Harmonising European ITS Services

Traveller Information Services
WEATHER INFORMATION

Deployment Guideline

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The Deployment Guidelines have been developed in EasyWay, EIP and EIP+
Co-financed by the European Union
Trans-European Transport Network (TEN-T)

Support

Further information	dg.its-platform.eu	**Questions/help**	dg.its-platform.eu/user-support

Preface (2016)

After the EasyWay project ended in 2012, the Deployment Guidelines have been updated by the EIP / EIP+ projects. They focussed on updating Best Practice and did neither have the capacity nor the intention for a full revision of the text, since especially the Member State adoption of the guidelines' requirements form a huge asset of European harmonisation. In the light of recent European Delegated Regulations, the EU EIP platform will now consider a full revision of the format and the content of the whole set of Deployment Guidelines.

Preamble (2012)

EasyWay is a cooperation of road authorities and road operators from 27 European countries that have teamed up to unlock the benefits of cooperation and harmonisation in the deployment of Intelligent Transport Systems (ITS) on Europe's major road network. ITS as a technology is a known contributor to sustainable mobility in terms of improved safety, efficiency and reduced environmental impact. Nevertheless, fragmented deployment on a national level will fail to deliver seamless European services and will not contribute to a coherent European Transport network. The European Member States have consequently launched the EasyWay project together with the European Commission as a platform to harmonise their ITS deployments.

This document has been drafted by EasyWay as part of the set of documents containing the 2012 version of the EasyWay Deployment Guidelines (DG 2012). These guidelines have been developed by EasyWay experts and practitioners. They have undergone a thorough review by international domain experts in an intense peer review exercise and they have been validated by the participating Member State Partners of EasyWay in an extensive formal Member State consultation process, which finally led to their adoption as basis for all deployment activities in future EasyWay phases.

EasyWay as a project is not a standardisation body, nor does it have any power to legally constrain the Member State in their national deployment activities. It is therefore crucial to understand that these documents are neither technical standards, nor are they specifications as they would be required for such cases, e.g. as currently developed by the European Commission as their part of the implementation of the ITS Directive 2010/40/EU. But since a certain level of strictness in compliance is required to achieve the intended goal of the EasyWay Deployment Guidelines – harmonisation and interoperability in Europe – the guideline documents are written in a way that clearly defines criteria that deployments have to fulfil in order to claim overall compliance with the guideline.

Although not legally binding in any sense, compliance may be required for the eligibility of deployments in future ITS road projects co-funded by the European Commission. Deviation from compliance requirements may nevertheless be unavoidable in some cases and well justified. It is therefore expected that compliance statements may contain an explanation that justifies deviation in such cases. This is known as the "comply or explain" principle.

Although not standards themselves, the EasyWay DG2012 Deployment Guidelines in some cases do mention – and sometimes require – the use of such standards. This is the case in particular regarding the use of the CEN/TS 16157 series of technical specifications for data exchange ("DATEX II"). Although standardised data exchange interfaces are a powerful tool towards harmonised services in Europe, it must be understood that real world deployments have to fit into existing – and sometimes extensive – infrastructures and investment in these infrastructures must be protected. It is therefore important to note that the use of DATEX II mentioned below as a MUST is referred to implementation of "new" data exchange systems and not the utilisation of the existing ones, unless these latter affect harmonisation of deployments or interoperability of services.

Service at a glance

SERVICE DEFINITION

The provision of Weather Information Services cover in most cases the following dynamic information:

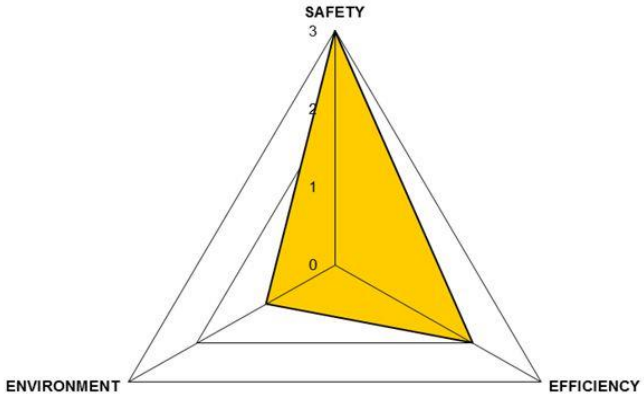
- common weather information/data such as temperature or wind direction/wind speed for regional areas, road traffic related weather messages
- special forecast Information leading to weather warnings about fog, ice and heavy rain
- infrastructure specific information on weather sensitive parts of the network such as a bridge (which can be closed due to special wind conditions). This information assumes particular significance (i.e. negative influence on road safety) particularly in areas which experience extreme climatic conditions, for example, the Baltic area or the alpine countries.

SERVICE OBJECTIVE

The main objective of providing weather information to the driver is improving the traffic safety and the efficiency of the European road transportation system.

If the driver is informed on the upcoming weather situation he is able to adapt his driving behaviour. Weather information can be factored into both pre- and on-trip journey planning. This may avoid congestion and the number of fatalities and accidents.

SERVICE BENEFIT RADAR



EUROPEAN DIMENSION

Each local, regional and national implementation of a Weather information service contributes directly to the vision of a European-wide consistent weather information and weather warning for the road user. On a purely technical basis, one can state that every new deployment adds to these objectives. However, from a service provider and end-user viewpoint there are additional requirements. End-users will only accept (and pay for) weather information services that cover larger areas with appropriate prediction horizons. In order to enable international services (e.g. covering multiple countries) both the technical and organizational aspects of providing Traveller Information services need to be harmonized cost and effort implications.

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List of abbreviations

ANPR	Automatic Number Plate Recognition
2DECIDE	EC supported project with the objective to develop an “ITS Toolkit” to assist transport authorities in the deployment of ITS
ARTIST	Italian national system architecture
B2B	Business to Business
B2C	Business to Consumer
CCTV	Closed Circuit Television
CEDR	Conference of European Directors of Roads (http://www.cedr.fr/home/)

CEN	European Committee for Standardisation - Comitée Européen de Normalisation. (http://www.cen.eu/)
CO2	Carbon dioxide
Co-modal	The efficient use of different modes and means of transport on their own (multi-modal) and in combination (inter-modal) that will result in optimal and sustainable utilisation of resources, high level of mobility and environmental protection. Concept introduced by the EC.
COOPERS	Co-operative systems for intelligent Road Safety (http://www.coopers-ip.eu/)
DAB	Digital Audio Broadcasting
DATEX	Standard developed for information exchange between traffic management centres, traffic information centres and service providers (www.datex2.eu/)
DG	Deployment Guideline
DG INFSO	Directorate-General for Information Society and Media (http://ec.europa.eu/dgs/information_society/index_en.htm)
DMB	Digital Multimedia Broadcasting
DSRC	Dedicated Short Range Communications
DVB-x	Digital Video Broadcasting for mobile reception
EC	European Commission (http://ec.europa.eu/index_en.htm)
EEG	(EasyWay) Evaluation Expert Group
eFRAME	Extended project of the forerunner project FRAME
ESG	Expert Study Group
EU	European Union (http://ec.europa.eu/index_en.htm)
FM	Frequency Modulation (FM broadcast band)
FRAME	Framework Architecture Made for Europe (supported project by EC DG INFSO)
Geo-information	geographic information - created by manipulating geographic (or spatial) data in a computerised system.
Geo-referencing	establishing something's location in terms of map projections or coordinate systems
GPRS	General Packet Radio Service
GPS	Global Positioning Systems
GSM	Global System for Mobile communications
HGV	Heavy Goods Vehicle
ICT	Information and Communication Technology
Inter-modal	A transport system that allows at least two different modes, and/or means of transport, to be used in an integrated manner (in combination) in a door-to-door transport chain. This necessarily involves transferring from one mode (or means) of transport to another. This usually takes place at modal interchanges. The development of a seamless web of integrated transport chains linking road, rail and waterways (and/or also linking different means of transport) leads to improved flexibility, quality, and cost effectiveness.
In-Time Project	Intelligent and Efficient Travel Management for European Cities - ICT Policy Support Programme EC funded project
IR-detectors	Infra-Red detectors

ISO	International Organization for Standardization (http://www.iso.org/)
ITS	Intelligent Transport Systems
LoQ	Level of Quality
LoS	Level of Service
MMS	Multimedia Messaging Service
MOBINET	Mobilität in Ballungsräumen - Mobility in Conurbations - German research project in the area of Munich. (http://www.mobinet.de/)
Multi-modal	A transport system that offers at least two different modes and/or means of transport to be used in a parallel manner in a door-to-door transport. The policy principle is not to stick to one single mode/means of transport information but also offering alternative means of travel.
OEM	Original Equipment Manufacturer
PDA	Personal Digital Assistant
Peri-urban	Immediately adjoining an urban area; between the suburbs and the countryside
POI	Points Of Interest
PT	Public Transport
QUANTIS	Quality Assessment and Assurance Methodology for Traffic Data and Information Services - supported project by EC DG TREN.
R&D	Research and Development
RDS-TMC	Radio Data System Traffic Message Channel
RWIS	Road Weather Information System
SIRI	Service Interface for Real Time Information
SMS	Short Message Service
TEAM	Czech Republic ITS National Architecture Project (www.czech-team.eu)
TEN-T	Trans European Network for Transportation
TERN	Trans European Road Network
TIC	Traffic Information Centre
TISA	Traveller Information Services Association (http://www.tisa.org/)
TIS	Traffic Information Service
TM	Traffic Management
TMC	Traffic Message Channel
TPEG	Transport Protocol Experts Group
UITP	International organisation for public transport authorities and operators, policy decision-makers, scientific institutes and the public transport supply and service industry. (http://www.uitp.org/)
UMTS	Universal Mobile Telecommunications System
VMS	Variable Message Sign
WWW	World Wide Web
XML	eXtensible Markup Language
FR<#>	Functional requirement <number>

OR<#>	Organisational requirement <number>
TR<#>	Technical requirement <number>
CL&FR<#>	Look and feel requirement <number>
LoSR<#>	Level of service requirement <number>

1 Introduction

1.1 The concept of the EasyWay Deployment Guidelines

1.1.1 Preliminary note

This document is one of a set of documents for the EasyWay project, a project for Europe-wide ITS deployment on main TERN corridors undertaken by national road authorities and operators with associated partners including the automotive industry, telecom operators and public transport stakeholders. It sets clear targets, identifies the set of necessary European ITS services to deploy (Traveller Information, Traffic Management and Freight and Logistic Services) and is an efficient platform that allows the European mobility stakeholders to achieve a coordinated and combined deployment of these pan-European services.

EasyWay started in 2007 and has since established a huge body of knowledge and a consensus for the harmonised deployment of these ITS services. This knowledge has been captured in documents providing guidance on service deployment - the EasyWay Deployment Guidelines.

The first iteration of the Deployment Guidelines mainly captured best practice. This strongly supported service deployment within EasyWay by:

- making EasyWay partners in deployment aware of experiences made in other European deployment programmes.
- helping to avoid making errors others had already made
- reducing risk and facilitating efficient deployment by highlighting important and critical issues to consider

Meanwhile, this best practice has already successfully contributed to ITS deployments across Europe. It is now possible to take the logical next step and actually start recommending those elements of service deployment that have proven their contribution to both the success of the local deployment, as well as the European added value of harmonised deployment for seamless and interoperable services.

1.1.2 Applying Deployment Guidelines – the “comply or explain” principle

The step from descriptive best practice towards clear recommendations is reflected in the document structure used for this generation of the Deployment Guidelines. Apart from introduction and the annexes that cover specific additional material, the Deployment Guidelines consist of two main sections:

Part A – this part covers the recommendations and requirements that are proven to contribute to successful deployment and have been agreed by the EasyWay partners as elements that should be part of all deployments of this particular service within the scope of EasyWay. Thus, the content of this section is prescriptive by nature. EasyWay partners are expected to ensure that their deployments are compliant with the specifications in this section. Wherever concrete circumstances in a project do not allow these recommendations to be followed fully, EasyWay partners are expected to provide a substantial explanation for the need for this deviation. This concept is known as the “comply or explain” principle.

Part B – this part offers an opportunity to provide more valuable but less prescriptive information. Supplementary information may be contained including – but not limited to – regional/national examples of deployment and business model aspects like stakeholder involvement or cost/benefit analysis results.

1.1.3 Use of Language in Part A

It is essential for every prescriptive document to provide specifications in a well-defined and unambiguous language. There are various definitions that clarify the use of particular words (such as those listed below) within their prescriptive texts.

For the purpose of the EasyWay Deployment Guidelines, the well-established provisions of the RFC 2119 (http://www.ietf.org/rfc/rfc2119.txt, see (1)) are used, which is used to specify the basic Internet standards:

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119.

An overview of the keywords, their meaning and the possible answers in the context of part A provides the following table. In general the keywords in brackets are possible, but their use is not recommended in order to avoid confusion which may arise as a consequence of different common linguistic usage of the terms in the different EU member states.

Requirement wording	Meaning in RFC 2119	Meaning in EasyWay	Possible checklist answers
MUST (REQUIRED, SHALL)	the definition is an absolute requirement	there may exist insurmountable reasons to not fulfill (e.g. legal regulations…)	**fulfilled: yes** **or** **Fulfilled: no - explanation of insurmountable reasons**
MUST NOT (SHALL NOT)	the definition is an absolute prohibition		
SHOULD (RECOMMENDED)	there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.	The Definition is very close to a "MUST", "MUST NOT" Meaning in EasyWay conform to RFC 2119	**fulfilled: yes** **or** **Fulfilled: no - with explanation**
SHOULD NOT (NOT RECOMMENDED)	there may exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label		
MAY (OPTIONAL)	The item is truly optional. One deployment may choose to include the item because of particular local circumstances or because it is felt to deliver a special added value	Meaning in EasyWay conform to RFC 2119	**fulfilled: yes - with explanation** **or** **Fulfilled: no**

Table 1: Part A - requirement wording

Note: the capitalisation of these keywords that is frequently used in IT standards is not recommended for EasyWay Deployment Guidelines.

The use of this 'requirements language' allows the direct transfer of the requirements stated in part A to a compliance checklist.

The following paragraph gives an example for a functional requirement:

Functional requirement:

- **FR2:** Data and information collected by both automatically and non-technical sources must be based upon both a consistent geographic reference model and a time validity model, which both **must** be part of data description.

Beneath "Requirement" a new semantic element "Advice" is proposed for part A, which has not the character of a hard requirement but of a "recommendation" and hence must not be listed in the compliance checklist. "Advice" is not immediately related to the three pillars of ITS-service harmonization (Interoperability, Common look & feel, Quality criteria) but to "inner features" of an ITS-service. Nevertheless such an element delivers a European added value and hence should be addressed by the deployment guidelines.

