FINNCONTACT

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BALTIC ROAD CONFERENCE ORGANISED IN RIGA

THE FIRST MEETING OF ROAD ENGINEERS FROM THE BALTIC COUNTRIES WAS HELD 70 YEARS AGO. ROAD CONFERENCES OF THE THREE BALTIC COUNTRIES WERE ORGANISED REGULARLY UNTIL THE SECOND WORLD WAR WHEN THE CHAIN OF THE CONFERENCES WAS BROKEN FOR OVER 15 YEARS.

THE 24th INTERNATIONAL BALTIC ROAD CONFERENCE WAS ARRANGED ON AUGUST 21-23, 2000, BY THE BALTIC ROAD COUNCIL (BRC) AT KIPSALA EXHIBITION CENTRE, RIGA, LATVIA. IN ATTENDANCE WERE MORE THAN 350 OFFICIAL DELEGATES FROM 20 COUNTRIES.

On the first conference day the plenary session was initiated with a welcome speech by Mr. Anatolijs Gorbunovs, Minister of Transport, Latvia, and succeeded by the greetings of the President of the World Road Association (PIARC) and the Chairman of the Nordic Road Association. Following, individual country reports were given by Mr. Talis Straume, Director of Road Department, Latvian Ministry of Transport; Mr. Riho Sormus, Director General, Estonian Road Administration; and Mr. Gintaras Striaukas, Director General, Lithuanian Road Administration. The reports comrehended reviews on the development since the previous BRC conference and on the present situation in the road sector in the respective countries.

The numerous papers given during the conference, by lecturers from different parts of the world, were grouped into 8 simultaneous and successive seminars as follows:

A1. Impact of the Road on the Environment
B1. Advanced Road Equipment
C1. Designing and Construction of Bridges
A2. Prospects of Development of International Transport Corridors and Transport Services in the Baltic Region
B2. Design, Building and Reconstruction of Roads
C2. Repairs and Maintenance of Bridges
A3. Management and Financing of the Road Network
B3. Routine Maintenance of Roads including Winter Maintenance.

Technical tours were included in the program as three alternative routes and topics – Reconstruction of Bridges, Road Construction and Road Maintenance.

The concurrent exhibition, Motorways 2000, with the goal of maintaining and improving interaction between the manufacturers of road machines, public institutions, consulting companies and the users of the equipment and services was also a part of the conference.

The Finnish Technology Transfer Center (FinnT^2) together with the Baltic T^2 Centers once again had a joint stand at the indoor exhibition. Outside at the open-air exhibition one could view also high-quality Finnish machines, e.g. a Sisu truck, Vammas grader and Lännen excavator loader.

This successful event will be succeeded by the next BRC conference in Vilnius, Lithuania, in October, 2003.

JARMO IKONEN

Next to each other, a Finnish Vammas grader and a Lännen excavator loader at the conference exhibition in Riga.

Also In This Issue:

RECENT PMS DEVELOPMENT

ROAD WEATHER INFORMATION SYSTEM

RECENT PMS DEVELOPMENT IN FINLAND

This article presents the implementation of Pavement Management System (PMS) outputs, practical use of PMS at network and project levels, as well as the role of PMS in the decision-making process. The focus is on the recent development of data collection, systems and decision-making procedures.

INTRODUCTION

The structure of the Finnish Pavement Management System is shown in Figure 1. This system has been in extensive and successful use since the late 1980's.

This article concentrates on the development efforts made to different components of this management system and process during the last 2-3 years. Continuous development of both the systems and the utilisation of results is essential for success. Development ideas have been collected from different sources: in-house experts, local consultants, international research and international co-operation, especially Nordic PMS discussion group.

AUDIT OF ROAD ADMINISTRATION

A major event in the development of pavement management was an international audit of pavement management activities in Finland. The State Audit Office and the ministries had been indicating that road funding needs, and reporting of the current road condition level is ambiguous, and that an audit would be needed to get an independent statement of the state-of-the-art of PMS, funding levels and decision-making.

The results of the audit confirmed that pavement management in Finland is at a very high international standard. Auditors also estimated the target for road conditions, and the funds needed to achieve it, which were the same results found by Finnra's own studies. The major recommendations concerned the marketing of the results in an understandable and consistent format and harmonisation of principles used in network and works programming level systems.

