PAVEMENT ASSET MANAGEMENT PRACTICE IN AUSTRIA TOLL ROAD NETWORK

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ASFINAG Service Ltd
Tokyo, 1. November 2017
Content

- ASFINAG – organisation and figures
- Approach in pavement management
AUSTRIA

In the heart of Europe

<table>
<thead>
<tr>
<th></th>
<th>Japan</th>
<th>Austria</th>
</tr>
</thead>
<tbody>
<tr>
<td>inhabitants</td>
<td>126 Mio</td>
<td>8.8 Mio</td>
</tr>
<tr>
<td>area</td>
<td>app. 380,000 km²</td>
<td>84,000 km²</td>
</tr>
<tr>
<td>Expressway network</td>
<td>app. 9,100 km</td>
<td>app. 2,200 km</td>
</tr>
</tbody>
</table>
ASFINAG

Road network in context with Europe
Toll Revenues 2016
1,915 Mio EUR (256.6 Bil. JPY)

<table>
<thead>
<tr>
<th>Toll sticker</th>
<th>Special toll</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 3.5t mpgw</td>
<td></td>
</tr>
<tr>
<td>Revenue*) of EUR 470 million</td>
<td>Revenue*) of EUR 170 million</td>
</tr>
<tr>
<td>26 Mio pieces</td>
<td>40 Mio crossings</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>More than 3.5t mpgw</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue*) of EUR 1,275 million</td>
<td></td>
</tr>
<tr>
<td>Fully electronic toll payment by GO-Box</td>
<td></td>
</tr>
<tr>
<td>730 Mio transactions</td>
<td></td>
</tr>
</tbody>
</table>
### ASFINAG toll road network

![Image](image_url)

<table>
<thead>
<tr>
<th>Assets in the responsibility of ASFINAG</th>
<th>Number (piece)</th>
<th>Length (km)</th>
<th>Lane (km)</th>
<th>Area (Mio. m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pavement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asphalt pavement</td>
<td>2,199</td>
<td>9,211</td>
<td>51.33</td>
<td></td>
</tr>
<tr>
<td>Concrete pavement</td>
<td>760</td>
<td>3,527</td>
<td>32.42</td>
<td></td>
</tr>
<tr>
<td><strong>Bridges</strong></td>
<td>5,077</td>
<td>340</td>
<td>5.65</td>
<td></td>
</tr>
<tr>
<td>On the road</td>
<td>4,142</td>
<td>279</td>
<td>4.90</td>
<td></td>
</tr>
<tr>
<td>Overpasses</td>
<td>935</td>
<td>61</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td><strong>Tunnel tubes</strong></td>
<td>160</td>
<td>385</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galleries</td>
<td>98</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Retaining walls</strong></td>
<td>1,341</td>
<td>123</td>
<td>0.602</td>
<td></td>
</tr>
<tr>
<td>Walls</td>
<td>1,141</td>
<td>99</td>
<td>0.430</td>
<td></td>
</tr>
<tr>
<td>Anchored walls</td>
<td>200</td>
<td>24</td>
<td>0.172</td>
<td></td>
</tr>
<tr>
<td><strong>Noise barriers</strong></td>
<td>3,613</td>
<td>1,000</td>
<td>3.421</td>
<td></td>
</tr>
<tr>
<td>Gantry</td>
<td>3,191</td>
<td>34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sumpans</td>
<td>27</td>
<td>4</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td><strong>Protective constructions</strong></td>
<td>190</td>
<td>18</td>
<td>0.001</td>
<td></td>
</tr>
</tbody>
</table>
ASFINAG was founded in 1982 and is 100% owned by the Republic of Austria.

ASFINAG Company structure

Reliability all the way
### Key financial data 2016 and 2015

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mio. EUR</td>
<td>Bill. JPY</td>
</tr>
<tr>
<td><strong>Net profit for the year</strong></td>
<td>615</td>
<td>82.4</td>
</tr>
<tr>
<td><strong>Current and non-current liabilities</strong></td>
<td>11,622</td>
<td>1,557</td>
</tr>
<tr>
<td><strong>Fictitious debt repayment period</strong></td>
<td>17 years</td>
<td>19 years</td>
</tr>
</tbody>
</table>