The notation for using the advice element in the text is as follows:

Organisational advice:

- Clear definitions of organisational aspects are a crucial precondition for the successful implementation of a "Forecast and real-time event information service" and should be documented and accepted of all involved parties/partners in form of a Common partner arrangement/MoU - Memorandum of understanding, which establishes the details of co-operation.

1.2 ITS-Service Profile

1.2.1 ITS-Service Strategy

1.2.1.1 General Service Description

Information should be provided to users to notify them if awkward weather- or road conditions are expected on the road ahead or any part of a route. Depending on type of vehicle (public transport, car, HGV, motorbike) and goods carried.

The provision of dynamic information about weather covers both weather information and weather warnings.

While weather information data covers e.g. conditions of road surface, visibility conditions and also infrastructure specific information on parts of the network such as bridges; which can be closed due to high wind conditions is dealt within the weather domain.

Both aspects (expert systems + end user services) are covered in this EasyWay deployment guideline, while the focus is clearly directed to end user services only (expert systems are mentioned but not dealt with in detail e.g. in the area of common look & feel).

1.2.1.2 What is the Vision?

The intention of the service is to make different user groups (e.g. road users, travellers) react and adapt their driving behaviour to the weather conditions they are going to meet, by informing them about the current and the expected development of weather conditions.

The vision is that a user provided with high quality information will react and adapt his travelling and driving behaviour includes a change of routes, modes or trip schedule (time of departure) as well as changes in the way of driving.

1.2.1.3 What is the Mission?

The mission of providing weather information to the users is to improve the traffic safety and the efficiency of the European transportation system.

The following example aims to highlight the need for information on weather conditions (incl. prediction) and the possible benefit which the related service could bring to the European travellers.

Snow flurries and slippery road surfaces caused the following scenario on a Bavarian motorway in February 2009: After a series of accidents caused by the poor weather hundreds of travellers caught up in the subsequent 30 or more km of congestion were forced to sleep rough in their cars for one night.

Figure 1: Exemplary road closure after heavy snow (Source: BBC)

Such dangerous scenarios could be avoided or mitigated in the future European transportation network through the provision of real-time and predictive weather information and decisions and actions taken on the basis of predicted weather information. A wide set of possible actions, some examples of which are listed below, are available to road operators using a combination of the provision of weather related information in conjunction with previously developed traffic/incident management plans:

- Modification of traffic flows using variable speed limits

- Closure of affected section and redirection of traffic flow to parking facilities or advice on alternative routes in case of adverse weather conditions where e.g. the prognosis does not show any sign of immediate improvement
- Information of travellers via Variable Message Signs
- Optimisation of winter services (e.g. shorter time to react, decrease of negative impact of chemicals on the environment...)
- The provision and execution of efficient winter maintenance service e.g. resource management

In addition the following core support to European travellers (herewith "end user service") and road operators ("herewith expert systems") can be gained through the establishment and operation of a weather information service which facilitates:

- Ease of travel
- alteration of travel departure times
- More effective routing decisions
- Temporary HGV storage
- Altering decision of travel or using inter-modal way of transportation
- Warning on dangerous situations to allow traveller to better prepared to meet possible adverse conditions ahead
- Decreased air pollution
- Reduced congestions
- Decreased number of accidents
- Reduced Road salting
- Reduced impact on groundwater reserves
- Optimised winter maintenance services; and optimised handling of construction sites

1.2.1.4 EasyWay harmonization focus

- Establishment of pan-European understanding on the functionality and the benefit of a (European-wide) weather information service
- Uniformity in the appearance of the weather related signing (common look & feel for the road user)
- European usage of DATEX II to exchange weather related information

1.2.1.5 Distinctiveness from other ITS-services

A distinction among the ITS services in the TIS domain is given in EasyWay "Traveller Information Services, REFERENCE DOCUMENT, TIS Deployment Guideline Annex, VERSION 02-00-00, chapter 2ff".

Weather information should be seen as prominent part/input to different other services (traffic information as well as traffic management). E.g. weather information can be seen as one layer of information for Co-modal traveller information services (TIS-DG07) or as one input parameter to traffic management plans (TMS-DG07). However weather data and information is primarily defined in the Deployment Guideline as these are secondary levels, requirements and advice (e.g. technical, organisational or common look and feel).

1.2.2 Contribution to EasyWay Objectives

1.2.2.1 Service radar

A general overarching description of Contribution of TIS-services to EasyWay Objectives is outlined in the "Traveller Information Services, REFERENCE DOCUMENT, TIS Deployment Guideline Annex, VERSION 02-00-00, Chapter 2.2 Contribution to EasyWay Objectives"

The graph below provides a quantification of the added value of "Weather Information" services regarding the three main objectives of EasyWay which are: safety, efficiency and environment. The applied scales for the service radars are based on an expert view and not on specific scientific analysis.

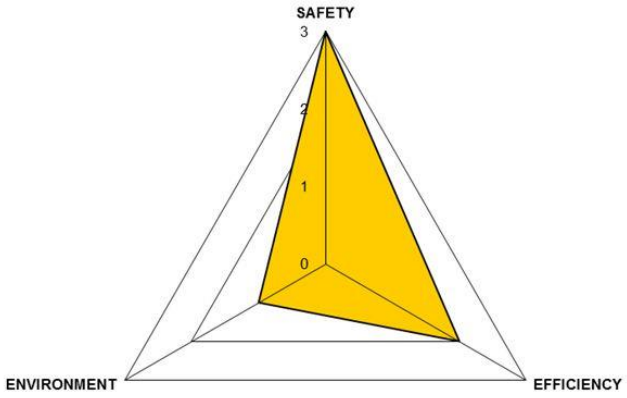

Figure 2: Service-Radar - Weather information service (Source: EasyWay TIS Study and Expert Group)

1.2.2.2 Safety

The provision of weather related information to the different user groups (e.g. travellers, dispatchers and operators) significantly contributes to increased road safety as the drivers can be warned in advance of an awkward weather situation.

1.2.2.3 Environmental impact

At the moment no quantitative figures can be given for the relation of weather information services and it's positive contribution to road traffics' impact on the environment. However within EasyWay the expert are fully convinced on this relation.

1.2.2.4 Network efficiency

Weather monitoring in itself does not provide any monetised benefits unless it is combined with information services such as weather centres and information systems. Major benefits by establishing a weather information service include:

- Improving motorists' travel time and safety
- Reducing operators' costs by supporting the dispatching activities for snow ploughs and de-icers (saving costs for fuel, labour as well as salt; reducing annual vehicle costs)

1.2.3 Current status of deployment

A big paradigm shift is also currently underway (not only for weather info services but for TIS in general): the main shift is from PULL services where the user needs to be proactive by to seeking out information towards PUSH services where users are actively informed by providers (about e.g. relevant weather warnings).

Beside adoptions in the area of Look & Feel also on the level of content a harmonisation is expected. As well as introducing improvements on existing elements the need will also arise for new requirements which will be reflected in further development of both internal expert systems as well as external public user services. Ongoing adoptions and improvements on one or both services will directly influence changes in other aspects of service provision.

In EasyWay Phase II (2010-2012), based on the 2010 version of the DG, the following EasyWay countries are performing the following activities in respect of weather information services (based on new developments or improvement of existing services/ data basis) :

- Austria:
  - Extension of weather information generated by SWIS (see chapter 3.1.1) to improve web based distribution
- UK:
  - Delivery of single service for the collection, storage, and dissemination of the weather information required by the Highways Agency and its stakeholders
- Portugal:
  - Installation of more meteorological stations
  - Development of a proof of concept of the integration between Traffic Portal Services with Weather Institute and with the several weather stations in the roads
- Belgium:
  - Improvement of weather forecast for the main weather stations and of follow-up of winter maintenance operations.
- France:
  - SAPN: Development of weather forecasting and information tool
- Italy:
  - Installation of VMSs in order to provide detailed information
  - Integration of the interface in the supervision system of all weather stations for information system
  - Isoradio: Italian traffic and weather radio information service, operated in collaboration with the national broadcaster (RAI)
  - Project FM in tunnel: Italian FM Broadcaster traffic and weather radio bulletin extended to motorway tunnels
- Czech Republic:
  - traffic control and information system implementation on motorway D5 to manage traffic flow and inform drivers via VMS about actual conditions (traffic flow situation, weather conditions)
- Germany:
  - Road Traffic Portal Strassen-sh.de, weather information, wind warning information and other information
  - Definition and specification of new TPEG applications: weather and other information
  - Wind warning systems in Schleswig-Holstein
- Sweden:

  - Upgrading of National Internet Portal (Läget på vägarna) and Regional Internet Portal (trafiken.nu). Free of charge, general road and multimodal traveller information to all including road weather information.
  - Enhancing information provision to external service providers
- Finland: The Finnish Transport Agency is implementing a development programme for road weather information. The key actions are:
  - evaluation of the accuracy and effects of weather information
  - improving the argumentation in weather warnings
  - choosing a designated “road weather person” for Finnish Transport Agency and using his/her person in the communication to clients
  - using social media
  - using “safety vehicles” for traffic calming in extreme weather conditions
  - weather information for pedestrians and cyclists.
- Ireland:
  - Enhancements of NRA traffic, weather and other information

An overview of different existing implementations regarded weather information service throughout Europe can be found in Part B - chapter 3.1.

1.2.4 European Dimension

Each local, regional and national implementation of a Weather information service contributes directly to the vision of a European-wide consistent weather information and weather warning for the road user. On a purely technical basis, one can state that every new deployment adds to these objectives. However, from a service provider and end-user viewpoint there are additional requirements. End-users will only accept (and pay for) weather information services that cover larger areas with appropriate prediction horizons. In order to enable international services (e.g. covering multiple countries) both the technical and organizational aspects of providing Traveller Information services need to be harmonized (cost and effort implications)..

2 Part A: Harmonization Requirements

2.1 Service Definition

A Weather information Service means the provision of the following dynamic information:

- common weather information/data such as temperature or wind direction/wind speed for regional areas, road traffic related weather messages
- special forecast Information leading to weather warnings about fog, ice and heavy rain
- infrastructure specific information on weather sensitive parts of the network such as bridge (which can be closed due to special wind conditions). This information assumes particular significance in areas (negative influence on road safety) which experience extreme climatic conditions, for example, the Baltic area or the alpine countries.

2.2 Functional Requirements

2.2.1 Functional architecture

The functional architecture defined in this Deployment Guideline does cover both weather information and weather warnings. The functional requirements for weather information services listed in this DG were elaborated as follows:

- General requirements have been derived and adapted from the European ITS Architecture[1]
- Complementary requirements have been collected from the FP7 project "In-Time".
- Additional requirements as defined by EasyWay Expert and Study Group

2.2.2 General requirements from European ITS Architecture

Based on the FRAME/ e-FRAME project and the European ITS Architecture the following general user needs were derived (and adapted/ extended to specifically cover aspects of weather information services and its special needs):

Functional requirements:

- **FR1:** The system **should** support road maintenance and infrastructure management (expert service) and **should** be able to collect process and disseminate weather information for travellers (end user service).
- **FR2**: The system **should** provide information in the native language(s) at the output location, and from a user selected choice of other appropriate foreign languages, when applicable.
- **FR3:** A written system **should** provide information using graphical representation or text. Graphical form **should** include the use of maps as well as text

Functional advice:

- Beside the provision of weather information (c.p. FR1) other services could benefit from weather information. This provision is not directly the scope of a weather information service and therefore the following list is to be seen as functional advice (not a requirement). However a clear definition of interfaces is needed at a later stage in the development of any further specification:
- The provision of the system may also assist other services in the planning of (inter-modal) routes/ finding of alternative routes and assist in any decision by the user to switch mode (weather information as e.g. input parameter for co-modal services)

[1]A general overview of the FRAME project and related findings can be found in the "Traveller Information Services REFERENCE DOCUMENT, TIS Deployment Guideline Annex, VERSION 02-00-00"

- The system may be able to recommend short term road maintenance activities, including winter maintenance, based on data collected from the road infrastructure possibly combined with the current and/or forecast weather conditions2.
- The system may support time predictions for a particular trip (weather information as inputs parameter for a travel time estimation given to users by info services.
- The system should have a minimum impact on the driving task (distraction).
- The system must not do anything to reduce the safety of either the travellers in the vehicle (e.g. distracting the driver by overloading him/her with too much simultaneous information), or the staff using to operational equipment, e.g. in toll booths.
- The service should provide a high level description of the message sets and data to be exchanged in data transfers (see DATEX II profile, chapter 2.4.2.1).

2.2.3 Functional decomposition[3] and interfaces

Functional requirements:

- **FR4:** Functional decomposition and the provision of interfaces **may** be carried out to ensure interoperability in those cases that the service is carried out by more than one organisation (and is recommended in any case to be prepared for an easy functional decomposition as may be the case in the future):

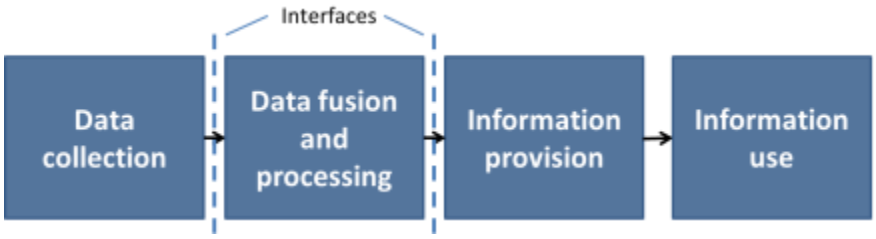

Figure 2: Functional Architecture (Source: EasyWay TIS Expert Group)

Requirements developed in the FP7 project In-Time [4]

- **FR5:** Data exchange between the content provider, service operators and service provider **may** follow the common agreed interface (CAI) specifications[5], developed under the FP7 co-financed In-Time project.

For further information see also chapter 2.4.2.2.

2.2.4 Additional requirements

Functional requirement:

- **FR6:** The following information **may** be provided for weather information and weather warnings:

---

[2] So there is no ambiguity in the decision making process a balance needs to be struck between what the system can recommend in terms of short term road maintenance activities and the contractual responsibilities of the Maintenance Providers.

[3] The ITS service is "distributed" over more than one administration (cross-border, cross-regional) for operation, i.e. different road operators and other parties are involved, providing "logical sub-functions". Between the distributed functions interoperability must be guaranteed by properly specified interfaces.

