vuosi
- > 5 mm/vuosi

Pavement thickness (cm)

- 0-8 cm
- 8-12 cm
- 12-16 cm
- 16-20 cm
- > 20 cm

Kemi
Salt Effect: Conclusions & Recommendations

- New roads with new pavements: use first de-icing salting round before the winter comes.
- Increasing the use of deicing salt on the roads with thin pavements and/or high air voids can lead to anomalous high permanent deformations.
- Safe thickness for bound layers against permanent deformation is 200 mm.
- And salt is not the only solution for better winter maintenance.
New Maintenance Monitoring Techniques

- Edge drop
- Verge
- Acceptable
- Acceptable
New Maintenance Monitoring Techniques

Monitoring Verges

Verge height shown over lidar reflectivity data

Cross section view
Results for GPS Guided Cell Phones and Tablets
Real Time Maintenance Quality Follow Up
Real Time Winter Maintenance Quality Follow Up

Parameters:
- Snow Wall Height
- Ruts due to compacted snow
- Roughness

Results to the Cloud in 2 second delay
Real Time Maintenance Quality Follow Up

Snow Walls 28.3.2018
Real Time Winter Maintenance Quality Follow Up

Parameters:
Snow Wall Height
Ruts due to compacted snow
Roughness

Results to the Cloud in 2 second delay
Summary: Better maintenance practices has major effect on pavement durability and life time costs, but ....

Photos from Lapland
PEHKO roads in Easter
Saturday 2018
... but it has naturally also a great effect on traffic safety

Photos from “other” roads in Finland Easter Saturday 2018
Tack