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# Digital Winter. Connected vehicles for safer roads

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## Abstrakt

Increased connectivity in cars, means that important information about infrastructure can be instantly transferred from the cars into a cloud. Car manufacturers have provided these systems for decades, but have just recently offered these connected functions to a broader customer base. Sharing data with the road authorities, however, is rare.
Trafikverkets FOI-project Road Status Information wanted to explore the possibilities to gather road friction data from cars in daily traffic to monitor and improve the winter maintenance of the roads.
A new cloud based digital solution from ÅF, in a joint venture with Volvo Cars, will now provide the Swedish Transport Administration of slippery road conditions data. One of the first initiatives in Europe to share data from vehicles in daily traffic with road authorities on a larger scale.

## Scope of work

### Collection of data

ÅF has built a platform for data collection, analysis and visualization of slippery road data.
All Volvo cars in Sweden fitted with Slippery Road Alert technology and that partake in the Connected Safety function will be involved in the data collection. The friction measurements are uploaded anonymously in real time to the Volvo Cars secure cloud solution. ÅF then refines and visualizes this data through maps and diagrams delivered through a web based interface to the Swedish Road authority.

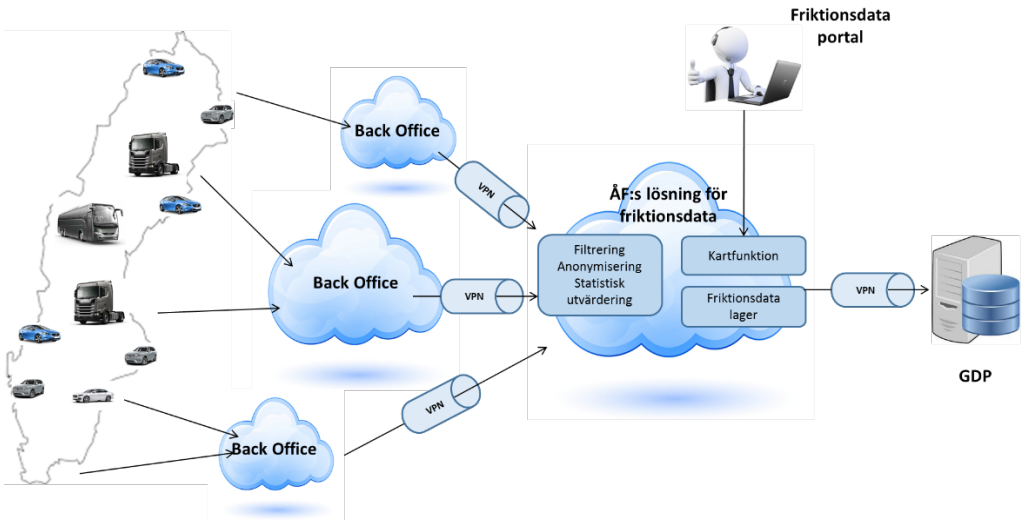


Figure 1- Schematic of ÅF:s solution for digital slippery road data.

The reported measurement points from vehicles are allocated to road numbers and road segments. The time series are converted into friction data for road numbers and road segments and are set up as time series in a friction database. In ÅF's solution there is also a service that provides map-based friction data, which is presented in a friction data portal.
By building up the structure in this way, ÅF creates the possibility of integrating data from several different vehicle manufacturers and system solutions into the ÅF's system. We are not dependent on a single data source, which creates a robustness over time. We are also not dependent on an external hardware product being mounted on a number of cars in order to be able to collect data, the cars are initially provided with the necessary communication technology.
Delivery and reporting of friction data is carried out continuously to update maps and diagrams. Monthly reports of the data for a specific districts can be exported.

In ÅF's system, a visualization of the friction mode is made. It is updated every half hour, and then contains measurements from the last half hour.

