

# **WEATHER DEPENDENT ROAD CONDITIONS CROSS BORDERS**

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## **Abstract**

Road Weather Information System (RWIS) is an effective instrument for winter maintenance operations in many countries. Baltic Countries – Estonia, Latvia and Lithuania have started the development of such information systems in the middle of nineties. In the beginning mainly was focused on composing the independent system according to national strategy and local opportunities. They used different sources for financing the project like public investments program, bank loan and road maintenance fund. After five years development the systems become quite similar due to proximity of the countries and the availability of high level know-how from developed neighbouring countries like Finland and Sweden. It gave good opportunities for the countries to make closer co-operation in information change in future.

## **Introduction**

### *Project Background*

In 1994, the following PIARC Winter Road Conference was held in Ceefeld. General directors of road administrations in three Baltic States applied to the Finnish Road Administration with request to have technical assistance for development of Road Weather Information and Traffic Monitoring systems. The expert group was formed for preparing feasibility study and terms of reference for the development of the systems. By the results the first four road weather stations was installed to the roads of Estonia in 1995.

By the end of 1999 there were in total over 60 road weather information stations in the Baltic States and in addition 275 stations in Finland. Even if the stations were mainly used for winter road maintenance services, Finnish and Lithuanian Road Administrations had developed output for the weather data on the administration web page also. Air and road surface temperature, surface status and some other parameter values were presented for common use. At the same time the Estonian and Latvian road users could not have access to the actual road weather data.

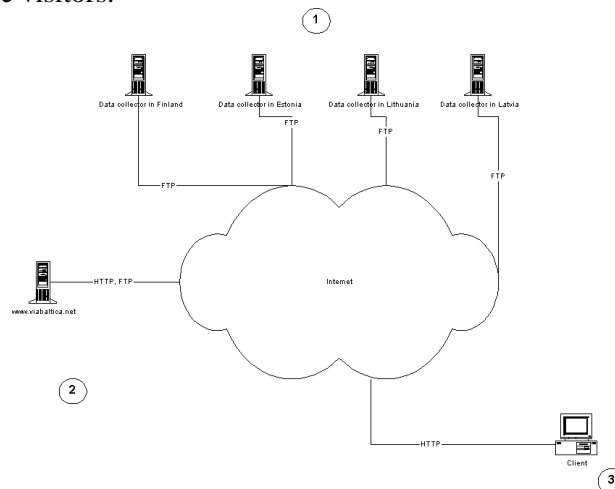
## Project Target

In 1999 four countries, Finland, Estonia, Latvia and Lithuania combined resources to develop a common Internet interface ([www.balticroads.net](http://www.balticroads.net)) to share and transfer the existing RWIS data collected around the Baltic Sea Region more effectively to the transport sector and other road users. In the first phase it could be useful tool also for road authorities where they have not access to the weather data. It is possible to access the service through an Internet connection at home, in office, in border and gas stations as well as to transfer the data via local radio operators and text-TV providers. The overall goal of the Internet interface is to provide better access to accurate road weather information for the transport industry and the driving public thus resulting in better service and improved traffic safety.

## Baltic RWIS Internet System

### Basic structure of the Information System

Information system consists of automatic road weather stations, installed on the roads and collecting actual weather information on and above the road. Each country collects its own data from RWIS stations and will form an export file of the data. The export file contains information such as number of the station, date, time and values of weather parameters that are previously agreed upon. Export file will be sent immediately after it's update by ftp protocol to the www-server. The server will control the export file arriving and when new data appears, it will be stored into databank and becomes available for the webpage visitors.



1. RWIS server – data collecting from the RWIS stations, transferring to the webserver.
2. webserver – RWIS data storing, query based page generating
3. client – webpage user

Figure 1. Scheme of the Information System

### *Road Weather Data*

Road Weather Stations (RWS) measure the present road weather using various sensors. The set of sensors in a RWS may vary from a station to a station. Some RWS's are better equipped and have more sensors than others but usually they all have at least the same set of basic sensors.

