Development of mobile optical remote road condition monitoring in Finland

Dr. Pirkko Saarikivi, CEO
Foreca Consulting Ltd

SIRWEC 2012
Helsinki Finland 23-25 May 2012
We argue that...

- Weather and road weather forecasters (and systems) are blind to the observational and forecast data being used.
- The weather and road condition analysis is not revealing the true situation but some blurred image seen through the data resolution glasses.
- The more resolution we get, the more we understand.
- Now we DO have means to improve our vision.
In the last decades Global Navigation Satellite Systems (GNSS) have improved our observing capabilities as well as the production phase, and also the final delivery phase.
In 2004, the most severe traffic accident in Finland. Bus and a truck collided, causing 23 dead and 14 injured.


Improved data sets, models and observing with DSC111 and DST111.
First observations of large variations

• Our observing vision improved dramatically!
• Large local variations, cold air pools
• Ice on road, friction dangerously low

Beautiful day => drivers cannot see the risk!
Second phase 2007-2010: unit on top

- Used in project ROADIDEA (2007-2010)
- DSC111 and DST111 mounted on poles on top of the car
- Datalogger, GPS, laptop and smart phone inside
Effects of road management observed

Sensor tracking

Global and local observations

SIRWEC 2012
Helsinki Finland 23-25 May 2012
Mobi-Roma in 2011-2012

- Using TECONER RCM411 optical remote sensor
- Accurate, light and easy to mount
- Data collected to a smart phone and web service
- Notice how water film increase is verified in the wheel path when the car stops (figure on the right)

SIRWEC 2012
Helsinki Finland 23-25 May 2012
Fixed networks improve as well

Variability of temperature as resolved with RWIS network

Variability of friction as resolved with fixed DSC111 sensors

SIRWEC 2012
Helsinki Finland 23-25 May 2012
Combine mobile observations to data from fixed stations to create **Hybrid Observing Systems** with increased resolution in time and space.

Fixed station network has resolution of 50-100 km whereas spacing of mobile obs is 50-100 m.

Thousand times better resolution!
Hybrid system combining the benefits

<table>
<thead>
<tr>
<th>Observing system</th>
<th>Fixed</th>
<th>Mobile</th>
<th>Hybrid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement units</td>
<td>Equipped masts</td>
<td>Equipped cars with GNSS</td>
<td>Both masts and cars</td>
</tr>
<tr>
<td>Total units</td>
<td>80</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Spatial resolution</td>
<td>60 km</td>
<td>100 m</td>
<td>60 km &amp; 100 m</td>
</tr>
<tr>
<td>Temporal resolution</td>
<td>30 min</td>
<td>3 sec</td>
<td>30 min &amp; 3 sec</td>
</tr>
<tr>
<td>Observations / day</td>
<td>3840</td>
<td>172800</td>
<td>176640</td>
</tr>
<tr>
<td>DC synoptic 100 km</td>
<td>100 %</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>DC meso-scale 10 km</td>
<td>40 %</td>
<td>15 %</td>
<td>55 %</td>
</tr>
<tr>
<td>DC micro-scale 1 km</td>
<td>1 %</td>
<td>5 %</td>
<td>6 %</td>
</tr>
<tr>
<td>DC topographic effects</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>DC lanes, GPS</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>DC lanes, Galileo</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Project GalileoCast assessed Detection Capacity = DC

Road condition observing system should be optimised to maximise the benefits and minimise the costs

Hybrid system must reveal the safety critical phenomena that the fixed system is missing

SIRWEC 2012
Conclusions and next steps

- Intelligent and multi-functional road infra and service systems are developed intensively around the world
- The transport systems of the future will be very much relying on accurate and reliable positioning systems
- In Finland development of mobile and hybrid observations continues
- Road condition models will be improved with mobile data
- Immediate product generation and delivery to road users’ cars
- I have a dream:
- 24/7 mobile observing network in Finland with weather alert button in each car: no driving if the driver does not listen to the warnings first!

SIRWEC 2012
Helsinki Finland 23-25 May 2012
Contact information

Foreca Consulting Ltd

Tammasaarenkatu 5, 00180 Helsinki, Finland

Dr. Pirkko Saarikivi, Managing Director
Tel. +358 40 5000262
Pirkko.Saarikivi@foreca.com

SIRWEC 2012
Helsinki Finland 23-25 May 2012