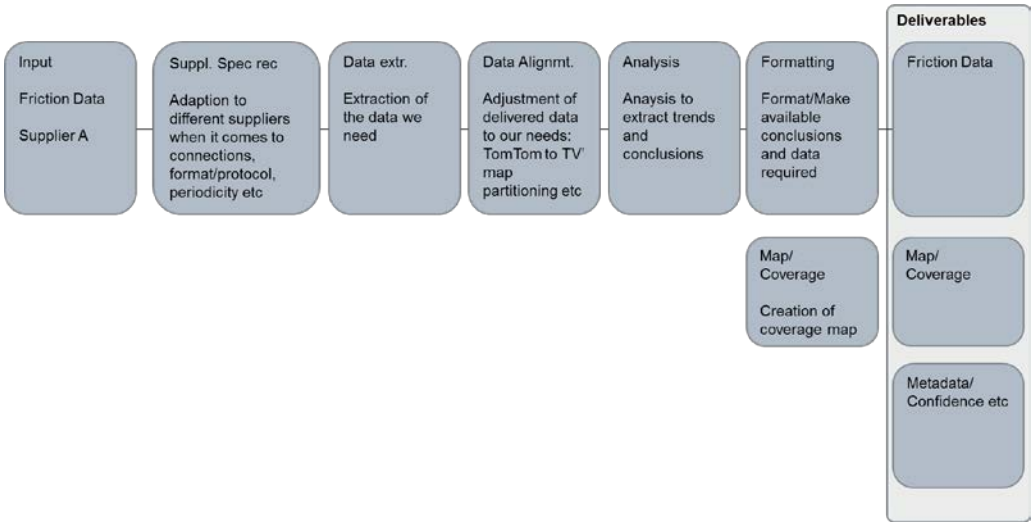


Figure 2- Systems architecture.

A compilation of friction data is delivered monthly with data per road number and road segment and time period (half hour) and with a given confidence estimate.

## Methods and analysis

The measurement of friction takes place by using the car's integrated system and looking at speed and direction changes in wheels and vehicles. The road friction is measured during the steering, braking and acceleration of the vehicle, based on the vehicle manufacturer's internal algorithms. The friction is judged to be above or below a limit value, which is then interpreted as a slippery road. The results of the measurements are uploaded in real time from each vehicle to a specific cloud solution, from where it is passed on to the ÅF integration system.

The confidence will depend on the quality of the individual measurement in the vehicle (supplied in data from Volvo) and on the number of measurements / road sections and their statistical consistency. The friction data collected is analyzed and evaluated continuously.

An agile approach has been applied to developing the system with close cooperation between Volvo Cars AB, ÅF and Trafikverket.
The work packages have included ensuring effective communication protocols for the collection and delivery of data, aggregation and data analysis, as well as visualization via web interface.

## Results

We have collected data from the 1 December 2018 and a first preliminary analysis of the results are possible to make. Approximately 3 million estimates are collected each week and covers both Norway and Sweden. The confidence measure of the data is overall high.
When comparing the data to real road and weather conditions we can observe a high correspondence.

We have also already identified several potential to further develop the function.

In this session we will present the results in detail and also describe potential further development.

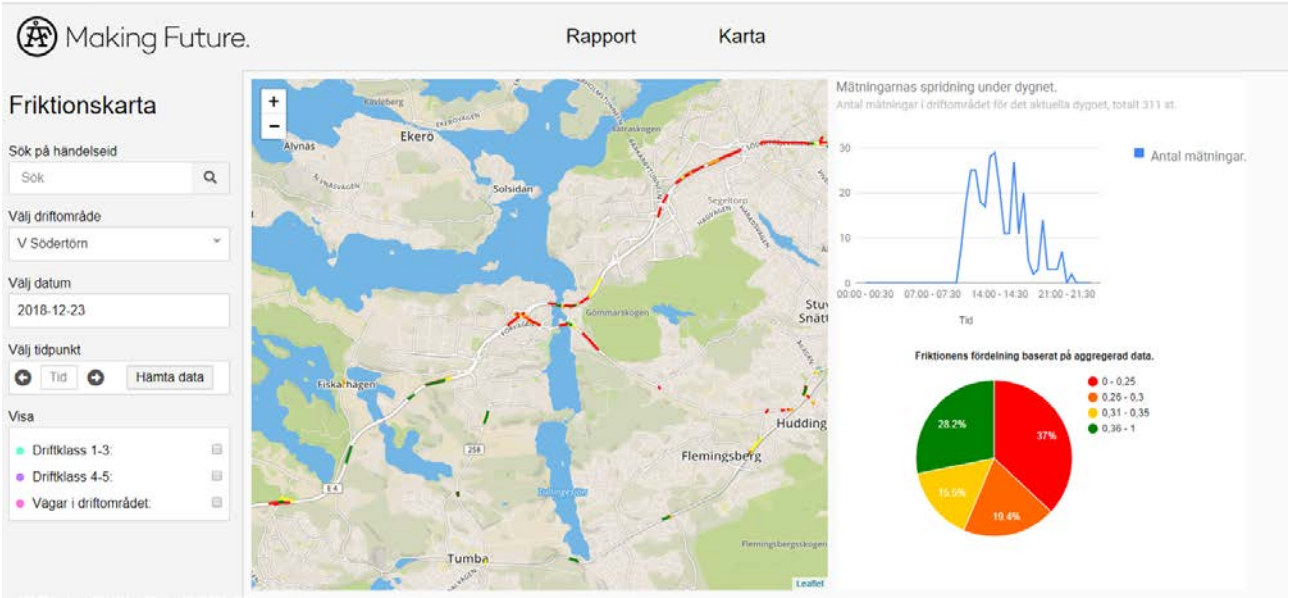


Figure 3: Screenshot from Digital winter system 23 December 2018. Area E4 passing Kungens kurva.

Figure 4: Road conditions at Kungens kurva 23 December 2018