[4] http://www.in-time-project.eu

[5] http://www.in-time-project.eu/download/publicdeliverables/d_3_2_1_specification_document_intime_server_interfaces_and_protocols_v10.pdf (chapter 4.18 - In-Time Service 15)

	end user service	expert service
air temperature	X	X
relative humidity		X
dew point		X
road surface temperature	X	X
precipitation intensity and type	X	X
Weather related traffic messages (acc. ALERT-C or TPEG-TEC)	X	
wind speed and direction	X	X
cloudy degree		X
visibility	X	X
road condition[6]	X	X
road surface friction		X
water film thickness		X
Snow depth		X
Freezing temperature		X
Dew point difference		X
Ice percentage		X

Table 2: Weather information/ Weather warnings to be provided for end user services vs. expert services[7]

- **FR7**: The weather information services **may** be able to provide weather information and warnings pre-trip (e.g. web-based ...) as well as on-trip (e.g. road-side equipment like VMS or mobile internet/ APPs ...) to be integrated into the traffic predicting programs.

Functional advice:

- The weather information services **may** be delivered in the following ways in any combination:
  - as an information service for non-recurring requests
  - as a subscription service for periodical requests with the same request parameters for a specific route or area and a defined time period;
  - as a monitoring service to monitor a specific area or a requested route during a trip. In case of a monitoring service only relevant weather warnings (alerts) shall be provided to the user.
- The weather information services should be supported by multimedia presentation (e.g. by provision of webcams) so the traveller can easily estimate the approaching weather situation during his journey.
  - The weather information services should use historic and current climate data to develop road and weather information (e.g. nowcasts and forecasts).
  - The system should be connected with other national weather services

[6] The relevant definition of the condition of a road as "slippery" is still very difficult to measure. For example, in Germany, it is measured by the ratio of road surface temperature to the freezing temperature of the water-de-icing mixture or the BASt smoothness model (Federal Highway Research Institute)

[7] A reference to the weather related ALERT-C event code list can be found in Annex B of this document

2.3 Organisational Requirements

The following figure gives an overview of the organizational characteristics of weather information services (and in general any Traveller Information Service). Any related weather service can be characterized with the criteria shown.

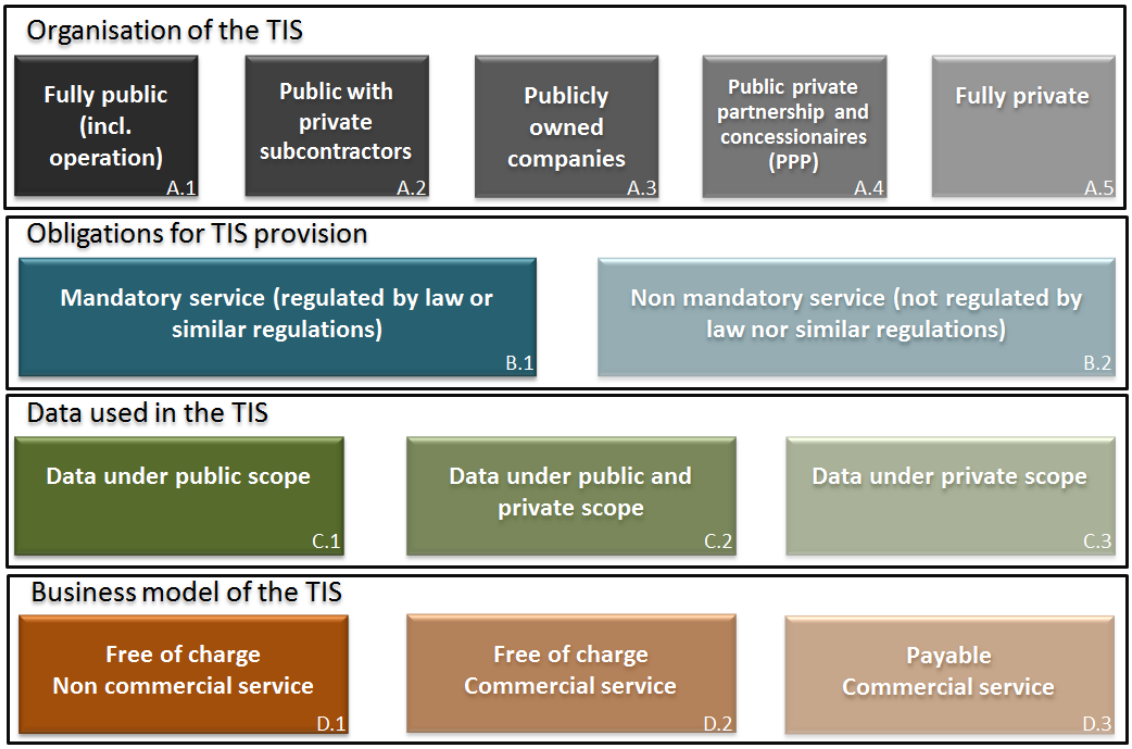

Figure 3: Organisational characteristics of weather traveller information services (Source: EasyWay TIS Expert Group)

Organisation of the TIS

These 5 categories represent define the different models of responsibility for a weather-service. For instance A.2 stands for a service which is operated privately but this is only half the truth, as the private service provider acts according to the contract he has with the public organisation.

Obligations for TIS provision

Public administrations act according to the assigned scope of their activities which is normally regulated by law or similar regulations. In the field of weather information service provision ,it has therefore to be distinguished between mandatory services and non-mandatory (voluntary) ones.

If a guarantee is needed that a service is provided in a single country, a regulation must be issued. The authors are not aware of such examples of this type of weather information service in the current frame of EasyWay.

Data used in the TIS

Services which aim to provide weather information consist of various different data sources. One can distinguish between data models e.g. under public scope (C.1) which might be operated by private companies but on behalf of public, and data under private scope (C.3), for instance travel profiles from telecommunication companies or both, data under public and private scope (C.2).

Business model of the TIS

Weather data can be provided by common weather services or by transport and infrastructure operators (or their service operators) derived from e.g. a road weather information system (RWIS) that is used for traffic control issues

The individual services summarized within Part B of this document include a classification in accordance to the classification.

Organisational advice:

- The recommended organizational characteristics for minimum LoS[8] in the area of safety critical Operating Environments (C1, T2, T4, R2, R4, R6, R8), is as follows:
  - Organisation of the TIS: **A.1, A.2, A.3 or A.4**
  - Obligations for TIS provision: **B.1**
  - Data used in the TIS: **C.1** or **C.2**
  - Business model of the TIS: **D.1**

2.4 Technical Requirements

2.4.1 ICT Infrastructure requirements

The ICT infrastructure is defined along the value chain for a weather information service.

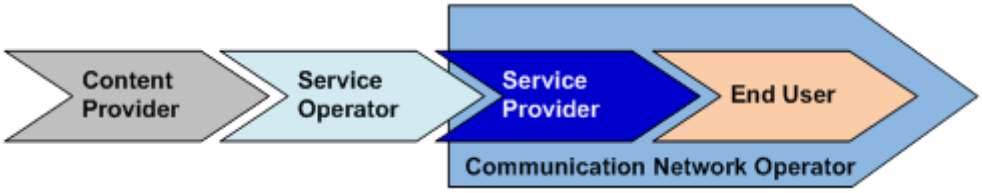

Figure 4: Value chain for traffic information services (Source: ESG1 - EasyWay Expert Group 1)

Content provider/ Data collection

Different scenarios are possible for gathering the necessary information for the provision of weather information:

- Set-up of a road weather monitoring network of fixed road weather monitoring stations possibly complemented with mobile road condition monitoring vehicles and units
- Information gathering via agreements with other partners/ institutions/ authorities. In these cases the information procured might also be enhanced by local weather monitoring stations[9].
- CCTV cameras with associated algorithm to extract the weather information from the delivered stream.
- Information gathering via crowdsourcing / FCD initiatives may enhance the available information on weather conditions.

Regardless of the scenario above the following data fusion and processing, and information broadcasting requirements should be met in order to provide weather information services.

The European standard EN 15518:2011 Winter Maintenance Equipment – Road Weather Information Systems should be considered particularly in relation to the collection of road weather station data.

Content provider/ Data fusion and processing

The incoming weather data needs to be matched with the road network and statements need to be derived from the local weather situation (current as well as short and long term prediction). In most cases, this is not the core skill of road operators, but covered by external providers. Therefore forecast providers may be external to the system but provide a fundamental element.

[8] In chapter 2.6.2 the optimum and minimum Level of Service for EasyWay operating environments are defined.

[9] If information is gathered with other partners there needs to be consideration of what will be the mechanism used, if this is DATEX, it will require extension. Aspects such as quality and availability will be key factors in those agreements if the information is to be used for operational decision making.

Moreover, the weather data needs to be especially matched and fused with data concerning winter maintenance actions already carried out (preventive salting etc.) and planned for in the near future in order to predict the development of the road weather situation.

Service provider/ Information broadcasting

In practise a number of standardised information channels may be used for the provision of weather related information such as:

- Road sign guidance system (e.g. VMS)
- Traveller information radio (e.g. FM/Digital/Internet radio, RDS-TMC, TPEG)
- TV services (road weather cameras or CCTV)
- Websites
- Mobile devices (mobile phones, PDAs)
- On-board computers (normally used for communication between driver and carrier)
- Navigation systems
- Smartphone APPs

It is necessary to use one, or a combination, of these channels to provide information in a way which meets the general requirements for Levels of Service and Levels of Quality outlined in section 2.6 of this document.

Data from road weather stations:

Based on LoS envisaged in a local/ regional and national implementation the different requirements towards ICT infrastructure is given in this chapter. Data from road weather stations are an important input for the information service added value chain. However it is not suitable to provide this data directly to the end user. According to the experience so far,

Technical advice:

- It is recommended to acquire the following data types from the road site stations10

Short form	description of data type	unit	already covered in DATEX II data model 2.0
Road surface condition			
STF	(Road) Surface Temperature	°C / °F	ok
SST	Sub-Surface Temperature	°C / °F	not present
SFC	Surface Condition (dry, damp, wet, ice, blackice, snow, slush, hoarfrost) (acc. to prEN15518)	enum.	ok
WFD	Waterfilm Depth (amount of coverage on pavement water equivalent)	mm / µm	ok
FT	Freeze Temperature (freeze point of liquid water/de-icing chemical solution on surface of pavement)	°C / °F	ok
SC	Salt concentration (concentration of deiceing chemicals in liquid solution saturation or amount)	% or g/m2	ok

[10] At the moment not all data types are covered in DATEX II data model, therefore a further extension of DATEX II is recommended

Alternative surface condition parameters (non-invasive)			
ILC	Ice layer thickness or Ice percentage	mm/ %	not present
SLT	Snow layer thickness	mm	ok
FC	friction (estimated tire friction between pavement surface due to surface conditions)	-	not present
Atmospheric Weather situation on site			
AT	Air Temperature	°C / °F	ok
RH	Relative Humidity	%	ok
IOP	Intensity of Precipitation (water equivalent)	mm/h	ok
TOP	Type of Precipitation (none, rain, snow, hail, drizzle, etc.) (subset acc. to WMO Table)	enum.	ok
WS	Wind Speed (velocity of wind) measured vectorial 10 min or gust	m/s or km/h	ok
WD	Wind Direction	°	ok
VIS	visibility	m	ok
AP	Air pressure	hPa	not present
GR	Global Radiation	W/m2	not present

Table 3: Data types to be acquired from the road site stations

Technical requirement:

- **TR1:** The European standard EN 15518:2011 Winter Maintenance Equipment – Road Weather Information Systems as well as the German technical bulletin "Technische Lieferbedingungen für Streckenstationen" (TLS, draft version 2010) as well as the "Hinweise zur Erfassung und Nutzung von Umfelddaten in Streckenstationen" (FGSV 306, 2010) **may** be considered particularly in relation to the collection of road weather station data.

2.4.2 Standards and Agreements: Existing and Required

2.4.2.1 DATEX II profile for weather information

EasyWay provides DATEX II profiles to support core service deployment in the domains of Traffic Management, Traffic Information and Freight & Logistics services. These profiles describe a subset of the DATEX II data model, tailored to the needs of the particular core service. If these deployments have a special requirement to support particular downstream standards used in subsequent stages of the service delivery chain, it may become important to tailor these profiles further and to use only the cross-section between the TIS/TMS/FLS-DGnn profile and a DATEX profile tailored for interoperability to the particular downstream standard.

As an example, a TIS profile may allow for multiple location referencing methods, but if dissemination of the information via RDS-TMC is envisaged by a particular deployment, compliance with the ALERT-C standard is essential since this standard only supports the use of ISO 14819-3 location codes. Hence, it might be preferable to tailor the EasyWay TIS profile further to use only ALERT-C location codes to ensure that the service provider can use the data provided.

In the course of future revision of this document, a dedicated DATEX II profile should be elaborated in the course of future revision of this document, in order to foster the implementation of cross border weather information services. To support this activity the following figure gives an overview of DATEX II profiles. The

relevant sub-set is highlighted from the DATEX specification have been identified and highlighted in the figure below.

Technical requirement:

- **TR2:** To enable interoperability between different actors involved in the traffic information condition service value chain the following Data collection DATEXII-Profiles[11] **may** be used (If DATEX I protocol is in place this can be seen as equivalent substitution).

