

Weather Related Traffic Management - E18 Finnish Test Area

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Abstract

The test area prepared for the demonstration of Weather Related Traffic Management Telematics solutions is the E18 corridor running from Turku along the southern coast regions of Finland via Helsinki and Kotka to Vaalimaa on the Russian border. The corridor will also include maritime links from Turku to Stockholm in Sweden, from Helsinki to Stockholm, Travemunde (Germany), and Tallinn (Estonia), and from Kotka to various ports in Germany, as well as road and rail links from Vaalimaa to St Petersburg in Russia.

The total length of the Finnish part of E18 is about 350 km. The average daily traffic on E18 varies from 2.500 vehicles near the Russian border to 35.000 vehicles near Helsinki. The average daily traffic at the border station in Vaalimaa is about 1.000 vehicles. In Turku the traffic crossing the border is about 1.300 vehicles per day and in Helsinki about 1.400 vehicles per day.

The corridor runs through three FinnRA districts, each of which has its own weather and road surface condition monitoring centre (RWMC), which in turn are exchanging information between themselves and the national traffic information centre (TIC) in

information between themselves and the national traffic information centre (TIC) in Helsinki. The regional road weather monitoring centres in Turku, Helsinki and Kouvola serve the whole corridor. There are nine RWMCs in Finland in all.

There are several variable message signs (VMS) warning of the slippery road conditions along the whole corridor, and a 14 km motorway section with 36 automatic weather and road surface condition controlled speed limit signs and 5 information signs on the eastern part of the corridor near Kotka. Road weather stations and traffic monitoring stations exist at ca. 30 km intervals along the corridor. The weather monitoring centres have immediate access to these stations.

1. Introduction

Finnish National Road Administration (FinnRA) tries to improve the traffic fluency and safety and increase the driving comfort as much as possible. The environmental aspects are carefully taken into account.

The adverse weather conditions are significant problem in traffic safety in Finland. Almost the half of the winter time accidents occur during bad weather or road conditions. The road users are not always well enough aware of the road conditions and the risk when driving during winter time. The road conditions are quite often estimated to be better than they really are. The increase of the international traffic in Finland will cause problems because the foreign drivers are not accustomed to drive in as wintry road conditions as there prevails on the Finnish roads. That may possibly increase the risk of accidents. The weather related traffic management is one way to settle the traffic safety problems and to increase the effectiveness of the road network during the adverse weather conditions.

The road transport telematic systems are used more and more all around the world and especially in Europe. In Finland the telematic solutions are used e.g. to decrease the negative effects of the surprisingly bad road conditions to the traffic safety.

The good existing telematic infrastructure in Finland and especially on the E18 Test Area creates a firm base to the new transport telematic applications. The data transmission networks are highly developed and reliable. The GSM network covers the whole 350 km long road section. Finnish citizens are accustomed to use different kinds of modern telematic equipment in information transfer.

The test area can be divided into two main areas considering the problems. On the capital area the main problems are the worsened traffic fluency and driving comfort. On the interurban area the problems during winter time are related to the adverse weather conditions.

The level of the winter road maintenance will be improved in TERN (Trans European Road Network) in Finland. One way is to use the preventing salting. It requires exact and real time information of the road surface conditions as well as good weather forecasts.

The need of several kinds of information in safe driving is increasing. The development of the information processing systems becomes more and more current. Automatic data collecting and processing will lead to the automatic information distribution to the drivers when the receiving media and equipment are developing in tremendous speed. The road authorities have to be ready for this development.

2. Visions of the weather related traffic management

When describing the future situation on the E18 Test Area from Turku via Helsinki to Vaalimaa it is possible to find out e.g. the following items:

- weather, road surface conditions, road surface friction, status of the maintenance activities and traffic information is known all the time through the whole corridor
- it is possible to forecast as well the road conditions as the traffic a few hour ahead
- all the information systems concerning the E18 road section are compatible
- the information from Sweden, Estonia and Russia is possible to receive before crossing the borders
- the information about the surprising traffic situations is available via information systems to the road users
- the speed limits are controlled according to the road surface conditions and traffic
- the local variable info signs are used whenever needed
- the prevailing information media are used effectively both before and during the trip
- elderly drivers are taken into account when planning telematic applications
- a part of the information can directly have an affect on the vehicles

In the future an uniform information service is available in understandable form for the driver of any nationality on E18 Test Area.

