Development project ColdSpots: Towards more detailed road condition forecasts

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Project :: ColdSpots

- **Researching and developing road weather models and studying what cause problems for road weather**

- **Co-operation with FMI, Foreca and Destia**

- **Funding from MINTC (Ministry of Transport and Communications), Finnish Road Authority and partners**

- **Initiated after serious wintertime road accidents in Finland**

- **Concentrating in the problem spots of the Finnish road network**

- **The goal: Develop our road weather models and possibility to do more accurate road weather forecasts**

Background

- We wanted to study how the slipperiness and the road surface temperature varies along the road stretches

- … and what usually cause the slipperiness

- … and is it possible to do better and more accurate road weather forecasts especially for those points/stretches where slipperiness occurs more often

- There have been a lot of different kind of information available e.g. what cause slipperiness and what places are usually more slippery than others. We wanted to collect that information to the one database.

ColdSpots :: Benefits and risks

- **Less traffic accidents, saving money and lives**

- **Winter road maintenance becomes more efficient**

- **Scheduling and planning maintenance actions becomes easier**

- **We take a risk on the quality of new forecasts. As this is a pilot project, we do not know how much improvement (if any) can be made**

- **We want to do:**

  - ❖ more accurate forecasts to predict road weather

  - ❖ more effectively warnings for drivers, especially considering the problem spots

  - ❖ learn how much the road conditions differ locally along the road network and why

  - ❖ learn more about the influence of weather for road accidents

- **In this project we done mobile friction measurements and thermal mapping along the roads (using Vaisala's optical measurement devices)**

  - ❖ We wanted to study how the slipperiness and surface temperature varies along the road stretches and what can cause the variation

  - ❖ More information about mobile measurements on 15.5. by Pirkko Saarikivi - Foreca Consulting

What is a ColdSpot?

- **A spot with accidents due to slipperiness**

- **Or a spot which is difficult for road maintenance personnel**

- **Can be an open area → large sky-view factor, radiation cooling**

- **A valley with cool air pooling at night**

- **Coastal area near the sea or lake → lots of moisture advection**

- **Elevated spot, a hill top → lower temperature, forced uplift of moving air**

- **A bridge, curve, ramp, passing lane, …**
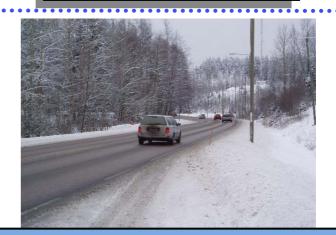
How does a ColdSpot look like?

Aneriojärvi: an open area, a lake on the right

Ikela hill: an open area ending to a hill

Bridge of Halikko may be slippery, strong wind can cause extra risk

Curve of Koikkala: Road curving on a hill – poor visibility

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ColdSpots do not look like much but they may be dangerous...

- **Drivers can not sense the danger while driving**
- **One good way to warn: variable signs**

ColdSpots database

- **We collected different kind of data considering the problem spots**

- **Data has been collected from different sources:**
    - Car accident database
    - Road maintenance personnel

- **The database includes**
    - Information about why it is problem spot
    - Technical information about structure of the road
    - Environmental information of the surrounding area
    - Accident information
    - …

- **The database is available for model developers as well as for road maintenance personnel**

Parameters effecting for local road weather

Meteorological	Geographical	Road construction profiles and other
Solar radiation	Latitude	Depth of the construction
Terrestrial radiation	Altitude	Thermal conductivity
Air temperature	Topography	Thermal diffusivity
Cloud cover and type	Screening	Density
Wind speed	Sky-view factor	Emissivity
Humidity / dew point	Landuse	Albedo
Precipitation	Topographic exposure	Traffic and maintenance activities

Ref. from: Thornes & Shao (1991), A comparison of UK ice prediction models. *Meteorol. Mag.*

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Road weather modeling and problems

- **Meteorological** parameters

  - ❖ Small scale phenomenon are hard or impossible to predict

- **Geographical** parameters

  - ❖ Some are included in numerical weather model (latitude and large scale topography)

  - ❖ Screening and slopes are (partly) possible to model

  - ❖ There are techniques available to define sky view factor

- **Road construction** parameters

  - ❖ Hard to find values

  - ❖ Possible to get average values, but actually values varies along the road stretches

  - ❖ Bridges and ramps have totally different kind of road construction than other road stretches

Conclusions

- **Road surface can be slippery and it can be hard to notice it**

- **Road surface temperature varies pretty much along road stretches as well as friction and the amount of snow/ice/water on the surface**

- **There can be found several different parameters that can cause the variation**
  - ❖ meteorological
  - ❖ geographical
  - ❖ road construction

- **Some of the parameters can be taken into account when modeling road surface temperature, but not all**

Conclusions #2

- **Some improvement can be done for road weather models, but exact modeling is still impossible**

- **Also, all reasons for the road surface temperature or friction fluctuation cannot be easily explained**

- **Other techniques to develop road weather modeling:**
  - ❖ Thermal mapping
  - ❖ Statistical corrections
  - ❖ Information available
  - ❖ In our case needs further studying