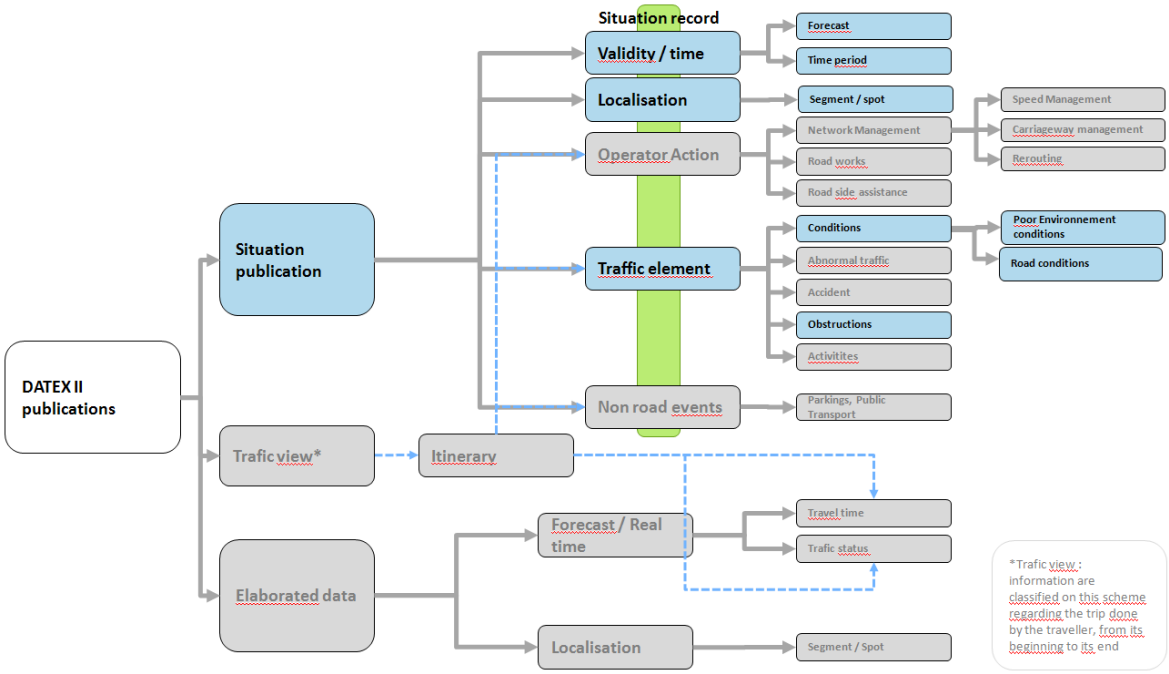

Figure 5: DATEX sub-elements relevant for weather information services (Source: EasyWay TCT)

The DATEX II profile was used as basis for an enhanced Data Model developed under the EU project "eMOITION". Weather and environmental related traffic messages for traffic information services are subelements of "situation publication – Traffic element – conditions – Environment conditions". These specifications are also used as basic concept for the CAI in In-Time

2.4.2.2 Dynamic Weather information in the In-Time CAI (Common Agreed Interface)

Service operation platforms should provide dynamic weather information for specific roads, road segments (links), route or administrative area. The current information shall be regularly updated in certain intervals (5, 15, 60 minutes); optionally with filter for specific message type and specific validity period.

For On-Trip purposes a dynamic weather and environment information distribution service provides weather related messages and warnings for road traffic. The messages can be TMC (ALERT-C) or TPEG coded and the location reference is based on road segments (links). Location reference can be coded in TMC Locator, TPEG Locator, AGORA-C or OPEN-LR.

The following table show the most available weather information messages which can be generated in a road weather service operation platform.

ALERT-C Code	Message	Subtyp

[11] DATEXII profiles consist of a set of data elements taken from the overall DATEX model and can include a subset (Schema) of relationships between those elements

1002	danger of aquaplaning	Road Surface Condition
1003	slippery road	Road Surface Condition
1019	slippery road due to frost	Road Surface Condition
1009	freezing rain	Road Surface Condition
1008	black ice	Road Surface Condition
1011	slush	Road Surface Condition
1112	rain	Atmospheric Weather Condition
1109	heavy rain	Atmospheric Weather Condition
1104	snowfall	Atmospheric Weather Condition
1101	heavy snowfall	Atmospheric Weather Condition
1107	sleet	Atmospheric Weather Condition
1203	gales	Atmospheric Weather Condition
1205	strong winds	Atmospheric Weather Condition
1304	fog	Atmospheric Weather Condition

Table 4: List of most frequent available weather related traffic messages[12]

The interval between the display of messages is dependent on the latency of available data sources and the monitoring devices used. Usual intervals are 15 minutes.

The messages should be provided for all road segments (links) of all covered road classes within a certain administrative area (county, country etc.). The push service of the operation platform transmits regularly all generated messages and affected road segments to the traffic information service provider platform. Road segments which are not affected by a traffic related weather message are not transmitted.

For general purpose and different transportation modes key information is to be specified by the driver / passenger / cyclist / pedestrian by entering the following requests into his navigational device (if on-trip) or computer (if pre-planning a trip):

- Area of interest (specific location, specific roads or routes, geographic or administrative areas)
- Time period of validity (current time, period in future for forecast)

The driver / passenger / cyclist / pedestrian will be provided with:

- Weather current & forecast for a given time frame

The weather data model is based on the DATEX II standard and like the other parts of the model follows the encoding rules, specified in the ISO 191xx standards. The weather package includes also Environment data models.

The focus is on road weather and road traffic domains although the Weather Package includes some data structures for general application purposes.

Different publication models are dealing with specific types of information:

- SituationPublication includes weather condition information, road weather and environment events which are based on RDS/TMC messages.
- MeasuredDataPublication comprises all measured weather and environment source data acquired from measuring devices
- ElaboratedDataPublication is dealing with data processed and forecasted.

[12] A complete overview of weather related ALERT-C event codes can be found in Annex B

The eMOTION model element for traffic related weather messages and warnings is the RoadWeatherAndEnvironmentEvent class. For actual event messages the class RoadWeatherAndEnvironmentEventActual class is used.

The enumerations RoadWeatherAndEnvironmentEventActualTypeEnum include in principle the ALERT-C messages. The above table is a subset of the enumerations in the model and should be considered as most relevant messages.

The complete specification of the weather and environmental data model can be found in:

- eMOTION UML Model, part of the eMOTION deliverable D6[13]
- eMOTION Deliverable D6, Appendix 1, chapter 10

The complete description of data types can be found in the eMOTION UML model.

2.4.2.3 Data model for Weather calibration of traffic models

Weather and environmental conditions on roads can have a strong impact on traffic flow. Therefore aside from existing uncoupled weather information and warnings, it is a requirement of future traffic information services to reflect the impact of weather on traffic flow.

However, this is not an existing service, so this should be a future extension for road weather service operation platforms which can essentially advance traffic information and journey planning services, so reduced travel times due to critical weather and road surface conditions can be better estimated.

The following values reflect the expected weather impact on certain traffic flow parameters. Some of them describe specific properties of the fundamental diagram of the traffic.

Attribute Name	Data Type	Description
MaximumFreeSpeed	Speed	The maximum possible speed a vehicle can drive on road at low traffic density (= “free”) due to the weather situation which is expected or actual encountered on the related location (road segment) and the related time frame
CriticalVelocity	Speed	Expected velocity at maximum traffic flow (capacity) due to the weather situation which is expected or actually encountered on the related location (road segment) and the related time frame
CriticalDensity	Real	Expected density at maximum traffic flow (capacity) due to the weather situation which is expected or actually encountered on the related location (road segment) and the related time frame
AverageDistanceGap	Length	Expected average distance between the front of this vehicle and the rear of the preceding one, at the specified measurement point. Averaged for all vehicles within a defined measurement period at the specified measurement point which is expected due to the weather situation within the relavant time frame.
AverageTimeGap	Time	Expected average time interval between the arrival of a vehicle's front at a point on the roadway, and that of the departure of the rear of the preceding one. Averaged for all vehicles within a defined measurement period at the specified measurement point due to the expected weather situation at the relevant location (road segment) and time frame.
MeanTravelTime	Time	Expected travel time for a vehicle for a defined road segment due to the expected weather situation within the relavant time frame

[13] All documents are publicly available from the eMOTION project web site : www.emotion-project.eu

Table 5: List of attributes of class WeatherRelatedTrafficValue (may be extended)

The above mentioned values may be extended for future requirements. The values are added to the data model as attributes to an additional class, called WeatherRelatedTrafficValue. The class is associated to the BasicDateValue class and belongs to the domain of ElaboratedDataPublication.

The following diagram shows this extended part of the emotion data model.

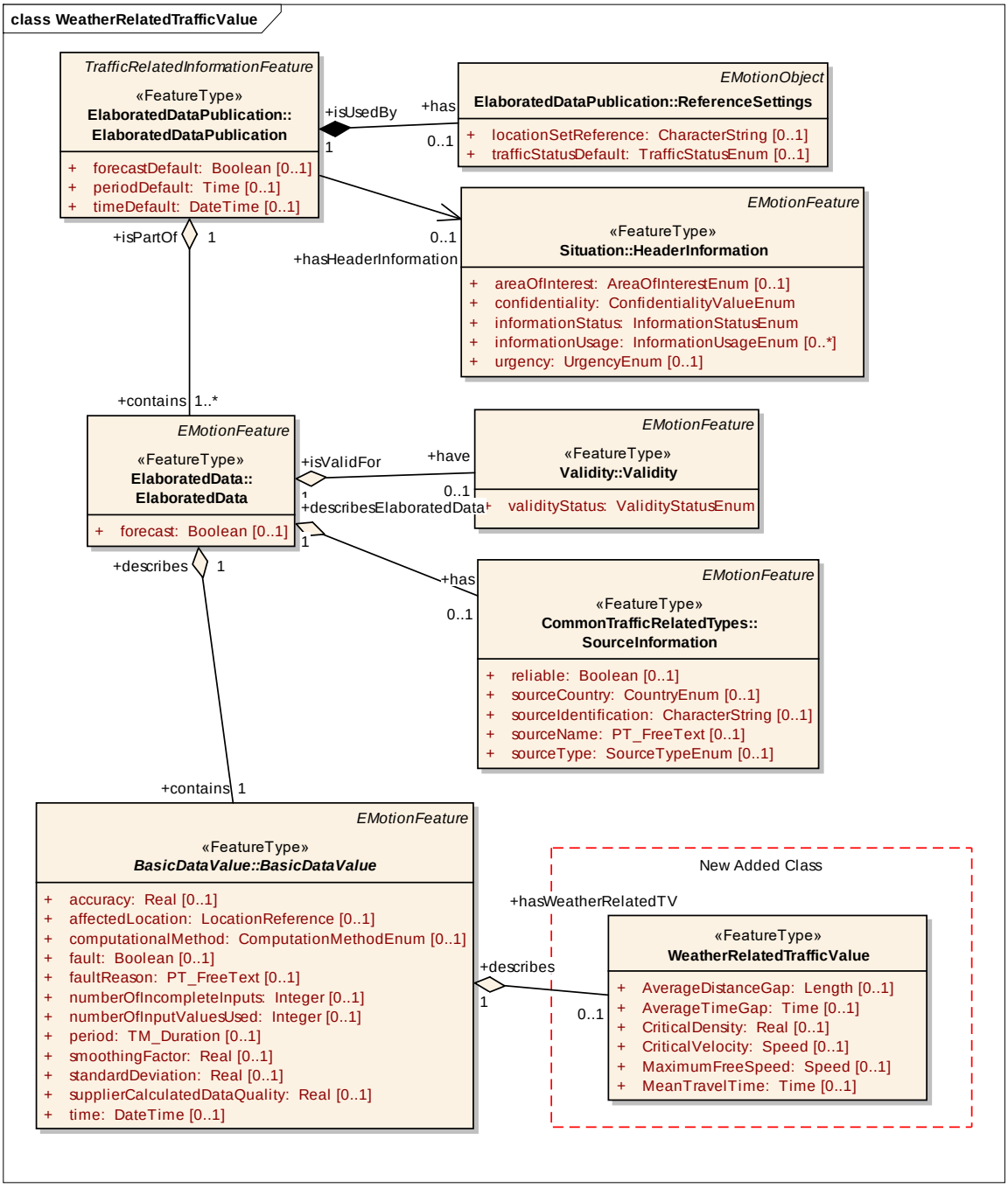

Figure 6: UML diagram of new added class WeatherRelatedTrafficValue in domain ElaboratedDataPublication (Source: www.emotion-project.eu)

2.4.3 Need for Additional Specifications

Table 3 includes data types which are not yet included in the DATEX II model. It is recommended that DATEX II is extended accordingly.

2.5 Common Look & Feel

2.5.1 Preliminary remark

Based on the existing services and systems throughout Europe, this section tries to identify common denominators. In the area of weather information, the distinction between an end user service and an expert system is common.

The focus of this DGs' harmonisation effort in the area of Look & Feel is solely on end user services!

Users of expert systems normally act within a single organisation or within a cooperation established by a limited number of organisations. Hence, a Look & Feel harmonisation focus on expert systems would have only limited impact.

Furthermore, the majority of the existing systems make distinctions between weather information and weather warnings. Therefore also the DGs' harmonisation effort in the area of Look & Feel is different in these two areas.

When dealing with the harmonisation of the Look & Feel of the service, operators should keep in mind that those services (and their harmonisation) should not distract the drivers or spoil the attention.

2.5.2 General weather information/ forecast

For the weather information (weather warning see next chapter) no harmonisation on Look & Feel is currently envisaged for the following information to be provided to the end users, as most visualisation should be self-explanatory to the end users:

- Weather condition + prediction (cloudless/sunny, cloudy, rain, snow)
- Temperatures of air- and road surface
- Wind speed and direction

Based on the national focus additional information may be added to the above list, e.g.:

- road weather reports: salting and snow removal actions

2.5.3 Weather warnings

Based on the existing systems throughout Europe (Part B) the following look & feel is recommended to arrive at a level of harmonised interaction with the European travellers:

Common look & feel requirements:

Weather Warnings: Recommendations for common Look & Feel	
CL&FR1:	Three or four levels **may** be indicated based on seriousness/ probability of the event when providing a web-based information service. It is recommended that the levels are defined based on local circumstances. However the message for the drivers should be clearly communicated and be the same across Europe Level 0 (normal conditions) - message for drivers: be prepared
	Level 1 (moderate conditions) - message for drivers: drive carefully[14]
	Level 2 (strong conditions)- message for drivers: special attention needed[15]
	Level 3(extreme conditions) - message for drivers: take action
CL&FR2:	A graphical representation **may** use a pictogram + a coloured bar to indicate the level of

[14] Level 1 could be merged with Level 2 to communicated only three levels towards the end users

[15] Level 1 could be merged with Level 2 to communicated only three levels towards the end users

	seriousness/ probability when providing a web-based information service. Level 0 (normal conditions) - green
	Level 1 (moderate conditions) - yellow[16]
	Level 2 (strong conditions)- orange[17]
	Level 3(extreme conditions) - red
CL&FR3:	As content for pictograms the defined set of content for pictograms **may** be used when providing a web-based information service. heavy rain: cloud + rain
	thunderstorm, hail: cloud + snowflakes
	snow on road: sliding car
	fog/ other visibility reduction: cloud + fog
	slippery road surface: slippery road (according Vienna convention)
	strong wind: wind cone

Table 6: Recommendations for common Look & Feel: Weather warnings

To support the above mentioned recommendation nr.3, the following pictograms are taken from the Austrian web-based service SWIS as one deployment in compliance with this Deployment Guideline:

	Level of seriousness / probability			
Weather warnings	Level 0 (normal conditions) => "be prepared"	Level 1 (moderate conditions) => "drive carefully"	Level 2 (strong conditions) => "special attention needed"	Level 3 (extreme conditions) => "take action"
heavy rain				
hail, thunderstorm				
fog/ other visibility reduction				
snow on road/ slippery road surface				
strong wind				

Table 7: Recommendations for common Look & Feel: Weather warnings, exemplary icons[18]

[16] Level 1 could be merged with Level 2 to communicated only three levels towards the end users

[17] Level 1 could be merged with Level 2 to communicated only three levels towards the end users

[18] Based on the delivery channel different restrictions may apply to the look & feel

2.6 Level of Service Definition

2.6.1 Preliminary remark

The scope of EasyWay is to provide Core European Services to the European road users. These services are harmonized in content and functionality, but also in their availability: The road users shall be able to expect a certain services offer in a specific road environment. In order to provide a basis for the harmonization process EasyWay needs a tool to define such environments in an agreed manner. This tool is the Operating Environments – a set of pre-defined road environments combining physical layout of the road and network typology with traffic characteristics.