3. Objectives of the E18 Test Area

The telematic solutions are tested and evaluated on the transport telematics E18 test area. The aim is to improve traffic safety and fluency, driving comfort by means of the traffic management, information supply and more effective winter road maintenance. The project is running from the year 1995 to 1999.

The test area on the road E18 from Turku to Vaalimaa will be one part of the transport telematic corridor from Sweden via Finland to Russia.

The main areas of the study carried out on the E18 Test Area are as follows:

- development of the data collecting methods to a totally new level
- development of the data handling corresponding to the new data collecting methods
- development of the information analysing and road condition forecasting
- development of the information distribution and automatization of the message generation to the information systems of the road users
- evaluation of the system as a technical system and evaluation of the effects of the system on the traffic and winter maintenance.

The final aim is to find out what kind of solution is the best one to the Finnish road and traffic conditions.

Transport Telematics - E18 Finnish Test Area

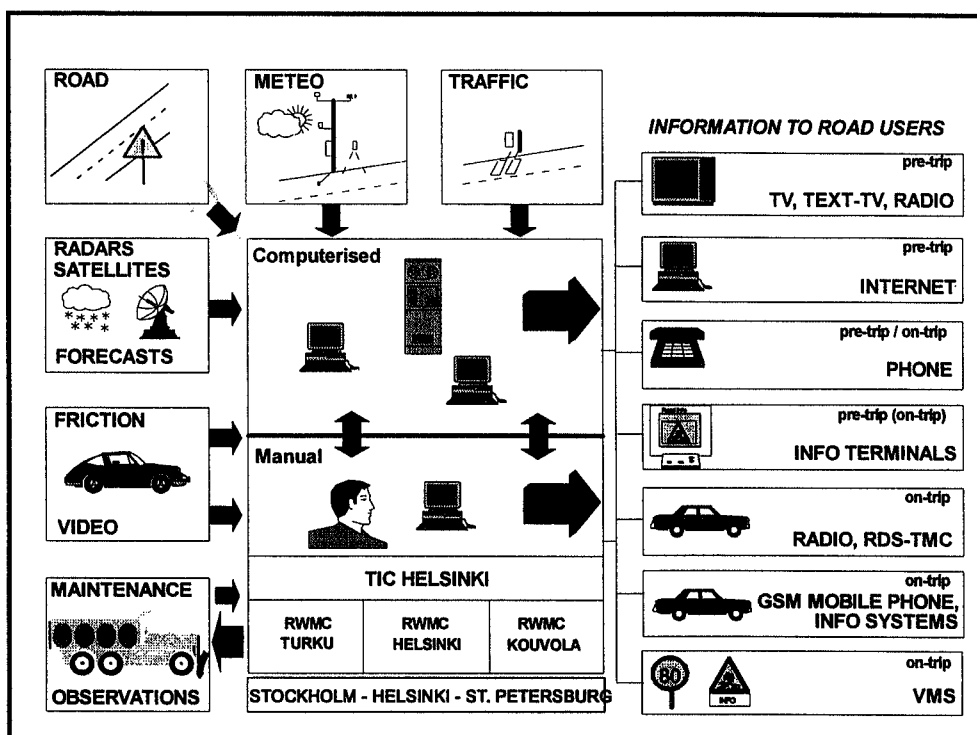


Figure 1. The information flow concept of the Finnish Transport Telematics E18 Test Area

4. E18 Test Area, developing of the information systems

4.1. Prevailing information

In Finland the total amount of road weather stations is over 200 and also the amount of traffic monitoring stations is about 200. The road weather monitoring video cameras are complementary to the information from road weather monitoring stations. Three weather radars serving the southern part of Finland are located in Turku, Helsinki and

near Kouvola. The basic information of the road surface conditions and the weather comes from the previously illustrated observation systems. The data is collected with the road weather information system. On the test area there are already 14 road weather and traffic monitoring stations and 5 video cameras.

