# Automated Road Condition Forecasts on a Public Map Service

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## ABSTRACT

Purpose of this abstract is to introduce a new fully automated and revolutionary road condition forecast system available for all road users in Finland. The system was delivered for the Finnish Transport Agency as a turnkey solution by the Finnish GIS-company Karttakeskus. The forecasts and weather models are produced by the Finnish Meteorological institute.

The aim of the system is to reduce work load of road weather professionals on duty by offering user-friendly road condition information accessible from any location.

In addition, all road users can plan and schedule their travel routes according to prevailing road conditions at no extra cost. Road conditions are updated real-time in 15-minute intervals and weather conditions once an hour. The service also provides up-to-date pictures from about two hundred road weather cameras.

Keywords: road condition, forecast, free automated public map service

## 1    INTRODUCTION

ROAD CONDITION service is delivering road condition information for road sections and providing forecast information about the road condition for the next 12 hours. The road condition forecast information is used for improving traffic safety and predictability. The service is available during winter months, from mid-September to mid-May. [1]

The up-to-date road condition classification is based on information from the road weather stations located by the road side on each road section. Stations are owned by the Finnish Transport Agency. The forecast for classifying the road condition is based on weather and road surface forecast, the intensity and form of precipitation and wind speed. The road condition forecasts for 2, 4, 6 and 12 hours are updated every hour. The service includes 272 road sections. A new road section usually starts at main road junctions or where the winter maintenance class of the road changes. The length of the road sections can vary between 10 and 117 kilometres depending on the traffic amount and meteorological factors. [1]

The Road Condition service was procured for the Centre for Economic Development, Transport and the Environment for Southeast Finland, which is responsible for traffic telematics in co-operation with the Finnish Transport Agency. The service is provided as a turnkey solution by Karttakeskus Oy, a Finnish leading GIS organization. The forecasts and weather models are provided by the Finnish Meteorological Institute.
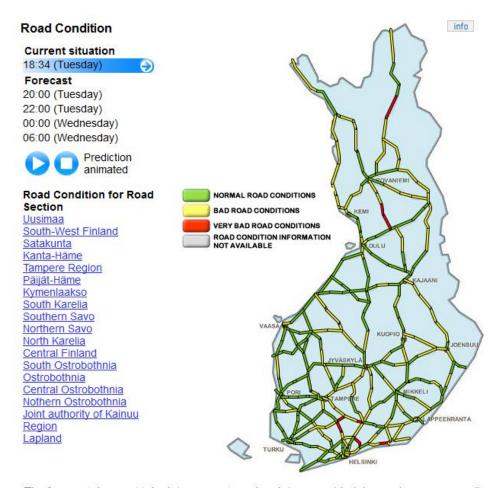
## 2        ROAD CONDITION SERVICE

The Road Condition service is provided online and is available for all on the Finnish Transport Agency website. It is also available in Finnranet, the internal service portal for road professionals. The information is available in Finnish, Swedish and in English.

### 2.1      Map views

The solution features two different map views –
1) A national summary of the current road conditions (fig 1)
 2) A road condition classes at regular intervals for selected areas (fig 2) .
The national map view functions as an access point to a more detailed and interactive road condition classes view. The user may navigate directly to their chosen location thus providing them with a user-friendly way of accessing observed and forecast road conditions.



Figure 1. The overall view of the Road Condition service.

The road condition classes of the road sections are shown on the graphic map interface at regular intervals. (fig 2).  The programme has some key functions and features which have been designed with the end-user in mind. Easy and effective navigation functionality such as "pan and zoom" and "selecting by hovering" ensures that the programme is convenient for anyone to use.

The observed and forecast conditions of the selected road section are shown on the panel to the right of the main view. The information panel shows the date, road number, the start and end locations of the road section and the current and forecast weather and road condition. The forecast is set to display predictions at selected intervals.

Up-to-date road weather camera images are provided and these can be accessed via the camera icons on the map. Images pop up by hovering over the camera icons. These can be further enlarged for closer view.
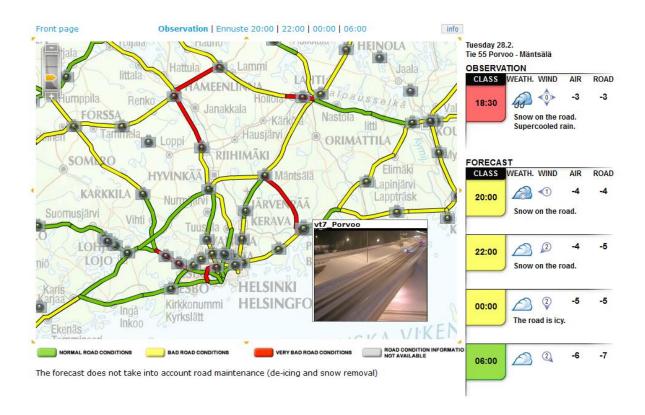


Figure 2. The interactive map view of the Road Condition service.

## 2.2    Displayed road condition

The weather and road condition information includes the average road condition class for a road section, weather conditions such as cloud cover, type of rain or snow, wind speed and direction and air and road temperature. Explanation is also included in case of poor or severe road conditions.

The condition class describes the driving conditions and the overall safety level of the road. The level is shown in green, yellow or red. The green roads correspond to normal, yellow to poor and red to severe road conditions. The conditions are also depicted by two symbols showing the weather and the wind. The wind symbol shows the direction of wind and wind speed in meters per second. Air and road temperatures are given in whole numbers. Possible textual explanations have been chosen to describe poor road conditions as detected by the system. Currently there are a total of 25 different textual explanations available. Combinations of multiple explanations are possible, as shown in the observation in figure 2.

## 3    ROAD CONDITION

The web page view is automatically updated every fifteen minutes to show the latest data available. Observations are updated four times an hour and forecasts once an hour. The road condition data is retrieved from the servers of the Finnish Meteorological Institute by the web map service hosted by Karttakeskus.

## 3.1    Observed road condition

Observed road condition data is retrieved primarily from road weather stations placed on the main road network. Stations are placed specifically to represent the conditions of the whole road network. A road weather model is used where road weather stations are not available.

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In case of multiple road weather stations on a single road section their sensor data may differ from each other. The variance may result from actual local differences or observational error. Due to safety reasons, the poor conditions are considered more significant in the model and therefore weighted accordingly.

## 3.2    Road condition forecasts

Road condition forecasts are calculated by the FMI Road Weather Model, which is a 1-dimensional energy balance model that calculates vertical heat transfer in the ground and at the ground atmosphere interface. The model is run once an hour and takes about 3-4 minutes to run.

Data from road weather stations is used as input for initializing the current time step of the model. The model calculates ground and surface temperatures and makes a road condition interpretation. The condition is classified into one or several road condition classes. After that the model uses further weather information to produce the three-valued traffic conditions index to describe the traffic conditions in more general terms. Predicted road condition classes are automatically compared to their respective observed classes to ensure the accuracy of the prediction model.

## 4    CONCLUSIONS

Road Condition, the public on line forecast map service, meets the needs of road professionals and the public by providing accurate real-time information about road conditions in an easily accessible and informative way. The system is customized for the volatile road weather conditions, capable of representing numerous descriptions of the different possible road and weather conditions.

The road condition model, the map service interfaces and the service model itself are continuously developed in close collaboration with the stakeholders. User feedback is also collected and taken into account. In the future, new sources of data and new models may be combined to provide additional data to the system.

## 5    REFERENCES

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