In this Internet applications 7-8 general parameters are used.

Parameter	Decimal	Unit
1. Air temperature	1 decimal	° C
2. Relative humidity	no decimal	%
3. Dew point temperature	1 decimal	° C
4. Precipitation	1 decimal	mm/h
5. Wind speed (maximum)	no decimal	m/s
6. Wind direction	no decimal	Deg
7. Road surface temperature	1 decimal	° C
8. Road surface status*	no decimal	by colour

0=not available (Grey), 1=dry (green), 2=wet (blue), 3=possibly slippery (red)

Note: \* - Not all the stations have equipped with road surface status analysing sensor. The estimation of surface status on these stations based on other parameters, like road surface temperature, dew point temperature and precipitation values.

### *Format of the Export File*

ASCII format was chosen for the export file because the file should be simple to read and fast to transmit. The format of the export file should also not be dependent on any operating system.

There will be one ASCII file per country. The name of the file would be based on the sending country: *countrycode1.txt*. Only small letters should be used when naming the file itself.

Examples of name codes:      fi1.txt Finland  
                                 ee1.txt Estonia  
                                 lv1.txt Latvia  
                                 lt1.txt Lithuania

The format of export file would be based on listing of semicolon separated parameters. Each stations would reserve one line in the file.

Content of the export file:      station1;date;time;sensor1;sensor2;sensor3; ... ;sensor8  
                                 station2;date;time;sensor1;sensor2;sensor3; ... ;sensor8  
                                 stationx;date;time;sensor1;sensor2;sensor3; ... ;sensor8

### *Data Value Criteria*

- The station names are to be coded as follows: EE0001-EE0099 (Estonia), LV0001-LV0099 (Latvia), LT0001-LT0099 (Lithuania), FI0001-FI0099 (Finland).
- The date and time values can be submitted in several formats as they will be converted to a uniform format in the receiving end and displayed in the Internet application in a uniform format.
- To symbolise a decimal point, both point (.) and comma (,) will be acceptable.
- Use of zero (0) before a decimal point is optional when sending data but when displaying data in the application the zero will be presented before a decimal point (0,5).
- Use of zero (0) before a whole number/integer (06,1) will be optional when sending data but when displaying data in the application the zero will not be presented before a whole number.
- If a data value is blank (empty between two semicolons) the value is considered to be “not available”.
- If a data value is –999 it is considered to be “not available”.
- “Not available” values presented in the map and table as a minus-line (-).
- Depending on station type both, precipitation intensity (mm/h) and precipitation status (yes/no) will be acceptable. In case of precipitation intensity would used, the 0 value considered as no precipitation. If value is 0,1 or bigger, there is precipitation.

For ensuring the quality and reliability of collecting data before the values will be stored, some control of coming values will be performed. The following accepted ranges for data values are agreed on:

Parameter	Criteria
Air temperature:	- 49 ≤ air temperature ≤ + 49
Humidity:	0 ≤ humidity ≤ 100
Dew point:	- 49 ≤ dew point ≤ air temperature ( ≤ + 49 ) If air temperature is not displayed, dew point is not displayed either
Precipitation:	0 or bigger accepted, others interpreted as “not available”
Wind speed (maximum):	0 ≤ wind speed ≤ + 39
Wind direction (average):	0 ≤ wind direction ≤ 360
Road surface temperature:	- 69 ≤ road surface temperature ≤ + 69

### *Technical details of the Internet application*

- The following Internet address is registered for the application: ***www.balticroads.net***  
The name is easy to understand and universal. It indicates to the roads in Baltic Sea countries and it is useful also for later use, when new region countries will enjoy to the co-operation.
- Update of the data on the page was agreed to 30 minutes interval in winter period. After that time it could happen more seldom, approximately 2 times per day. The update could delay for longer if maintenance or repair of system is needed.
- System will be implemented to operate on UNIX-server. Application will be planned and programmed so that the creation and presentation of the Internet pages can be on separate servers.

