Development and implementation of new features in a route selection and distance measurement system

Gunnar Svenson, Patrik Flisberg, Mikael Rönnqvist
Europe (standard):
Length - 18 m
GVW - 40 tons

Sweden:
Length - 25 m
GVW - 64 tons
1500 key-routes: Best practice agreed between forest and transport companies
Objectives

- Fairness
- Distance
- Driving time
- Safety
- Fuel consump.
- Work environ.
- Maintenance
- Stress
- Curvature
- Hilliness
Objectives
• Fairness
• Distance
• Driving time
• Safety
• Fuel consump.
• Work environ.
• Maintenance
• Stress
• Curvature
• Hilliness

Road feature (No. attributes)
• Functional road class (10)
• Maximum speed (13)
• Road width (16)
• Bearing class (4)
• Terrain class (3)
• Road owner (3)
• Timber route (2)
• Passing route (2)
• Length (1)
• Ferry line (1)
• Surface type (2)
The National Road Database
542 000 km roads
• 102 000 km government
• 56 000 km communities
• 384 000 km private
GIS network
• 4.43 million arcs
• 2.20 million nodes
Objectives
- Fairness
- Distance
- Driving time
- Safety
- Fuel consump.
- Work environ.
- Maintenance
- Stress
- Curvature
- Hilliness

Road feature (No. attributes)
- Functional road class (10)
- Maximum speed (13)
- Road width (16)
- Bearing class (4)
- Terrain class (3)
- Road owner (3)
- Timber route (2)
- Passing route (2)
- Length (1)
- Ferry line (1)
- Surface type (2)

- Curvature (30)
- Hilliness (20)
Objectives
- Fairness
- Distance
- Driving time
- Safety
- Fuel consump.
- Work environ.
- Maintenance
- Stress
- Curvature
- Hilliness

Road feature (No. attributes)
- Functional road class (10)
- Maximum speed (13)
- Road width (16)
- Bearing class (4)
- Terrain class (3)
- Road owner (3)
- Timber route (2)
- Passing route (2)
- Length (1)
- Ferry line (1)
- Surface type (2)

Weights

Key routes
- Curvature (30)
- Hilliness (20)
CRF – how does it work?

- Key-routes + NVDB = weight/road attribute
- Each arc has one value for each attribute
- $\sum$ weight*arc length = resistance/arc
- CRF choses the combination of arcs that gives the lowest resistance
## Shortest Path vs Fastest Path

<table>
<thead>
<tr>
<th>Distances (km)</th>
<th>84.3</th>
<th>85.8</th>
<th>105.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (min)</td>
<td>74.7</td>
<td>72.6</td>
<td>87.1</td>
</tr>
<tr>
<td>Total resistance (points)</td>
<td>2094</td>
<td>2407</td>
<td>1492</td>
</tr>
<tr>
<td>Curviness (points)</td>
<td>161</td>
<td>190</td>
<td>55</td>
</tr>
<tr>
<td>Hilliness (points)</td>
<td>74</td>
<td>36</td>
<td>3</td>
</tr>
<tr>
<td>Width 3-3.5m (km)</td>
<td>8</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>Gravel road (km)</td>
<td>20</td>
<td>33</td>
<td>9</td>
</tr>
</tbody>
</table>

**Resistance Categories (km):**

- **RC 0:** 0, 0, 0
- **RC 1:** 1, 0, 3
- **RC 2:** 0, 2, 4
- **RC 3:** 0, 0, 67
- **RC 4:** 9, 19, 14
- **RC 5:** 18, 13, 0
- **RC 6:** 44, 24, 6
- **RC 7:** 3, 5, 9
- **RC 8:** 3, 14, 0
- **RC 9:** 7, 8, 1
CRF – Development over time
CRF – Development over time
Summary

• Balance many objectives including traffic safety, stress, cost, environment, etc.
• Improves road safety and fairness
• Transparent and standardized system
• Standard and verified economic transactions
• Enables better use of transport resources
• System analysis (e.g. tax, CO$_2$, new regulations)
Next step

• Stop and start in crossings
• Augmented/expanded network
• Evaluate payment based on more than distance – fuel/time consumption, resistance points, etc