In essence, EasyWay has agreed on a set of 18 pre-defined Operating Environments (OE) where each OE is a combination of three criteria:

- Physical characteristics – Motorways, other 3/4 lane roads or 2-lane roads
- Network typology – Corridor, Network, Link or Critical spot
- Traffic characteristics – Traffic flow and road safety situations (with optional additions)

For more information and details, visit https://dg.its-platform.eu.

2.6.2 Level of Service Criteria

The Levels of Service (LoS) definition of Weather Information Services follows the general Levels of Service definition (core criteria) outlined in the "Traveller Information Services, REFERENCE DOCUMENT, TIS Deployment Guideline Annex, VERSION 02-00-00, chapter 5.1 Levels of Service and Quality" - User interface, Neighbouring Provision, Local and Secondary Network Information - and adds also a specific weather information criterion: Level of Information, which describes the type of weather information provided to the user.

Levels of Service Table: Weather Information			
Core Criteria	**A**	**B**	**C**
User interface* (Language)	One fixed language (all official languages)	Information available is capable of being provided in addition in a common and shared language.	Information available is capable of being provided independent of language
Neighbouring Provision**	No information exchange	Information exchange to neighbouring only	Neighbouring and beyond information provider exchange
Local and secondary Network Information***	None (only information on TEN-T road network)	Exchange and use for strategic non TEN-T road network (key roads)	Additional information on local routes with impact on the TEN-T road network
Level of information****	Weather Information	Level A + weather warning nowcast	Level B + weather warning forecast

Legend:

- *User Interface:
  This criterion relates to the interface between information and the user. Information should be capable of being displayed through pictograms (language independent) as an optimum, in an official language or an official language plus a shared language (English) as an intermediate level
- **Neighbouring Provision:
  Addresses the issue of information exchange and availability between
  - Operators managing neighbouring network.
  - Service providers dealing with several different sources
- ***Local and secondary Network Information (see LoQ for more details):
  Deals with provision of weather relevant for non-TEN-T routes, provided on TEN-T routes.
- ****Level of Information:
  Addresses the content to be provided by a weather info system. Existing services distinguish between weather information and weather warning based on seriousness/ probability of an event. A fairly detailed definition of regarded content can be found in Part A of this Deployment Guideline.

Table 8: Level of Service

The "Levels of Quality table" reflects the requirements of the data quality which are needed for Forecast and Real Time Event Information Services. This table is not end-user oriented as the Table 8: Level of Service. The definitions of the below-mentioned table are according to the ISO/PDTR 21707[i] standard.

Levels of Quality Table: Weather Information				
Criteria	**0**	**1**	**2**	**3**
Accessibility	Weather mapped to area/ region	Weather mapped to section/ corridor	Weather mapped to sections with homogenous meteorological and topographical attributes	Weather mapped to single point
Availability	N.A.	N.A.	N.A.	N.A.
Timeliness	< 120min.	< 60min.	< 20 min.	< 5 min.[19]
Update frequency	6h	3h	1h	< 1h[20]
Quality assurance	No regulation	Either input or output (partial check)	Service chain check (full)	Information Quality Assurance[21]
Cross verified	No verification	Information from one source – reliability not confirmed	Information from one or more sources – reliability confirmed	Collaboration from more than one source (data fusion from neighboured stations) - Reliability confirmed
Accuracy	N.A.	N.A.	N.A.	N.A.
Forecast Horizon	Forecast at t=0	Forecast > 6h	Forecast >12h	Forecast >=24h

Table 9: Levels of Quality

[19] Good practise: 1-3 min. for traffic control and about 5min. for winter services

[20] Good practise: update frequency every min. for taffic control and about 15-30 min. for winter services

[21] Good practise: technical bulletin "Hinweise zur Erfassung und Nutzung von Umfelddaten in Streckenstationen" (FGSV 306, 2010);

2.6.3 Level of Service Criteria related to Operating Environment

Level of Service requirement:

- **LoSR1**: In the case that pre-deployment surveys / evaluations provide the necessary evidence to proceed with the deployment of the ITS-service "Weather Information", the minimum and optimum LoS **should** respect the following Level of Service to Operating Environment mapping table.

Note: The Level of Service to Operating Environment mapping table is not an outcome of a specific scientific analysis but an expert view output.

WEATHER INFORMATION SERVICES Criteria for the Levels of Service [reference TIS - DG06]			EasyWay OPERATING ENVIRONMENT																
			C1	T1	T2	T3	T4	R1	R2	R3	R4	R5	R6	R7	R8	S1	S2	N1	N2	P1
User Interface	C	Information available is capable of being provided independent of language																		
	B	Data available is capable of being provided in a common and shared language	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	A	One fixed language (all officail languages)	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Neighbouring Provision	C	Neighbouring and beyond information provider exchange																		
	B	Information exchange to neighbouring only	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	A	No information exchange	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Local and secondary Network information	C	Additional information on local routes with impact on the TEN-T (road network)	O																	
	B	Exchange and use for strategic non TEN-T road network (key roads)		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	A	Only information on TEN-T (road network)	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Level of information	C	Weather information and weather warning nowcast and forecast	O		O		O		O		O		O		O	O	O	O	O	O
	B	Weather information and weather warning nowcast		O		O		O		O		O		O						
	A	Weather information	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M

Recommendations for LoS per OE:			
M	Minimum LoS recommended	O	Optimum LoS recommended
OM	Minimum = Optimum	NA	Non applicable

Table 10: Level of Service to Operating Environment mapping table

OE	Explanation
C1	critical spots, local flow-related traffic impact and/or potential safety concerns
T1	motorway (link), no flow-related traffic impact and no major safety concerns
T2	motorway (link), no flow-related traffic impact, potential safety concerns
T3	motorway (link), seasonal or daily flow-related traffic impact, no major safety concerns
T4	motorway (link), seasonal or daily flow-related traffic impact, potential safety concerns
R1	two-lane road (link), no flow-related traffic impact, no major safety concerns
R2	two-lane road (link), no flow-related traffic impact, potential safety concerns
R3	two-lane road (link), seasonal or daily flow-related traffic impact, no major safety concerns
R4	two-lane road (link), seasonal or daily flow-related traffic impact, potential safety concerns
R5	three-/four-lane road (link), no flow related traffic impact, no major safety concerns
R6	three-/four-lane road (link), no flow related traffic impact, potential safety concerns
R7	three-/four-lane road (link), seasonal or daily flow related traffic impact, no major safety concerns
R8	three-/four-lane road (link), seasonal or daily flow related traffic impact, potential safety concerns
S1	motorway corridor or network, at most seasonal flow-related impact, possibly safety concerns
S2	motorway corridor or network, daily flow-related traffic impact, possibly safety concerns
N1	road corridor or network, at most seasonal flow-related traffic impact, possibly safety concerns
N2	road corridor or network, daily flow-related traffic impact, possibly safety concerns
P1	peri-urban motorway or road interfacing urban environment, possibly safety concerns

OE type	Number	Flow-related traffic impact				Potential safety concerns	
		NO	SEASONAL	DAILY		NO	YES
Critical spots							
C	1		X	X	and/or		X
Motorway links							
T	1	X			and	X	
	2	X			and		X
	3		X	X	and	X	
	4		X	X	and		X
Road links							
R 2 lanes	1	X			and	X	
	2	X			and		X
	3		X	X	and	X	
	4		X	X	and		X
R 3 or 4 lanes	5	X			and	X	
	6	X			and		X
	7		X	X	and	X	
	8		X	X	and		X
Motorway corridor or network							
S	1		X		and		(X)
	2			X	and		(X)
Road corridor or network							
N	1		X		and		(X)
	2			X	and		(X)
Peri-urban motorway or road							
P	1				and		(X)

Table 11: Legend - EasyWay Operating Environments for Core European ITS Services.

3 Part B: Supplementary Information

The EasyWay Deployment Guidelines contain two main elements:

- *Part A elaborates on the content of the ITS service addressed, describing the entire deployment framework including Requirements and Levels of Services.*
- *Part B is an appendix of informative content. Its objective is to illustrate part A with examples and feedback from deployments in the field.*

Part B is a lively chapter – in contrast to Part A, which by nature should be stable for a certain time – and subject to continuous development and update. The focus of Part B lies on national practices and experiences which, as cross-fertilisation material, can benefit any road operator in Europe and which are documented in Chapter "3.1 Best Practice" consisting of two main sections:

Examples of deployment 2010 - 2012

This section consists of contributions delivered by those EasyWay-Partners that have actively participated in the development and editing of the EW Deployment Guidelines 2012. Against this background, the examples - in detail listed in Chapter "3.1.1 Examples of deployments 2010 - 2012" – reflect the state of the art at the end of the year 2012. As such they delivered the basis for the discussion of the EW-deployment guideline development process and the setup of Part A "Harmonization requirements" at this point in time. But this means also that no direct relation or compliance to the harmonization requirements of Part A (as they are listed in the Compliance checklists in Annex A) can be assumed for these examples. Nevertheless, the given examples provide a concrete documentation of the state of the art at that time and in most cases, they can still be considered as current best practice.

EIP/EIP+ user and application survey 2013 - 2015

In trying to keep Part B up-to-date, the EasyWay follow up project EIP (European ITS Platform) – launched in 2013 – started two phases of activities to contribute to Part B by collecting user as well as application experiences (both technical and organisational) of national deployments that applied or at least considered the EW-DG 2012:

- *In the time period from the beginning of 2013 to the end of 2014, the EIP work programme provided essential post-processing steps to improve the usability of the DGs in ITS deployments and further to reflect the initial experiences and feedback gained with the guidelines since their release at the end of the year 2012.*
- *In 2015, the EIP+ work programme contained a follow-up activity with the goal to monitor and collect feedback on the application of the DGs in the five European ITS Deployment Corridor projects and to consolidate reporting of the results, lessons learned and best practices concerning the DG practicability and the compliance with the DG requirements on a European scale.*

The results of those two activities are based on responses on questionnaires which were circulated to national ITS deployment experts and European ITS corridor projects and finally are reflected in Chapter "3.1.2 EIP/EIP+ user and application survey 2013 - 2015".

3.1 Best practice

3.1.1 Examples of deployment 2010 - 2012

3.1.1.1 Example Austria

GENERAL INFORMATION	
Name of service/project	SWIS - Road Weather Information System
Name of operator/organisation	Austrian motorway operator ASFINAG
Web link	web-based: www.asfinag.at/verkehrsinformationen web-based optimised for mobile devices: http://mobile.asfinag.at/
Contacts	Martin Nemec
Other	Available languages of the service: At the moment SWIS is only available in German and English language, strongly supported with pictograms.

GEOGRAPHICAL ASPECTS	
Country	Austria
Region of implementation	Weather data available for whole Austrian TERN. Data is mapped to meteorological sections
Networks concerned	Motorway network
Deployment indicators	2175 Number of kilometres

SERVICE DESCRIPTION	
Problem(s) addressed / Objectives (Relation to EW objectives. Background/motivation to the ITS application - basic question: WHY)	☐ Reduction of congestion ☒ Increase of safety ☐ Reduction of environmental damage (%) ☒ Other: Increase travellers convenience
ITS service description (Description of ITS application, example of systems used functionality and technologies used, users involved, location, context within wider ITS system, current status of the application.	In cooperation with the Austrian air control operator (Austro Control) available weather data is mapped to meteorological sections. Those sections have been defined based on (a similar) meteorological/ thermal behaviour Thematic coverage: Weather information/ prognosis: cloudless, cloudy, rain, snow Weather warning (3 levels each based on seriousness / probability): Heavy rain, thunderstorm, storm, hail, slipperiness, fog/ other reduced visibility, snow Data quality: Forecasting information available for up to 24h in advance
Service requirements (Which type of requirements specifications have been used during	☐ Functional requirements ☒ Organisational requirements: see chapter “organisational aspects” for more details

the service implementation)	☐ Technical requirements ☐ Look & Feel for the end user ☐ Level of Service criteria
Requirements specifications (If you have ticked any of the requirements above, can you provide information on how you have received or elicited the requirements, e.g. national recommendations, stakeholder sessions, etc.)	