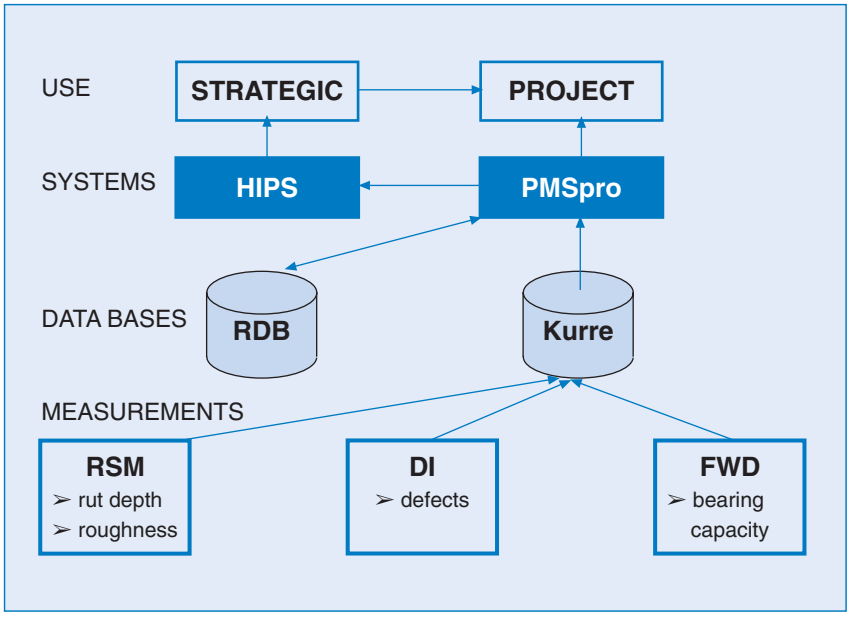

Figure 1. Pavement management process in Finland.

DATA COLLECTION AND DATA BANKS

Road Data Bank

A new road data bank has been implemented during the last few years. PMS now retrieves basic information from all traffic lanes, compared earlier to when only data from the main lanes was available. Maintenance and rehabilitation actions and effects of actions are now put into the road data bank in more precise way.

The need for accurate traffic volume data is often undervalued in pavement management; Finland is not an exception. However, the number of permanent traffic counting posts on the main road network has increased to well over 200 during the last number of years.

A comprehensive axle load study was executed in 1999. The results of this study show that axle loads have increased 20-30 percent in the last 15 years, and this should be acknowledged in pavement management as well.

Road Condition Data

The key road condition parameters used in pavement management are (1) rut depth, (2) roughness, (3) surface defects and (4) bearing capacity. The variables have been the same for quite some time, but considerable effort has been invested into finding a new and better variable for road structural condition, but no break-throughs have yet taken place.

The following enhancements to data collection and variable definitions have been made:

A new road surface monitoring vehicle is under development by the Technical Research Centre of Finland. The main objective of this work is to more accurately measure rut by replacing ultrasonic technology with laser cameras and with a new definition of rut depth determination, including crossfall of road and water depth in ruts.

Surface distresses are collected using subjective visual inspection. The quality of this data is variable, and several attempts, using both domestic and international technology were made in late 1990's to implement automatic distress inventory systems. None of these works were, however implemented, mainly due to high costs but also due to the non-applicability of international crack detection procedures to Finnish circumstances.

The main surface distress variable used has been distress sum, which is a weighted sum of different distresses. This formula was re-evaluated in 1999; more importance was given to edge damages, whereas the importance of narrow cracks was decreased.

No major changes in IRI and FWD measurements have been implemented. The use of ground penetrating radar has been commenced, mainly for project level analysis.

Recommended condition measurement cycles have been updated. Especially, interpolation of bearing capacity values for missing 100 m sections has been ceased, and shorter spacing of FWD measurements is being applied (from 300-500 m to 100 m). The aim in development has been "to measure less but more accurately".

Independent quality control procedures for all condition measurements have been implemented. These procedures are needed, because all of data collection has been outsourced, and this requires both quality control and unambiguous instructions.