The thermal mapping has been done for the whole test road section during the autumn 1995. It helps to situate the new monitoring stations to the right places.

4.2 Additional information

The monitoring of the weather and road conditions will be improved on the 60 km long road section in the western part of the test area. There will be installed 50 to 60 new monitoring stations or sensor spots measuring road surface condition. The observations will be caught from every kilometre on that road section. There will also be additional monitoring stations in the eastern part of the test section, but not so many as in the western part. The information will be added to the road weather information system.

The still video pictures are transmitted from the moving vehicles to the info system by the GSM based transmitting methods. During the test section it is possible to install the cameras e.g. to the buses driving along the test road section.

The road surface temperature and friction data will be collected by floating car sensors. The equipment that measures the friction will be installed at first to test vehicle but it is planned that it can be also fitted to the maintenance trucks and buses as well. The preventive salting is going to be made more effective with the longitudinal measurements of the road surface temperature and friction.

The maintenance activities will be informed to the new road condition information database. Every road weather monitoring centre keeps the information in real time in the data base and so the information can be used in all info centres whenever needed.

4.3. Data handling systems

The software applications of the information system will be made according to the European technical standards of the telematic architecture. The information is bound to the place and to the co-ordinates. The information outside the road administration is tried to get so that it is combined to the co-ordinates.

The data exchange between the neighbouring countries is tried to make automatically but a great deal of the information is so stationary that it is possible to update by manual data transfer.

All the information (road surface condition, weather, traffic, maintenance, incidents and so on) is recorded to the data bases. The data bases of each data collection system form a family of data bases and the user interface program is collecting all needed information from each data base through the data management application. The user interface is based on the mapinterface called "arcview". The information can be shown e.g. on the map base or in time series.

The message management is used when the information has to be sent quickly and straight to the road user, e.g. slipperiness warnings via RDS-TMC system.

One important thing is to define the responsibilities of the different road weather monitoring centres in feeding the data to the systems. On the test area there are four info centres: Helsinki traffic information centre (TIC), Turku road weather monitoring centre (RWMC), Uusimaa RWMC and Kouvola RWMC.

4.4. Exploitation of the information

Road users can obtain information before trip and during their trip about prevailing road conditions, traffic etc. Information is available via TV, radio, Internet, RDS-TMC, in-vehicle information systems, telephone service, VMS and info-terminals (at service

stations and border stations). National information networks like TELMO or Teletext provide access via TV or modem to real time weather data as well as forecasts.

The new data transfer techniques are tested in E 18 telematics project. The data transfer from the floating cars and to the road users terminals via GSM techniques is a new way to transfer the data. GSM is already a European standard and it gives a lot of possibilities to develop different kinds of message exchange as for instance short messages (SMS) and cellular broadcasting (CB).

Variable message signs are used when warning e.g.. about slippery road conditions, jams, incidents, maintenance activities or animals on the road.

The weather related speed limits and information boards are tested in eastern test road section near Kotka. The speed limit varies automatically according to the road conditions and weather. During adverse weather conditions the speed limit is 80 km/h and in good conditions 100 km/h during mid winter and 120 km/h in other seasons.

The more accurate information of the road conditions is also transmitted to the road maintenance personnel to improve the maintenance work.

5. Evaluations

There will be much more information to the road maintenance and to road users on the E18 test area in two years than before. Careful evaluations of the impacts of the information will be done during the third year of the project.

The main areas of the evaluation are:

- system functionality .
- comparison between the local monitoring stations and floating car measurements
- road condition forecasting
- pre-trip and on-trip information to the road user

- effects on the winter maintenance
- effect on the traffic safety and fluency
- information ergonomical aspects (HMI)
- economical aspects, cost-benefit analysis.

Though there already exists different kinds of road surface monitoring stations and sensors, the reliability of the information has to be examined and estimated. The need of more and more reliable information increases when it is used to control the traffic signs, information boards and various media of the information delivery.