IMPLEMENTATION ASPECTS	
Duration (start, end)	Start: 2007 End: service is under continuous improvement (e.g. development of new distribution channels like mobile web to fit mobile devices)
Lessons learnt / factor of success (Key lessons learnt in various aspects of the planning and implementation process; could be technical, institutional/organizational, legal, financial – basic questions: Was the implementation a success / Were the objectives met? Why? What could be done differently next time?)	Technical To be provided during a later stage of revision process Institutional/organisational To be provided during a later stage of revision process Legal To be provided during a later stage of revision process Financial To be provided during a later stage of revision process
Impacts assessment / results (Description of impacts in terms of safety, travel efficiency, environmental impacts, security, traffic management…)	

REFERENCES	
Documentation available on the project	Title: only internal documentation available Contact: Niklas Rausch Language: German ☐ EW/TEMPO evaluation

ORGANISATIONAL ASPECTS	
Classification (in accordance to Part A, chapter 2.3)	Organisation: A3 | Publicly owned companies Obligation for provision: B2 | non mandatory service Data used: C2 | data under public and private scope

Business model: D1 | free of charge - non commercial service

ILLUSTRATIONS

Figure 7: Austrian web-based weather info service

Figure 8: Austrian mobile web-based weather info service

3.1.1.2 Example England

GENERAL INFORMATION

Name of service/project	Highways Agency Weather Information Service (HAWIS)
Name of operator/organisation	Highways Agency
Web link	Web access will be provided for an expert system for use by Highways Agency staff and Service Providers. Road related weather information is currently provided to the public via the Traffic England website. http://www.trafficengland.com
Contacts	
Other	Currently only available in English language, strongly supported with appropriate icons where applicable

GEOGRAPHICAL ASPECTS	
Country	England
Region of implementation	Weather information available for all England mapped to regions and areas relating to road network management responsibilities.
Networks concerned	English Strategic and Trunk road network
Deployment indicators	Number of kilometres

SERVICE DESCRIPTION	
Problem(s) addressed / Objectives (Relation to EW objectives. Background/motivation to the ITS application - basic question: WHY)	☒Reduction of congestion ☒Increase of safety ☒Reduction of environmental damage (%) ☒Other: Increase travellers convenience
ITS service description (Description of ITS application, example of systems used functionality and technologies used, users involved, location, context within wider ITS system, current status of the application.	The system will consist of a number of key elements: Observations from Weather Stations located at strategic locations across the road network Forecasts from Forecast Providers A Highways Agency Weather Central Service (HAWCS) to collect, store and distribute weather information. This service is currently under development and due to launch May 2012. HAWCS will collect weather observations from around 250 weather stations across the English road network. The observation data will be distributed by the system to forecast providers and subsequent site specific forecasts will be received by the system. Forecast Providers will also provide additional forecasts including weather alerts. HAWCS will provide a website showing observation and forecast information on maps, tables and graphs to assist expert users to carry out their operational duties. A DATEXII interface will also be provided for exchanging data. The public facing element will be provided by the Highways Agency National Traffic Information Service (NTIS). This will receive weather information from HAWCS and deliver this to the wider

	public both through a website and data exchange interfaces. The new service will provide weather information 365 days/year replacing the existing roads weather information service that was focused on supporting operations and in particular maintenance activities during the Winter season. Thematic coverage: The information available will cover: • Weather observations including camera images, precipitation and visibility, wind speed and direction, atmospheric pressure, road surface condition and temperature. • Forecast information including national weather summaries for each region (covering today, tomorrow, days 3 to 5, Days 6 to 10); Severe Weather Alerts, 24 hour Area and Domain forecasts, 24 hour route based forecasts, 2 to 10 day Area forecasts, Site Specific Forecasts. Precipitation Radar and Satellite images. Road Surface Temperature Mapping. Data quality: Weather Station observation data will be collected at up to 10 minute intervals. Forecasts are delivered at an agreed schedule, for most this is typically once a day and updated on an ad-hoc basis until the next scheduled update.
Service requirements (Which type of requirements specifications have been used during the service implementation)	☒Functional requirements ☐Organisational requirements ☒Technical requirements ☒Look & Feel for the end user ☐Level of Service criteria
Requirements specifications (If you have ticked any of the requirements above, can you provide information on how you have received or elicited the requirements, e.g. national recommendations, stakeholder sessions, etc.)	Stakeholder sessions were used to understand and specify user requirements; Review of existing systems for understanding best practice; Appropriate National/International Standards and other Best Practice was utilised as appropriate.

IMPLEMENTATION ASPECTS	
Duration (start, end)	Start: August 2011 (Development Start Date) End: May 2012 (Launch Date)
Lessons learnt / factor of success (Key lessons learnt in various aspects of the planning and implementation process; could be technical,	Technical Institutional/organisational

institutional/organizational, legal, financial – basic questions: Was the implementation a success / Were the objectives met? Why? What could be done differently next time?)	Legal Financial
Impacts assessment / results (Description of impacts in terms of safety, travel efficiency, environmental impacts, security, traffic management…)	

REFERENCES	
Documentation available on the project	Title: Contact: Language: Choose an item. ☐ EW/TEMPO evaluation

ORGANISATIONAL ASPECTS	
Classification (in accordance to Part A, chapter 2.3)	Organisation: Wählen Sie ein Element aus. Obligations for provision: Wählen Sie ein Element aus. Data used: choose an item Business model:

ILLUSTRATIONS

3.1.1.3 Example Germany

GENERAL INFORMATION	
Name of service/project	SWIS – Road Condition and Weather Information System
Name of operator/organisation	Federal Ministry of Transport, Building and Urban Development (Germany), Deutscher Wetterdienst (meterological service) and Transport administration of the German federal states
Web link	web-based: www.dwd.de/swis example for end-user service: www.strassen-sh.de
Contacts	
Other	Available languages of the service: At the moment SWIS is only available in German language

GEOGRAPHICAL ASPECTS	
Country	Germany
Region of implementation	Weather data available for whole German TERN and selected parts of the secondary network. Data is mapped to meteorological sections. Road condition information available for motorway network and exposed parts of the secondary network.
Networks concerned	
Deployment indicators	Number of kilometers

SERVICE DESCRIPTION	
Problem(s) addressed / Objectives (Relation to EW objectives. Background/motivation to the ITS application - basic question: WHY)	☐ Reduction of congestion ☒ Increase of safety ☐ Reduction of environmental damage (%) ☒ Other: Increase travellers convenience
ITS service description (Description of ITS application, example of systems used functionality and technologies used, users involved, location, context within wider ITS system, current status of the application.	In cooperation with the German meteorological service available weather data is mapped to road sections. Those sections have been defined based on (a similar) meteorological/ thermal behaviour. Thematic coverage: Road condition service: air temperature, relative humidity, dew point, precipitation, road surface temperature, road surface humidity, water film height, residual salt-factor, freezing temperature, deep level ground temperature (30 cm), (partly) Wind speed and direction Weather information/ prediction: cloudless, cloudy, rain, snow Official weather warning (3 levels each based on probability): Heavy rain, thunderstorm, storm, hail, sleekness, fog/ other reduced visibility, snow Data quality: Forecasting information available for up to 24h in advance, less detailed forecast for the next 10 days.
Service requirements (Which type of requirements specifications have been used during the service implementation)	☐ Functional requirements ☐ Organisational requirements ☐ Technical requirements ☐ Look & Feel for the end user ☐ Level of Service criteria
Requirements specifications (If you have ticked any of the requirements above, can you provide information on how you have received or elicited the requirements, e.g. national recommendations, stakeholder sessions, etc.)	

IMPLEMENTATION ASPECTS	
Duration (start, end)	Start: End:
Lessons learnt / factor of success (Key lessons learnt in various aspects of the planning and implementation process; could be technical, institutional/organizational, legal, financial – basic questions: Was the implementation a success / Were the objectives met? Why? What could be done differently next time?)	Technical Institutional/organisational Legal Financial
Impacts assessment / results (Description of impacts in terms of safety, travel efficiency, environmental impacts, security, traffic management…)	

REFERENCES	
Documentation available on the project	Title: Contact: Language: Choose an item. ☐ EW/TEMPO evaluation

ORGANISATIONAL ASPECTS	
Classification (in accordance to Part A, chapter 2.3)	Organisation: Wählen Sie ein Element aus. Obligation for provision: Wählen Sie ein Element aus. Data used: choose an item Business model: D1 | free of charge - non commercial service Service is accessible for traffic management purposes (mostly used for winter maintenance services). End user services are operated in selected federal states (regional level).

ILLUSTRATIONS

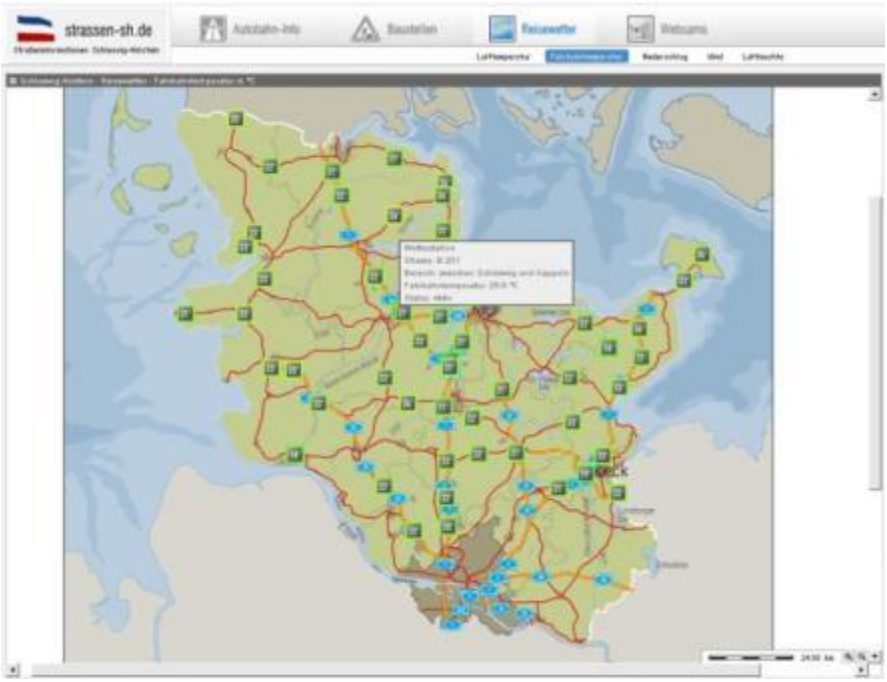

Figure 9: End-user interface, showing the road weather network for Schleswig-Holstein.

3.1.1.4 Example Hungary

In Hungary there is a website of the Road Traffic Information Service (UTINFORM) for the whole country is available, giving traffic information (kozut.hu) in Hungarian, English and German (HU, EN, DE) language.

Furthermore, each road operator (on state and PPP motorways) may have his own website with his network and his own road condition. In wintertime, they mix weather forecasts and traffic information, giving road users some of the advice in Hungarian and English languages.

For reasons of simplicity, only the general website is described. More information on different other services are available upon request.

GENERAL INFORMATION	
Name of service/project	ÚTMET - Road Weather Information System
Name of operator/organisation	Hungarian Public Roads Nonprofit Ltd. (Magyar Közút Nzrt.)
Web link	web-based: utmet.kozut.hu
Contacts	Zoltán Vályi
Other	Available languages of the service: At the moment ÚTMET is only available in Hungarian language

GEOGRAPHICAL ASPECTS	
Country	Hungary
Region of implementation	Weather and road condition data available for Hungarian state main roads. (~200 stations) Data is mapped to meteorological sections.

Networks concerned	State main roads and secondary roads without motorways and expressways (~11 500 km)
Deployment indicators	Number of kilometers

SERVICE DESCRIPTION

Problem(s) addressed / Objectives (Relation to EW objectives. Background/motivation to the ITS application - basic question: WHY)	☐ Reduction of congestion ☒ Increase of safety ☐ Reduction of environmental damage (%) ☒ Other: Increase travellers convenience
ITS service description (Description of ITS application, example of systems used functionality and technologies used, users involved, location, context within wider ITS system, current status of the application.	In cooperation with the Hungarian Weather Services (Országos Meteorológiai Szolgálat) available weather data is mapped to meteorological sections. Those sections have been defined based on (a similar) meteorological/ thermal behaviour. Thematic coverage: Road condition service: air temperature, relative humidity, dew point, type and intensity of precipitation, road surface temperature, road surface humidity, water film height, salt-factor, freezing temperature, deep level ground temperature (5 cm), (partly, mainly on motorways) wind speed and direction Weather information/ prognosis: cloudless, cloudy, wind-speed, fog, rain, snow. Weather warning (3 levels each based on seriousness / probability): Heavy rain, thunderstorm, storm, hail, slipperiness, fog/ other reduced visibility, snow Data quality: Forecasting information available for up to 72h in advance and short term (3 h) weather warning.
Service requirements (Which type of requirements specifications have been used during the service implementation)	☒ Functional requirements ☐ Organisational requirements ☒ Technical requirements ☐ Look & Feel for the end user ☐ Level of Service criteria
Requirements specifications (If you have ticked any of the requirements above, can you provide information on how you have received or elicited the requirements, e.g. national recommendations, stakeholder sessions, etc.)	They were worked out for technical part of international tender by a group of specialists after survey of the international WIS'.

IMPLEMENTATION ASPECTS	
Duration (start, end)	Start: 10 / 1999 End: 06 / 2002
Lessons learnt / factor of success (Key lessons learnt in various aspects of the planning and implementation process; could be technical, institutional/organizational, legal, financial – basic questions: Was the implementation a success / Were the objectives met? Why? What could be done differently next time?)	Technical The project was successful. At the time of implementing of the system the information transmission was via GSM SMS. The operation of it proved to deliver an expensive solution. It has been changed for 3G or GPRS modems after further revision this year. Institutional/organisational Legal Financial
Impacts assessment / results (Description of impacts in terms of safety, travel efficiency, environmental impacts, security, traffic management…)	Unfortunately no post-implementation investigation has been made.

REFERENCES	
Documentation available on the project	Title: The ÚTMET is an application of road and weather information system in field of winter road-operation in Hungary Contact: Zoltán Vályi Language: Hungarian and English ☐ EW/TEMPO evaluation

ORGANISATIONAL ASPECTS	
Classification (in accordance to Part A, chapter 2.3)	Organisation: A3 | Publicly owned companies Obligations for provision: B2 | non mandatory service Data used: by Hungarian Public Roads Nonprofit Co. only Business model: D1 | free of charge - non commercial service End user service is only for road operator units, during winter mainly

ILLUSTRATIONS

Figure 10: Hungarian open screen for one county (Pest megye) dispatcher

3.1.1.5 Example Scotland

GENERAL INFORMATION	
Name of service/project	Traffic Scotland Web Service - Weather Information System
Name of operator/organisation	Transport Scotland: Traffic Scotland service,
Web link	web-based: http://trafficscotland.org web-based optimised for mobile devices: http://m.trafficscotland.org
Contacts	Scott Lees
Other	Available languages of the service: Currently the Traffic Scotland website is only available in English language, strongly supported with appropriate icons where applicable

GEOGRAPHICAL ASPECTS	
Country	Scotland
Region of implementation	Weather data is available for the Scottish mainland and the majority of islands.
Networks concerned	
Deployment indicators	Number of kilometres

SERVICE DESCRIPTION	
Problem(s) addressed / Objectives (Relation to EW objectives. Background/motivation to the ITS application - basic question: WHY)	☐ Reduction of congestion ☒ Increase of safety ☐ Reduction of environmental damage (%) ☒ Other: Increase travellers convenience
ITS service description (Description of ITS application, example of systems used functionality and technologies used, users involved, location, context within wider ITS system, current status of the application.	In cooperation with the UK Met Office, the Traffic Scotland website displays weather warnings and alerts that may affect the Scottish trunk road network. Thematic coverage: Weather Warnings and Alerts are issued for the following: Rain/ Snow/ Wind /Fog/ Ice Warnings and Alerts are based on a combination of: Likelihood and Impact. A combination of likelihood and impact is measured against a matrix to give each warning or alert a colour: Red (Take action) and Amber (Be prepared) Data quality: Forecasting information (Alerts) available for up to 5 days in advance with Warnings issued up to 24 hrs ahead
Service requirements (Which type of requirements specifications have been used during the service implementation)	☐ Functional requirements ☐ Organisational requirements ☐ Technical requirements ☐ Look & Feel for the end user ☐ Level of Service criteria
Requirements specifications (If you have ticked any of the requirements above, can you provide information on how you have received or elicited the requirements, e.g. national recommendations, stakeholder sessions, etc.)	