- In the maps the Road Weather Stations will be coloured with various colours according to the prevailing road conditions. The maps will be only “static” with defined road network, zooming will be not possible, but maps will be presented in three different scales.
- The values could be seen on maps and tables. The values disappear from the map, if they are older than two hours. The values on the table are presented with the measuring time and they will disappear when are more than 25 hours old.
- In the beginning the following languages are included in the application.
  - English
  - Estonian
  - Latvian
  - Lithuanian
  - Finnish
- The application system will accept any 8-bit character set language. That means that for example Russian can be added later without changing the program itself.
- The Internet pages have been optimised to function on most commonly used WWW-browsers, that is Netscape and Microsoft Internet Explorer. The application will be tested to work on versions 3 or higher on both WWW-browsers.
- The webpage have a links page where other useful information for driving or travelling could be found.

### *The use of pages*

The Internet interface includes selected road weather information both in map and table format. There are three individual screens or data sets available to be presented in the maps. These screens include data as follows:

#### Screen 1: Temperature and Precipitation

- road temperature (number format)
- air temperature (number format)
- precipitation (symbol format)
- road condition (symbol format)

#### Screen 2: Road Condition

- road temperature (number format)
- dew point temperature (number format)
- relative humidity (symbol format)
- road condition (symbol format)

#### Screen 3: Wind

- maximum wind speed (number scale format)
- wind direction (symbol format)

The maps are available in three different levels

Level 1. – home page with regional overview map presents a regional overview with major road network and without actual road weather data (refer to Figure 2). There are currently four individual maps identified by a blue box to be selected for closer review. Selecting one of the boxed map areas by clicking on it will bring the user to Level 2.



Figure 2. Level 1 map of balticroads.net

Level 2. – country map with selected stations presents a map of one country or in Finland’s case the Southern part of the country (refer to Figure 3). The level 2 country maps present a selection of the available road weather stations. Again the country map is divided into three or four smaller areas by blue boxes.

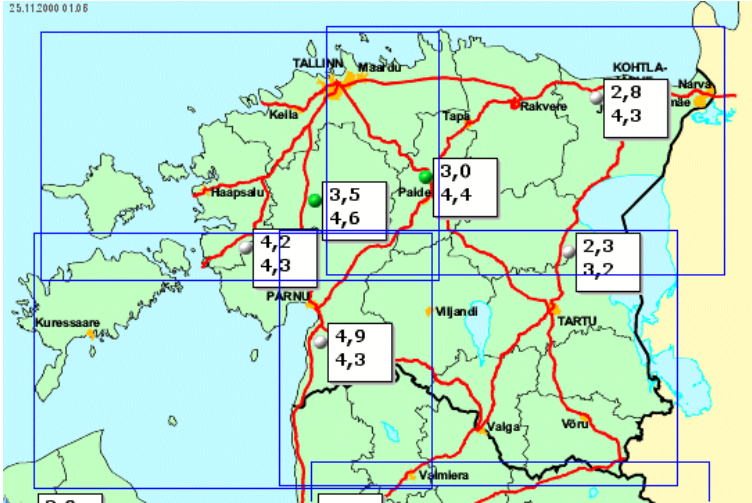


Figure 3. Level 2 map of Balticroads.net

Level 3. – part of country with all stations presents a more detailed map of the country with usually all the road weather stations displayed on the map (refer to figure 4).