ROAD CONDITION DATA BANK

A new centralised version of the road condition data bank (Kurre) was introduced in the beginning of 2000.

This new condition data bank is purely data storage, because road condition prediction models, as well as related reporting, was moved to district level PMS. The main reason for this is to avoid discrepancies in reporting from different systems.

The contents of the condition data bank were completed with the data from GPR (Ground Penetrating Radar) measurements.

The new condition data bank also provides a new tool for the quality control of measured data, which is always checked with a certain procedure before the final input into the data base.

The reporting system of Kurre is under development.

DISTRICT LEVEL PMS, PMSPRO

The district level system, PMSpro, is software for the preparation of paving and reconstruction programmes. PMSpro is an improved version of PMS91 and was put into use in February, 2000.

The main enhancements have been:

- All the input data (general data from RBD and condition data from Kurre) is divided into 100-meter sections.
- The recommendation process predicts the change in condition of the pavement and recommends an effective action for each 100-meter section, instead of homogeneous segments. These 100-meter sections with recommendation are then combined for reasonable project lengths.
- New road condition prediction models are introduced in PMSpro.

PMSpro provides the present condition distribution of pavements for the network level PMS, HIPS. Previously, this was one task of Kurre.

The development of PMSpro continues by improving the properties of the economic evaluation of the paving program and individual projects.

Figure 2. By means of PMS deteriorated road sections can be discovered and compared with each other.

OLD CRITERIA	ROUGHNESS (MM/M)	RUTS (MM)	SUM OF DEFECTS (M^2)	BEARING CAPACITY-RATIO
ADT< 350	5.5	-	140	70
350-1500	4.1	20	80	70
1500-6000	3.5	20	60	70
ADT> 6000	2.5	20	30	70

Figure 3. Old criteria for substandard pavements.

NEW CRITERIA	ROUGHNESS		RUTS	SUM OF DEFECTS	
SPEED LIMIT	ADT < 1500	ADT > 1500	ADT>350	ADT < 1500	ADT > 1500
< 80	6.5 – ADT/750	4.5	18	160 – ADT/15 (60 -> 160(ADT=0))	60
80	5.5 – ADT/750	3.5	16		
100	4.5 – ADT/833	2.7	14		
120	3.5 – ADT/1000	2.0	13		

Figure 4. New criteria for substandard pavements.

NETWORK LEVEL PMS, HIPS

The network level PMS, Highway Investment Programming System, has been extensively used in supporting strategic decision-making by the Finnish National Road Administration (Finnra) for the last decade. The same system and approach has been applied in several other European countries (Hungary, Poland, Sweden, Norway and Estonia). During the ten-year application period only minor improvements to the system have been made, and it was lately determined that there is a clear need to re-evaluate the system and to develop a new version which would serve the needs of the road agency.

The following enhancements are needed:

- Development of optimisation, including new objective functions.
- New technical environment. Windows instead of DOS.
- Flexibility. Road agency needs are changing almost annually, and the system should accommodate these changes better.
- Synchronisation of deterioration models with works programming level PMS.
- Better data management procedures and visualisation of results.
- Integration with bridge management and other infrastructure management.

The development work has now started, and the plan is to prepare a system design to reflect all the needs of the road agency by the end of 2000. Implementation of the new system, in an integrated manner with bridges and gravel roads, will start in year 2001.

NEW MODELS

Considerable effort has been put into development of new road deterioration and road user cost models during the last years. New prediction models, and road user cost models have been implemented in year 2000.

The principles of extrapolation and simplicity have been followed in preparation of road deterioration models for district level PMS. In most cases, it has been found adequate that a one to three-year forecast of road condition for a 100-m section can be used.

In 1999, a study was conducted for finding applicable road user cost models. Several models, including models from Sweden as well as HDM-4 were tested, but none of those was proved to be superior to the existing HIPS RUC model.

In 2000, a project will be conducted for updating the deteriorating models, and for models for the effect of maintenance and rehabilitation actions on road condition at network level.

ROAD MANAGEMENT PROCEDURES

Finnra has been following management-by-objectives methods, with annual setting of objectives in management of all roadkeeping activities since 1988. Currently there are serious plans to extend the setting of objectives from a one to a three year planning period.