IMPLEMENTATION ASPECTS	
Duration (start, end)	Start: End:
Lessons learnt / factor of success (Key lessons learnt in various aspects of the planning and implementation process; could be technical, institutional/organizational, legal, financial – basic questions: Was the implementation a success / Were	Technical Institutional/organisational Legal

the objectives met? Why? What could be done differently next time?) Impacts assessment / results (Description of impacts in terms of safety, travel efficiency, environmental impacts, security, traffic management…)	Financial

REFERENCES

Documentation available on the project	Title: Contact: Language: Choose an item. ☐ EW/TEMPO evaluation

ORGANISATIONAL ASPECTS

Classification (in accordance to Part A, chapter 2.3)	Organisation: Wählen Sie ein Element aus. Obligations for provision: Wählen Sie ein Element aus. Data used: choose an item Business model: D1 | free of charge - non commercial service

ILLUSTRATIONS

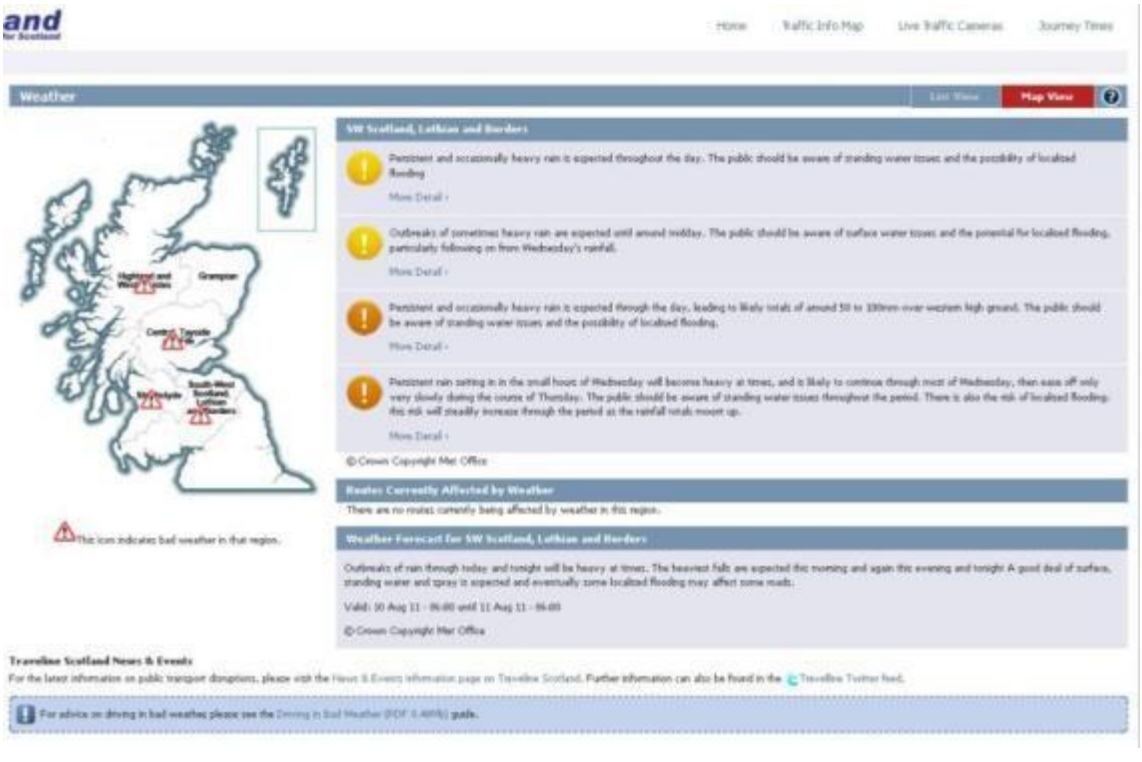

Figure 11: Traffic Scotland web-based weather info service

3.1.1.6 Example Spain

GENERAL INFORMATION	
Name of service/project	Spanish eTraffic service
Name of operator/organisation	Spanish Directorate General for Traffic (DGT)
Web link	web-based: http://infocar.dgt.es/etraffic/
Contacts	Juana Fernández: Juana.Fernandez@dgt.es
Other	Available languages of the service: Currently the eTraffic website is available in Spanish, English, French and co-official languages from Spain.

GEOGRAPHICAL ASPECTS	
Country	Spain
Region of implementation	whole Spanish TEN-T network
Networks concerned	
Deployment indicators	Number of kilometers

SERVICE DESCRIPTION	
Problem(s) addressed / Objectives (Relation to EW objectives. Background/motivation to the ITS application - basic question: WHY)	☐ Reduction of congestion ☒ Increase of safety ☐ Reduction of environmental damage (%) ☒ Other: Increase travellers convenience
ITS service description (Description of ITS application, example of systems used functionality and technologies used, users involved, location, context within wider ITS system, current status of the application.	The service provides real-time traffic information integrating different sources of traffic data in Google Maps. The end user can access (via a single map application) all traffic information as well as the ITS road equipment installed in the Spanish TEN-T directly. In the roadmap, the user can click the traffic sensor to get real-time traffic data. A window is displayed with traffic sensor related data as intensity, speed, occupancy, ... Thematic coverage: Information from weather stations are issued for the following: Temperature, humidity, visibility, rainfall, type of rainfall, wind, wind speed, atmospheric pressure, current weather, amount of rainfall, water depth, wind direction, surface conditions, surface temperature, salinity and overall radiation. Data quality: Availability all the time and cross verified (more than one source). It allows to save your most frequent journeys and to personalize the information about the services you are most interested in.

Service requirements (Which type of requirements specifications have been used during the service implementation)	☒Functional requirements ☒Organisational requirements ☒Technical requirements ☒Look & Feel for the end user ☒Level of Service criteria
Requirements specifications (If you have ticked any of the requirements above, can you provide information on how you have received or elicited the requirements, e.g. national recommendations, stakeholder sessions, etc.)	From the experience with a previous service and usability analysis, there was an interest in this service by the users of traffic information. Likewise, the emergence of online maps on the market, led to a new way of representing information with a high degree of availability, good response times and a friendly and intuitive interface.

IMPLEMENTATION ASPECTS	
Duration (start, end)	Start: 2006 End: 2007
Lessons learnt / factor of success (Key lessons learnt in various aspects of the planning and implementation process; could be technical, institutional/organizational, legal, financial – basic questions: Was the implementation a success / Were the objectives met? Why? What could be done differently next time?)	Technical New technologies imply new developments. Improvements will include integration with smartphones and alerts subscription service. Institutional/organisational Legal Financial
Impacts assessment / results (Description of impacts in terms of safety, travel efficiency, environmental impacts, security, traffic management…)	Good experience. Continuous increase on information demand “sponge effect”. Request of information with strong peak in case of: Special traffic operations and Weather problems (aprox. 1 million maps requested in just 1 day).

REFERENCES	
Documentation available on the project	Title: Contact: Language: Choose an item. ☐ EW/TEMPO evaluation

ORGANISATIONAL ASPECTS	
Classification (in accordance to Part A, chapter 2.3)	Organisation: A1 | Fully public (incl. operation) Obligations for provision: B2 | non mandatory service Data used: C1 | data under public scope Business model: D1 | free of charge - non commercial service

ILLUSTRATIONS

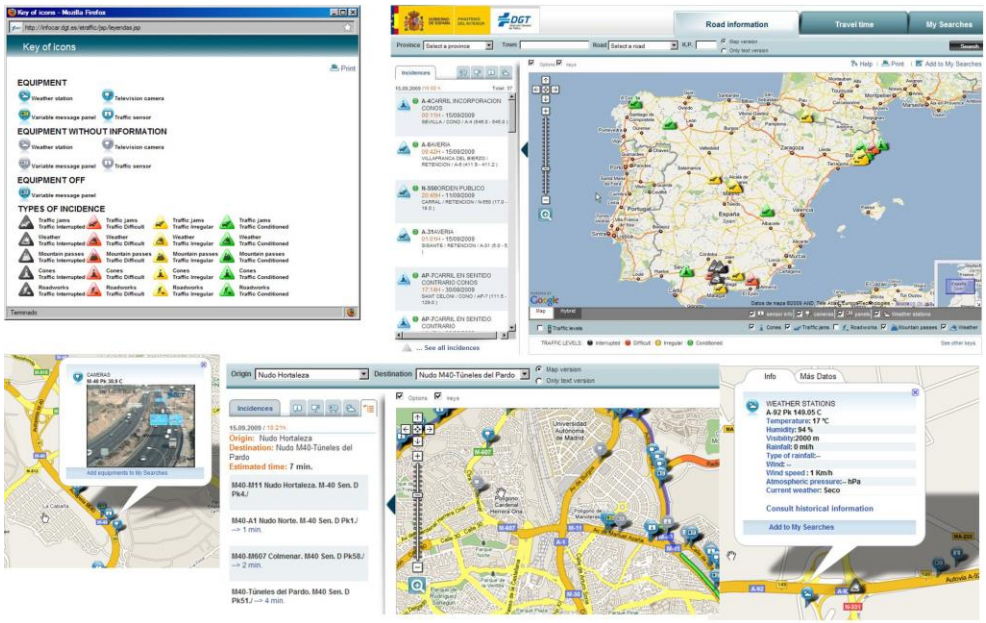

Figure 12: Spanish eTraffic service

3.1.2 EIP/EIP+ user and application survey 2013 - 2015

3.1.2.1 Concept and Practicability

For Weather information (TIS-ED06) answers were received from three Member States: Denmark, Finland and Sweden. Main results from these answers regarding new implementations of weather information deployments and DG functional requirements (FR1, FR2 and FR3) can be summarized in the following way:

- DG Functional requirements were relevant and they were easy to apply

- Additional effort or costs for applying the requirements were low or none

- Acceptance of the requirements were high

3.1.2.2 Results "Compliance checklists questionnaire"

All "should" functional requirements (FR1, FR2 and FR3) were met in the implementations by all 3 cases and there were no deviations reported.

Following best practise examples from Denmark, Finland and Sweden in chapter 3.1.2.3 includes short descriptions on how the functional requirements were fulfilled in each of these implementations.

3.1.2.3 New best practice examples of deployment 2013-2015

Example Denmark – Updated Road weather Information System

GENERAL INFORMATION	
Name of service/project	Vejvejr.dk (Road Weather Information System)
Name of operator/organisation	Danish Road Directorate (DRD)
Web link	vejvejr.dk (login is required)
Contacts	Freddy Knudsen fek@vd.dk
Other	Available languages of the service: Danish The service is being used also by traffic centre operators and winter maintenance operators in their daily work.

GEOGRAPHICAL ASPECTS	
Country	Denmark
Region of implementation	Vejvejr is a system that is installed in a series of computers including 1 national winter centre and 84 municipalities. These receive and present data from the road weather stations and other meteorological information from DMI (Danish Meteorological Institute).
Networks concerned	
Deployment indicators	Number of kilometres: min. 67.000 km

SERVICE DESCRIPTION	
Problem(s) addressed / Objectives (Relation to EW objectives. Background/motivation to the ITS	☐ Reduction of congestion ☒ Increase of safety

application - basic question: WHY)	☐Reduction of environmental damage (%) ☒Other: Increase travellers convenience
ITS service description (Description of ITS application, example of systems used functionality and technologies used, users involved, location, context within wider ITS system, current status of the application.	Vejvejr.dk provides current road weather and forecast for the next five or 24 hours. Broadcast a new forecast every hour. There are a total of 430 monitoring stations along state and municipal roads. A road agency can set their own stations and cameras in addition to the existing ones. Monitoring stations are placed at the locations on the road network, which only occurs on slippery situations - so-called "white spots". To recognize "white spots", the Road Directorate developed portable measuring equipment. The Danish Metrological Institute (DMI) analysing weather data and mapped them to several defined meteorological areas. The information are mainly collected in real-time and displayed in Vejvejr.dk for traffic centre- and winter maintenance operators in their daily work Thematic coverage: Weather information: In VejVejr there is access to new precipitation images from DMI's radar network every 10 minutes. It is possible to create an animation of the images up to 6 hours back in time. Also included is a model interpretation of the precipitation type, so you can see if there is rain, sleet or snow. Rain will show on the picture as green, yellow sleet and snow or freezing rain red. Finally, you can also choose to see the projected radar images, i.e. a forecast of precipitation moving the next 2 hours. Among other information, the system provides: Air temperature, Road temperature, Air humidity, Road condition (dry, wet, salted, snow, ice and hoar frost), Wind (speed and direction), Precipitation (form and amount), visibility, Cloudiness (satellite pictures), Precipitation (radar pictures), Webcams, Area forecasts. Many stations are equipped with sensors giving information about residual salt amount, freezing point and salt concentration. Data quality & overview: The system is built with a quality management system. Built-in algorithms prevent the parameters to exceed an allowable rate. Regular observation of meteorologists ensures that inoperable stations are sorted from the system. Opening screen in VejVejr is a nationwide presentation of the current situation and an outlook for development in the next 5 hours. This is shown in the form of alarm categories of road temperature and the risk of slippery road condition. The alarm condition is based on observations every 5 minutes from the over 430 measuring stations located around the country. Forecasts are updated every hour.

Service requirements (Which type of requirements specifications have been used during the service implementation)	☒ Functional requirements ☐ Organisational requirements ☒ Technical requirements ☐ Look & Feel for the end user ☐ Level of Service criteria
Requirements specifications (If you have ticked any of the requirements above, can you provide information on how you have received or elicited the requirements, e.g. national recommendations, stakeholder sessions, etc.)	All requirements are based on national guidelines, road weather quality system, EasyWay VIKING ICT infrastructure and EasyWay 2012 deployment guidelines.

