

Usage of RWIS MeteoTrassa in the ITS

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ABSTRACT

Intelligent Transport System (ITS) is used to control the car traffic at the Ring Highway, which surrounds St. Petersburg over the length of 141 km. The ITS ensures optimal traffic organization in automatic mode. To improve the quality of the ITS functionality meteorological information and information about road surface conditions has to be taken into account in its algorithms. Twenty five Road Weather Stations are mounted at the Ring Highway. The RWIS MeteoTrassa collects data from all of them every five minutes. It includes a prediction module to forecast temperature and state of the road and precipitation for 4 hours ahead. Forecasts are based on the numerical model of atmospheric boundary layer. Weather radar data are used to predict precipitation quantity. Procedure of thermal mapping has been applied for the Ring Highway. It allows us to retrieve data about surface temperature along the whole length of the Ring Highway. The RWIS MeteoTrassa provides the ITS with the following information: current and forecasted road surface conditions, surface temperature, wind speed, and visibility. The RWIS MeteoTrassa transmits all required meteorological data to the ITS.

1. INTRODUCTION

The Ring highway in Saint-Petersburg was constructed in 2011. Heavy rain, snow and ice can result in dangerous conditions and accidents on the highway. The RWIS MeteoTrassa has been installed as a part of its infrastructure to provide maintenance personnel with current weather information and road weather forecasts and warnings and recommendations on road treatment [1, 2]. The RWIS MeteoTrassa is a dedicated data collection, management and display system for road authorities. It operates as a maintenance decision support system (DSS) in different climatic regions of Russia. The system facilitates cost effective maintenance, road safety and high road capacity with minimal damage to the environment.

Road weather forecasts are extremely important and helpful for those responsible for managing the ring highway to optimize their winter maintenance activities to keep road users safe. To limit the impact on the travelling public, it is vital for road maintenance decision-makers to have warnings of hazards like ice beforehand so they can apply precautionary treatment. The RWIS MeteoTrassa contributes to keeping the highway moving by providing forecasts and warnings. Winter road maintenance operatives can determine much more accurately which sections and which traffic lanes of the road need treating. This means they can selectively treat routes, or segments of routes, in order to manage salt supplies more effectively, operate more effectively, and reduce costs without comprising safety.

The ring highway stretches over 141 km under the influence of different local climate conditions and consists of flyovers, bridges, low and high sections. Forecast techniques rely on the model simulation for road weather stations and thermal mapping to make spatial temperature in-

terpolations between road weather stations. Doppler weather radar data enhance the system performance providing good basis for precipitation forecasts. The system simulates road surface temperature and condition on a route by route basis by using the thermal mapping database.

Next step of the RWIS MeteoTrassa development is its interaction with the ITS. The ITS ensures optimal traffic organization in automatic mode. To improve the quality of the ITS functionality meteorological information and information about road surface conditions has to be taken into account in its algorithms.

2. CONFIGURATION

The system has been operated since year 2011 at a new Management Center of Ring Highway in Saint-Petersburg. It is comprised of 25 road weather stations ROSA (each of them being installed with 8 road sensors in accordance with the number of traffic lanes), central computer, workstations, special - purpose software and communication tools. The RWIS MeteoTrassa software is responsible for collection of the data, processing, analysis, storing and distribution, presentation of the data, forecasting and generation of recommendation on road treatment.

The system receives data from different sources:

- Road weather stations network
- Doppler weather radar
- Regional hydrometeorological center
- Mesoscale NWP model.

The ROSA weather station responds to requests for data from the central station at predefined polling times with 5- min intervals.

The Doppler weather radar Meteor-MeteoCell at Pulkovo airport operates at 10-min intervals. The radar data is accessible from the regional hydrometeorological center (HMC) FTP-server.

An example of road surface temperature, condition and precipitation forecast for the Ring Highway is represented in Figure 1.

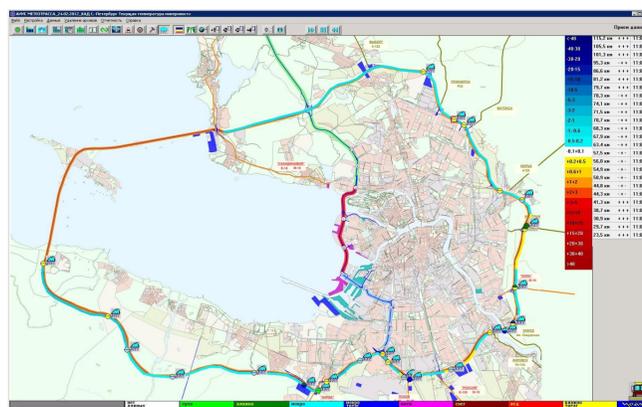


Figure 1. Road surface temperature, condition and precipitation forecast for the Ring Highway

Workstations are installed at road service contracting organizations and the regional HMC. Workstations receive observation data and textual messages from the central computer automatically. HMC workstation sends area specific weather forecasts and warnings of the re-

gional HMC to the central computer, which then distributes them to other user workstations automatically.

3. INTERACTION BETWEEN THE RWIS AND THE ITS

Interaction between the RWIS MeteoTrassa and the ITS is necessary to improve safety traffic and to optimize traffic organization. The RWIS MeteoTrassa is involved in determining the speed limit on the Ring Highway, in addition to other winter road maintenance objectives.

The RWIS MeteoTrassa identifies hazards automatically based on current and forecasted data. Every five minutes the RWIS MeteoTrassa transmits automatically all required meteorological data in XML format to the ITS. The ITS divides the Ring Highway into 25 routes. The ITS determines speed limit for each route in accordance with data on traffic, congested traffic probability and meteorological hazards.

Depending on the hazard level ITS may decide only to inform road users about meteorological hazards, or to reduce the speed limit. The ITS provides information and management interaction with road users using variable information signs and placards.

Table 1
Main criteria for determining meteorological hazards on the road

Risk Factor	No Danger	Not Dangerously	Dangerously	Very Dangerously
Visibility, m	$V > 750$	$750 \geq V > 300$	$300 \geq V > 100$	$100 \geq V$
Surface Conditions	Dry, Moist	Wet	Snow	Ice
Surface Conditions Warning	-	-	Ice Warning	Ice Alarm
Intensity of Rainfall, mm/hour	$I < 0.2$	$1.2 > I \geq 0.2$	$4.0 > I \geq 1.2$	$I \geq 4.0$
Intensity of Snowfall, mm/hour	$I < 0.1$	$0.5 > I \geq 0.1$	$1.7 > I \geq 0.5$	$I \geq 1.7$
Maximum Wind Speed, m/s	$WS < 5$	$15 > WS \geq 5$	$25 > WS \geq 15$	$WS \geq 25$

4. CONCLUSION

The RWIS MeteoTrassa provides the ITS with the following information: current and forecasted road surface conditions, surface temperature, wind speed, and visibility. The RWIS MeteoTrassa transmits automatically all required meteorological data to the ITS to ensure optimal traffic management.

5. REFERENCES

- [1] T. Bazlova, N. Bocharnikov, M. Vinogradov, A. Solonin. Road weather forecasting for a ring highway. In: *Proceedings of SIRWEC 16th International Road Weather Conference, Helsinki, Finland, 23-25 May 2012.*
- [2] T. Bazlova, N. Bocharnikov, A. Pugachev, A. Solonin. Decision support system. In: *Proceedings of SIRWEC 16th International Road Weather Conference, Helsinki, Finland, 23-25 May 2012.*