The main objective of the paved-road periodic maintenance has recently been to keep the increase of deteriorated roads as low as possible year by year. The variable used in this process is length of substandard road network. The goal for year 2000 is that the number of roads that don't fulfill criteria values, is not allowed to increase by more than 100km/year.

The old and current definitions of substandard roads are given in Figures 3-4. The main improvements have been:

- use of speed limit as a criteria for rutting and roughness levels
- introduction of limit for unacceptable condition (1 percent limit)
- application of linear criteria of ADT instead of step functions.

Bearing capacity criteria have not been changed.

A new criterion of a new concept, "lowest acceptable condition" is implemented. The amount of roads that are exceeding one or more of certain facilitated values (lowered requirements), is not allowed to exist more than 1% of the length of paved roads.

A new policy for management of paved roads was prepared and implemented in 1998-2000.

The main features of this policy are:

- new definition of sub-standard roads
- the amount of substandard roads should not increase
- status-quo principle (i.e. road network condition is kept as it is now), instead of optimal road condition distribution
- funding for paved roads is going to be 20% higher than in late 1990's.

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ROAD WEATHER INFORMATION SYSTEM IN FINLAND

1. BACKROUND

The purpose of the Finnish National Road Administration's (Finnra) road weather information system is to provide road maintenance with information about prevailing driving conditions and weather on the road network in winter. Another increasingly meaningful function of the system is to provide road users with information about driving conditions and weather.

2. MONITORING EQUIPMENT

The monitoring equipment of Finland's road weather information system consists of road weather stations and road weather cameras.

Finland's road weather information system has currently 270 automatic road weather stations. They are primarily located along public main roads. There are also road weather stations situated in or near the largest towns. The road weather stations monitor air and road surface temperature, humidity, dew point, precipitation, wind speed and direction, and particularly, the condition of the road surface.

There are approximately 130 road weather cameras in Finland. Some of these cameras also function as traffic cameras.

3. DATA COLLECTION

Collection of road weather information is distributed among nine collection computers. The data collection system has been renewed in 1999-2000. Road weather information is collected every 15-120 minutes.

The road weather camera system is used to collect still images. The images are stored in a common, centralised file server.

4. COMPUTING APPLICATION

The road weather information system includes a control and computing application that produces recommendations used to control variable speed limit and information signs on the basis of set computing and deducing rules. The computing application is also able to automatically produce alarms on the basis of set conditions.

Figure 1. Road weather station in Utti in Finnra Southeastern Region.

5. ROAD WEATHER FORECASTS

Up to the winter season of 1999-2000 Finnra purchased all of its road weather forecasts from the Finnish Meteorological Institute

(FMI). In the spring of 1999 Finnra decided to request bids from three road weather forecast suppliers. After a careful comparison, a private weather service supplier was selected, and the road weather forecasts for two winter seasons were ordered from it.

The forecasts include a verbal regional forecast for a 12-hour period. The verbal forecast also includes a more general 24-hour forecast and a 5-day forecast for the entire country. In addition to the verbal message, the regional forecasts are also presented in a forecast table. Time is shown in the table in three-hour intervals. There are five columns, the present time, +3, +6, +9, and +12 hours from now. The predicted variables are air temperature, road surface temperature, dew point temperature, cloudiness, precipitation and wind.

Forecast maps are compiled for air temperature, cloudiness and precipitation. Maps are updated every three hours, with the most recent maps predicting 12 hours ahead.

All of the forecast products are produced four times per a 24-hour period.

The new products include analysis maps of road weather information. Air and road surface temperatures, dew point difference depicting evaporation or condensation, and humidity measured by the road weather stations are presented on analysis maps that are updated every half hour.

6. WEATHER IMAGE PRODUCTS

Finnra purchases all of its weather image products from FMI. Finnra has actively participated in the development of Finland's radar network and has worked together with FMI over ten years already. Today Finland has six quite new or completely new Doppler precipitation radar stations.

Today numerous different kinds of radar image products can be produced. Naturally, ordinary precipitation radar images are the most commonly used applications. A new precipitation radar image is produced every 15 minutes in winter and every 30 minutes in summer.

The new Doppler radar stations also produce total precipitation images. Until now most summation images have been separate images, i.e., each radar station has produced its own 3 and 6-hour summation images. A 12-hour combined summation image has been tested.