1 EUR = 134 YEN, rounded on October 2017
Current programme for investment in infrastructure
2017 - 2022 in Mio. EURO

- New constructions & expansion
- Structural maintenance
- Investment

Reliability all the way
Approach in pavement management

- Strategic objectives
- Data management
- Condition measurement System RoadSTAR
- Assessment of pavement condition
- Analysis method
- Analysis results
Pavement management

Objectives

- Systematic and objective planning of maintenance treatments
- **Basis** = knowledge about the pavement
  - Inventory (length, areas, construction types, etc.)
  - Condition from condition inspections
- Integration of strategic objectives into the maintenance process
- PMS as a part of Asset Management
- **Output**
  - Which maintenance treatments?
  - When is the best point of time for the treatments?
  - Where should it be done?
- **Input for Infrastructure Investment Program (IIP)**

Reliability all the way
Pavement management
Strategic objectives and KPIs

- **Customer goals**
  - **Network availability**
    - Limitation of the length of construction site
    - 95% of carriage ways of network free from construction sites
  - **Network safety**
    - Amount of sections with road safety index class 5 must be less then 3%

- **Financial goals**
  - **Annual surplus**
    - Quality of estimated costs
    - Schedule reliability
  - **Sustainability**
    - Best cost-benefit ratio
    - Exceed expected lifetime
Pavement management
Data management - overview

- **Inventory data**
  - Network data
  - Referencing information (GIS)

- **Traffic data**

- **Pavement construction data**
  - Materials and type of layers
  - Thicknesses
  - Year of placements

- **Condition data**
  - Condition measurements
  - Visual inspections
  - Investigations on project level

- **Information of current budget**
  - 6 years committed treatments
Pavement management

Data management - condition data

- Basis are Austrian guidelines RVS 13.01.15 and RVS 13.01.16
- Pavement surface characteristics
  - Rutting (rut depth under 2m straight edge)
  - Longitudinal evenness (International Roughness Index IRI)
  - Cracking (% of cracked area)
  - Surface defects (% of surface defects)
  - Skid resistance (longitudinal friction coefficient)
- Collected on each single lane and evaluated in form of 50m sections
- Main input information for analysis
Pavement management
Condition measurement System RoadSTAR

Reliability all the way
Pavement management
Assessment of pavement condition

- **Single condition indices**
  - Transformation of technical parameters into dimensionless indices (scale 1-very good to 5-very poor)

- **Combined indices**
  - Comfort and safety index (CSI)
  - Structural index (SI)
  - Total condition index (TCI)

- **Basis**: COST 354 “Performance indicator for road pavements” (2008)
Pavement management
Assessment of pavement condition

Condition attribute | Technical parameter | Condition Index | Comfort and Safety Index (CSI) | Structural Index (SI) | Total Cond. Index

Skid resistance | $TP_{SR}$ | $CI_{SR}$ | $CSI_{safety}$ | $CSI_{comfort}$ | $CSI$ | $TCI$
Rutting | $TP_{RT}$ | $CI_{RT}$ |
Longitudinal evenness | $TP_{LE}$ | $CI_{LE}$ |
Surface defects | $TP_{SD}$ | $CI_{DS}$ |
Cracking | $TP_{CR}$ | $CI_{CR}$ |
Age wearing course | $AGE_{WC}$ | $CI_{age}$ |
Bearing capacity (theoretical) | $TP_{BC}$ |

Reliability all the way

Normalization | Weighting and combination (breakdown rule)

*) calculation TP by using performance prediction (age, D1)
$W$ constant weight
$W_1$ linear weight between 0 und 1
$W_2$ quadratic weight between 0 und 1
Pavement management
Analysis method

- Heavy maintenance treatments
  - Surface
  - Wearing course
  - Reinforcement
  - Reconstruction

- Minor maintenance treatments
  - Intensive routine maintenance treatments based on risk assessment (CSI and SI)

- Comparison of maintenance treatment strategies on each single section as basis for LCCA and optimization
Pavement management
Analysis results

- **Section based results**
  - Type, year and location of treatment
  - Treatment prioritization
  - Basis for further investigation on project level

- **Network level results**
  - Total network or sub-networks
    - Condition distribution
    - Cost distribution
    - Comparison of scenarios
    - Treatment distribution
    - Maintenance backlog
    - Development asset value

Reliability all the way
Pavement management
Analysis results

- Long-term prognosis of condition
  Net substance value

Net custom value of security
Thank you for your attention

Contact for further questions:

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