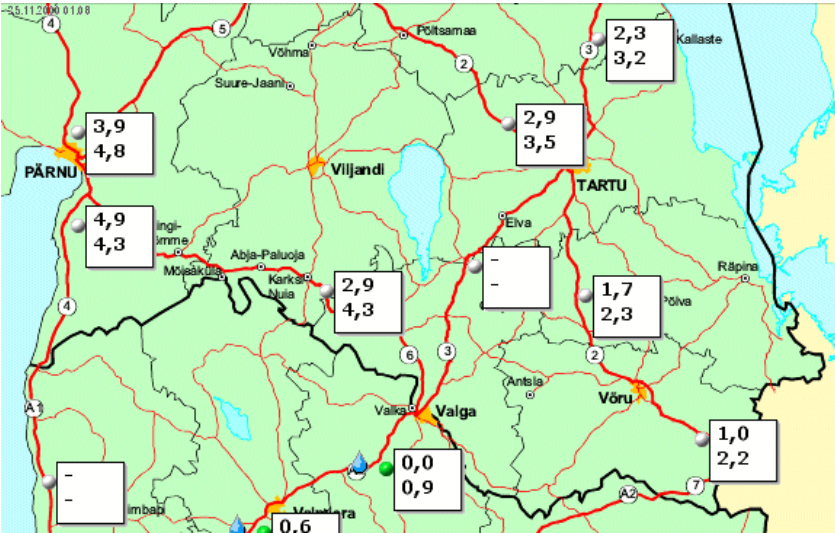


Figure 4. Level 3 map of Balticroads.net

### Data in Table

In table mode all the stations of one country are presented (refer to Figure 5). By clicking to the name of the station, more detailed information box with the station address will appear.

FINLAND (local time: 30.07.2001 04.06)									
Station	Observation time	Temperature °C	Humidity %	Dew point °C	Precipitation	Wind max m/s	Wind direction	Road temperature °C	Road condition
Auranlaakso	30.07 03.46	18,4	94	17,5	no	4	→	-	dry
Hapua	30.07 03.15	17,0	89	15,3	no	5	↑	18,5	dry
Hämeenlinna_F	30.07 03.41	16,8	95	16,0	no	3	↑	17,4	dry
Inkoo	30.07 03.16	19,6	93	18,4	no	3	↑	20,4	dry
Kähkönen	30.07 03.10	19,7	74	14,9	no	7	↑	19,4	dry
Lahti_F	30.07 03.41	16,6	91	15,1	no	3	↙	-	dry
Lappeenranta_F	30.07 03.36	16,0	96	15,4	no	1	↗	18,7	dry
Mikkeli_R_F	30.07 03.41	17,0	84	14,4	no	4	↑	18,9	dry
Myllylampi	30.07 02.44	16,8	94	15,9	no	1	↗	-	dry
Pirkkola_R	30.07 02.44	20,1	79	16,3	no	5	↑	21,3	dry
Porvoo	30.07 02.34	19,3	84	16,6	no	3	→	21,2	dry
Riihimäki	30.07 03.37	16,2	88	14,1	no	3	↑	18,6	dry
Tupuri	30.07 03.44	18,2	98	17,8	no	3	↙	19,4	dry
Utti_F	30.07 03.44	13,3	95	12,6	no	0	-	17,9	dry
Virojoki_F	30.07 03.47	19,2	78	15,3	no	0	↓	20,7	dry

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Figure 5 table of balticroads.net

### Next Steps

The possibilities to expand the Internet service are endless. It is possible to access the service through an Internet connection on border stations and gas stations, as well as to transfer the data via local radio operators and text-TV providers. The vision is also to extend the Internet service to cover the road weather data of the neighbouring countries in the Baltic Sea Region, such as Sweden, Poland, and St. Petersburg area in Russia.

### Conclusion

It is common, particularly in wintertime, to seek weather and road information beforehand the road trip can start. Usually the location of such information for home country is well known but if the trip continues to the neighbour countries the information seek is usually more complicated and may not lead always to the target.

This project strive to eliminate at least one artificial border between countries through giving to the road users actual weather and road condition data in their own language even if the trip continues across the national border.

The Balticroads.net project is a good example, how several countries can implement with simple instruments collective targets and ideas.