A new product that has been in trial use during two winters is a radar image that shows the form of precipitation. The image has proved to be quite reliable, even though the information is computed from many different physical quantities.

Another rather new product is a precipitation movement forecast image. In these images the movement of precipitation cells in the latest images is extended using motion vectors, taking into consideration the speed and direction of movement of the cells. Presently the forecast period of these images is 4 hours.

Meteosat satellite images provide general images of the weather in Scandinavia once an hour. Even though the satellite orbiting above the equator has a slanted view of Scandinavia, these images are quite accurate.

NOAA satellite images of Finland are obtained 4-8 times per 24-hour period.

All the image products have very basic maps showing only seas, borders, large lakes and the main road network.

7. DATABASES

All the collected road weather information is stored in one national, centralised database. Because the database is centralised, its reliability has been emphasised. It has been calculated that an interruption in database operation costs about 4000 $ per hour.

The weather image products and road weather camera images included in the system are stored in one centralised file server.

The supplier of forecast services saves road weather forecasts directly into Finnra's intranet server.

8. UTILIZATION OF DATA

8.1 Road weather centres

As the weather station network became denser, road weather centres were taken into use in Finland in the beginning of the 1990's. Road weather centres were established to monitor weather and driving conditions in each road region. When road planning, construction and maintenance were separated into separate production units within Finnra in 1997-1998, the number of road weather centres was decreased from nine to six.

The road weather centres operate 24 hours a day in winter. The person on call reports changes in weather or driving conditions and road weather forecasts to the heads of maintenance teams in the district. Today the activity of the road weather centres is more advisory than supervisory.

8.2 Traffic information centres

With the introduction of road weather centres, reporting of information about weather and driving conditions to road users gradually became more common. In connection with Finnra's organizational reform two years ago,

Figure 2. Traffic information center in Kouvola in Finnra Southeastern Region.

distribution of information was left to the responsibility of the administrational body. So, nine traffic information centres were set up under the jurisdiction of the road administration. The job of the traffic information centres is to report on weather and driving conditions and also to inform about regional road work, traffic accidents, other permanent or temporary traffic disturbances, weight limits on frost damaged roads, etc.

8.3 Weather and traffic information centre workstation

The most important road weather application is Road Weather for Windows. With this application users can analyse road weather information graphically using map, chart or table screens. The application supports image product viewing, but weather images and road weather camera images are usually viewed using a separate Image product application.

The road weather forecasts are stored directly into Finnra's intranet server in html format by the weather service supplier. The users can examine and analyse the forecasts using a web browser.

8.4 Other users

Other users inside Finnra utilise the information produced by the road weather information system by means of a special intranet application. By using this application they can examine road weather data, weather images, road weather camera images and forecasts.

The public is served in many different ways of which Internet service is the most important. It provides information from the road weather stations and road weather cameras, but it also provides road weather bulletins and forecasts made by the traffic information centres, traffic information, information about road work and ferry timetables. The service is very popular. For example, 2.2 million searches targeted the road weather pages in March 2000. This amount is relatively large taking into consideration that Finland's population is approximately 5 million! The information is updated every ten minutes. The address of Finnra's English pages is http://www.tielaitos.fi/alk/english/.

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GREAT EXPECTATIONS FOR TRAFFIC MANAGEMENT DEVELOPMENT IN LITHUANIA

As part of the Phare Transport Programme of the European Union, the Finnish National Road Administration (Finnra) implements a traffic safety programme for a safe and effective road transport system in Lithuania. One part of the traffic safety project was to discuss how traffic management methods could be utilised in a reasonable way in the future.

At first, many Lithuanian experts from the ministries, police, Road Administration (LRA), cities, Gediminas University and the Transport and Road Research Institute (TRRI) were interviewed to find out the actual situation in traffic management in Lithuania. Then, a workshop was held in Kaunas, Lithuania, with 37 participants brainstorming how to develop the traffic management in the country.

The topics discussed in the workshop were: traffic management in general, the monitoring of road and traffic conditions, information technology, traffic information, real-time traffic control, and orders to be changed. The first handled was the current situation in Finland and Lithuania. Then, comparing and analysing discussions directed towards the future took place. This method of working was found to be successful in earlier workshops.

