PROJECT

Forecasting expert system for road slipperiness (ASTRA2008/002_OBF)

Strassenglätte-Prognosesystem (SGPS)

Funding: National (Switzerland)
Duration: Jun 2008 - Oct 2010
Status: Complete with results

Background & policy context:

The interactive expert system for the winter maintenance service was developed by the Bern University of Applied Sciences, Engineering and Information Technology (BFH-TI) by order of the canton Lucerne. The aim of the expert system is to propose automatically in a computer based way spread- or plough actions to the winter maintenance team to be completed for the roads of the Canton Lucerne. During the winter 06/07, the system was put into operation and the strength and weakness were evaluated.

It's now planned, to establish the expert system on the national roads in the area of the canton Bern by support of ASTRA and the research promotion of the Bern University of Applied Sciences. Thereby the modeling of the road conditions should not only be done by using local sensor data but also in conjunction with modeling of weather models by MeteoSchweiz.

Objectives:

The aim of the "Forecasting expert system for road slipperiness" is to improve the modeling of the road conditions, developed in the IMWD project, and to copy this to the spreader route network of the canton Berne. To do that, the existing way of modeling has to be analyzed and optimized by meteorologists and physicists. The success of this development can be checked with calculations and evaluations from the data in winter 07/08.

To receive and store the winter 07/08 data as well as to put the system into operation in November of 2008, the improved IMWD system will be used. To put this system into effect a new graphical user interface has to be developed in consideration of the requirements of the winter maintenance team.

Methodology:

To carry out the research project, a structured approach in 6 phases is planned:

Phase 1: Integration of forecasting system in the existing winter road system structure;
Phase 2: data collection in winter 07/08;
Phase 3: modeling of road conditions, including implementation and evaluation;
Phase 4: planning (needs assessment) and implementation of user interface;
Phase 5: Operating mode in winter 08/09;
Phase 6: Evaluation.

Parent Programmes:
ARAMIS - ARAMIS information system

Institute type: Public institution
Institute name: Swiss Government: State Secretariat for Education and Research
Funding type: Public (national/regional/local)

Partners:
Switzerland
Key Results:

The SPGS calculates alert messages, shown by yellow or red warnings, for situations of freezing roads, glazed frost or hoar-frost, and for freezing rain.

Yellow colour means about 50% probability of dangerous situations, red colour of about 80 - 100%. The SPGS does not produce warnings for weather fronts leading to snowfall and slippery snow on the roads, these situations being already reliably forecast by meteorological services. The system's forecast of critical street situation is based on modular algorithms which rely on meteorological models.

Calculation is always done in three steps:

Calculation step 1: indicates whether the actual road situation has the potential of getting critical. The result is quantified by a code, the "actual-situation number".

Calculation step 2: The algorithm checks whether the actual-situation number exceeds a threshold value. If not, the colour green is displayed (small probability of dangerous situations). If the threshold value is exceeded, the system proceeds to step 3.

Calculation step 3: The system calculates a forecast number indicating the probability that street situation gets critical. The calculation is based on mathematical, physical and meteorological models and on empirical criteria, allowing a forecast for a two-hour time window. The actual value of the forecast number calculated determines whether the colour green, yellow or red is displayed.

In the winter seasons 2008/09 and 2009/10, the SPGS has been implemented and tested on four street segments with different micro-climatic environments at highways A6 and A8 in the canton of Berne. Experiences made with the SPGS by the winter service staff were exceedingly positive. Statistical methods were applied to determine the system's error rates. False alerts errors were of the order of 15 % ± 5 % for red colour warnings and of about 50 % ± 5 % for yellow colour warnings. Critical street situations were correctly forecast in about 90 % of all cases.

The SPGS fully demonstrated its forecasting ability:
• The winter service staff appreciated the simple, but comprehensive user interface that was always and everywhere attainable via the internet.
• The SPGS offers assistance for reliable and rapid decision making by the service staff. Such an instrument is useful and even necessary for doing preventive interventio

Innovation aspects

Improving of the existing model.

Policy implications

Enhanced safety of road transport.

Documents:
- Final report in German (Final report)

STRIA Roadmaps: Network and traffic management systems, Infrastructure

Transport mode: Road transport
Transport sectors: Passenger transport, Freight transport
Transport policies: Safety/Security
Geo-spatial type: Other