LITHUANIA IS NOT AT A ZERO-POINT IN IMPLEMENTING TRAFFIC MANAGEMENT

There are some cases in which Finland can in Kaunas City learn something from the Lithuanian practices. For example, there is the "reversible" lane (i.e. a lane that is trafficked in opposite directions during morning and evening) and it works very well – preventing traffic jams, and drivers can use the traffic lanes correctly. Also, there are some good solutions adaptable in Finland on the real-time Internet pages taken care of by LRA.

In Lithuania, the automatic monitoring system consists of 10 traffic stations and 20 road weather stations but there are no cameras at the moment. Information is collected manually by the police and the road authorities.

Data from road weather stations are collected to the database in the maintenance unit of LRA in Vilnius. TRRI in Kaunas collects traffic data from the automatic stations. Information about road works is gathered daily from the road regions to the LRA's road maintenance division.

Road weather data from LRA are automatically transferred to the Internet. National and local radio stations utilise these Internet pages as they inform drivers about road conditions. Some local radios, especially Radiocentras, collects information about traffic conditions and accidents directly from drivers. In addition, police provide information about accidents that cause disruption to traffic for at least one hour.

In the big cities in Lithuania there are quite many intersections with traffic signals, yet they do not sycronise in a clever way, because most of them are old. Their maintenance costs are

Figure 1. A road sign indicating a "reversible" lane in Kaunas.

high, too. In Kaunas and Vilnius traffic control centres take care of the remote control of traffic signal systems.

On the main road A1 from Vilnius to Kaunas there are four message signs above the road: two in both directions. Messages concerning traffic and road weather conditions along with also some general information can be provided.

One pilot project of speed display is going on in Siauliai City.

HOW TO CONTINUE IN THE FUTURE

In Lithuania, there is an essential need to create continuous co-ordination between various organisations and actors in road traffic management. Now, each party carries out its own projects. A coordinator should be found and organisational arrangements made as soon as possible.

The main conclusions of the Lithuanian experts recognise the great need for a research and development programme, some guidelines for traffic management and the necessity to promote these issues among high-level decision-makers.

In the above-mentioned workshop many practical questions were discussed.The below list tells of the most important conclusions or questions needing answers.

- Common Internet pages are needed for the Baltic countries (Lithuania, Latvia, Estonia) and a similar solution would be good in co-operation with the Belorussian and Polish road authorities. Common Internet pages or linked pages would be useful also for LRA and Vilnius and Kaunas cities.
- More extensive traffic monitoring is necessary and the number of road weather stations must be increased, especially if their information is needed directly to alarm winter maintenance personnel. A plan already exists to implement 10 road weather stations or traffic cameras on the state roads. Kaunas and Vilnius cities have similar plans to install cameras on their streets.
- Regular communication between different actors – LRA, cities, police, rescue service, and the neighbouring countries must be improved in automatic monitoring, but especially in manual monitoring.
- Data storage in the country level and data exchange between different organisations should be developed in the near future. Also it is worth exploring whether a traffic management centre is needed in Lithuania, and where it would be located and who would take care of it.
- More information about road and traffic conditions should be offered to road users. One organisation must take the responsibility for the implementation of traffic information. Road weather forecasts for drivers, prepared together with the Meteorological Institute, could be useful in improving road safety and increasing the satisfaction of drivers.
- Message lists in Lithuanian must be done according to an EU-event list. It is also worthwhile to create a list of place names for traffic informing and to use these place names in tourist maps. These lists make data exchange between neighbouring countries possible providing traffic conditions in real-time through radio, Internet or in-vehicle equipment.
- Traffic light systems must be renewed in Vilnius and Kaunas cities (see Figure 2) as soon as possible and, at the same time, speed limits on main streets. Free turn-to-right against red-lights, priorities for public transport and separate pedestrian lights should also be considered as should traffic and road weather cameras.
- It would be possible to use variable speed limit signs but there are legal and financial problems to be solved first. Also automatic speed and intersection enforcement is worth trialing, but before implementing such systems, the traffic law must be changed.

Figure 2. The traffic signal control centre of Kaunas City.

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