IMPLEMENTATION ASPECTS	
Duration (start, end)	Start: 2013 End: 2014
Lessons learnt / factor of success (Key lessons learnt in various aspects of the planning and implementation process; could be technical, institutional/organizational, legal, financial – basic questions: Was the implementation a success / Were the objectives met? Why? What could be done differently next time?)	Functional All "should" functional requirements from deployment guidelines were met in the implementation: FR1: Information is utilised for road maintenance and traffic management centre for dissemination purposes. Road users can use the service from web, mobile devices, Traveller information radio, and TV services. FR2: The service is available in official language in Denmark: Danish while the system is also graphical format, which makes the system applicable for other road operators to interpret and use the data. FR3: Information is presented in textual and graphical format. Technical All "may" technical requirements from deployment guidelines were met in the implementation As a service provider to own system we are responsible to meet the general requirements for levels of service to local, regional and nation interests. That is also to ensure coverage/upgrade of road weather stations and cameras along the state roads and with consents of municipalities also along their road network. All services are targeted at providing more and better dissemination and accessibility as well as improved customization and presentation to the end-users. All efforts have been done simultaneously on improving all platforms, i.e. web-based and mobile platforms. Institutional/organisational Legal

	Financial Is sold to companies and municipalities that pays between 2000 and 6000 € per year depending on size.
Impacts assessment / results (Description of impacts in terms of safety, travel efficiency, environmental impacts, security, traffic management…)	

REFERENCES	
Documentation available on the project	Title: Technical coordinator Contact: Freddy Knudsen fek@vd.dk Language: Danish ☐ EW/TEMPO evaluation

ORGANISATIONAL ASPECTS

Classification (in accordance to Part A, chapter 2.3)	Organisation: A3 | Publicly owned companies Obligations for provision: B1 | mandatory service Data used: C2 | data under public and private scope Business model: D3 | Payable commercial service

ILLUSTRATIONS

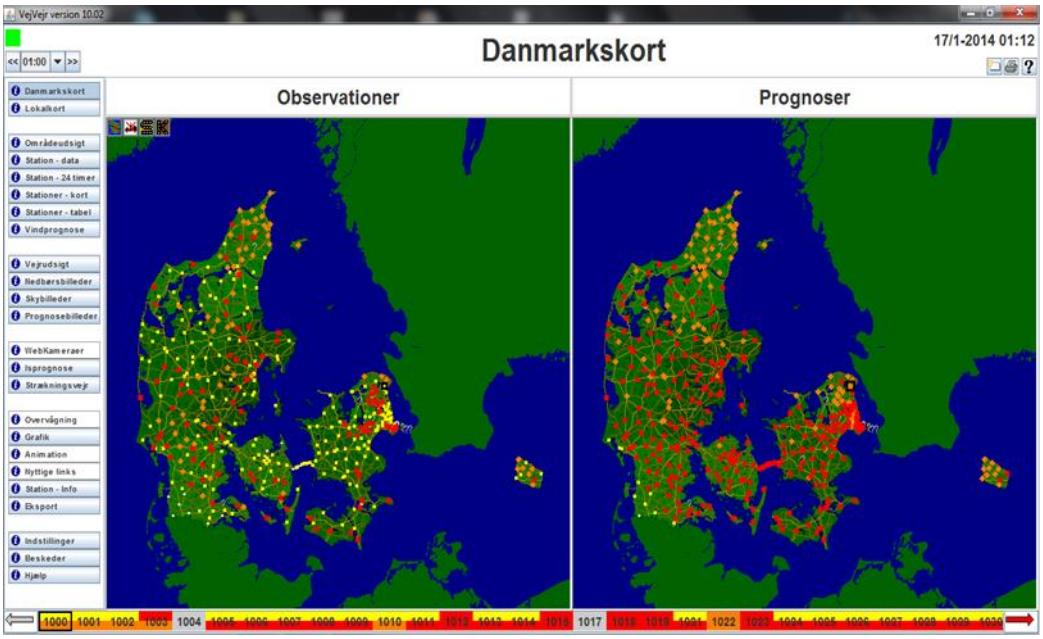

Figure 13. Alarm Map for monitoring stations

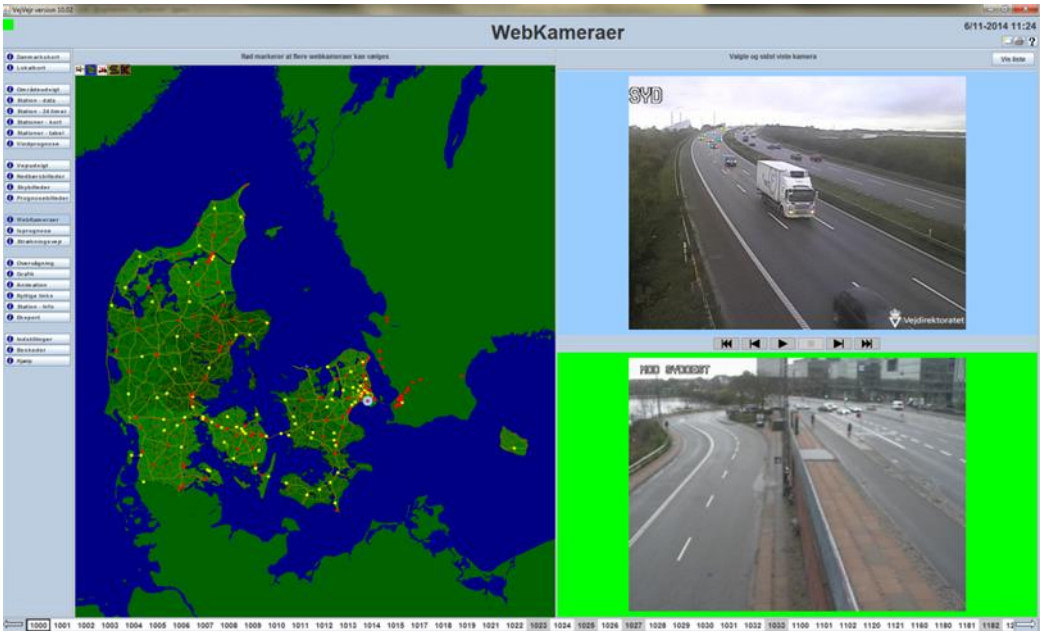

Figure 14: Webcams along the road network

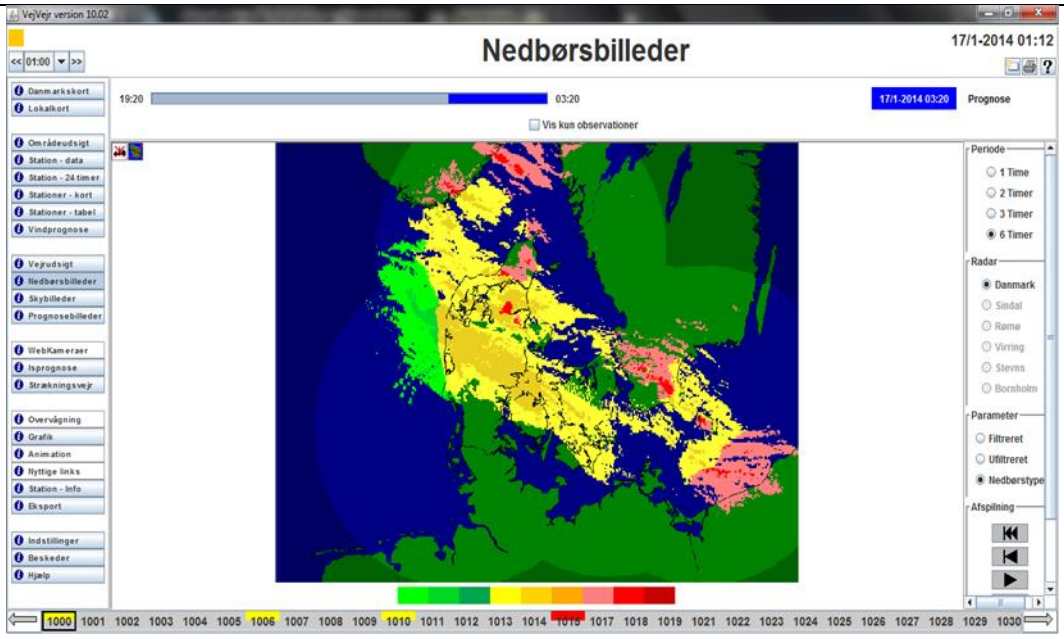

Figure 15. Precipitation photos from DMI's radar network every 10 minutes.

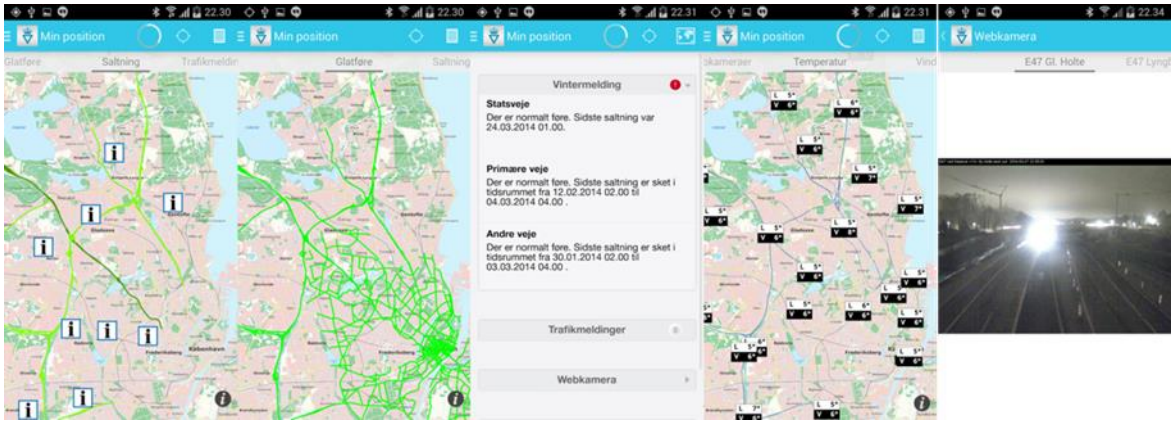

Figure 16. Latest developed Smartphone app, with view of icy road conditions and recent salting at both state and municipal roads.

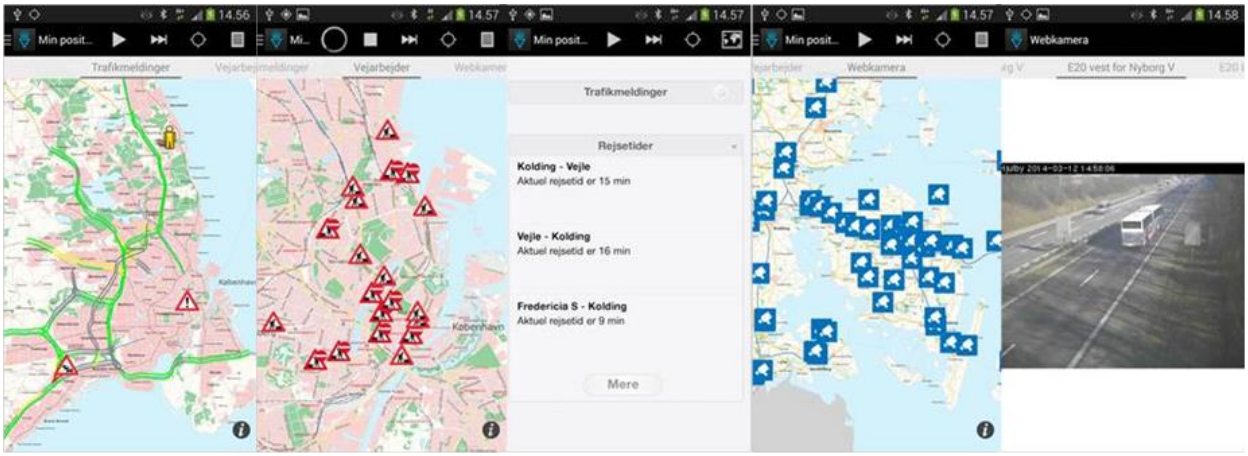

Figure 17. Danish mobile web-based traffic information service.

Example Finland – Updated Road condition warning service

GENERAL INFORMATION	
Name of service/project	Sectional Road Condition Forecasts in Finland
Name of operator/organisation	The Finnish Transport Agency (FTA)
Web link	http://www2.liikennevirasto.fi/alk/keliennuste/ (Finnish) http://www2.liikennevirasto.fi/alk/svenska/keliennuste/ (Swedish) http://www2.liikennevirasto.fi/alk/english/keliennuste/ (English)
Contacts	Jaakko Myllylä
Other	Available languages of the service: Finnish, Swedish and English The service is being used also by traffic centre operators and winter maintenance operators in their daily work.

GEOGRAPHICAL ASPECTS	
Country	Finland
Region of implementation	Weather data available for whole main road network
Networks concerned	
Deployment indicators	Number of kilometres: 9900 km

SERVICE DESCRIPTION	
Problem(s) addressed / Objectives (Relation to EW objectives. Background/motivation to the ITS application - basic question: WHY)	☐ Reduction of congestion ☒ Increase of safety ☐ Reduction of environmental damage (%) ☒ Other: Increase travellers convenience
ITS service description (Description of ITS application, example of systems used functionality and technologies used, users involved, location, context within wider ITS system, current status of the application.	FTA provides current road weather and a 2-4-6-12 hour forecast for main roads. The main road network is classified into 272 road sections, the length of which is usually between 30 and 50 km, with a minimum of 10 km and maximum of 117 km. The conditions on individual sections as well as any road weather camera images can be seen by moving the mouse on top of the section in question. Thematic coverage: Weather information: Road condition in three categories of normal winter condition (green), bad condition (yellow), and very bad condition (red). sectional information includes reason for category, icons for weather and road surface condition (e.g. ice, rain, sun, clouds,…), temperatures of road and air, and other weather information. Road weather camera pictures are also available of the road sections. Data quality: Forecasts for next 2, 4, 6 and 12 hours. Information updated each 15 minute for current road condition and each hour for the forecasts.

Service requirements (Which type of requirements specifications have been used during the service implementation)	☒Functional requirements ☒Organisational requirements ☐Technical requirements ☒Look & Feel for the end user ☒Level of Service criteria
Requirements specifications (If you have ticked any of the requirements above, can you provide information on how you have received or elicited the requirements, e.g. national recommendations, stakeholder sessions, etc.)	All requirements are based on national guidelines, road weather quality system, EasyWay VIKING ICT infrastructure and Easyway 2012 deployment guidelines.

IMPLEMENTATION ASPECTS	
Duration (start, end)	The service is provided and operated by a service provider. Current contract started in autumn 2013 and it ends in the spring 2016. Start: End:
Lessons learnt / factor of success (Key lessons learnt in various aspects of the planning and implementation process; could be technical, institutional/organizational, legal, financial – basic questions: Was the implementation a success / Were the objectives met? Why? What could be done differently next time?)	Functional Technical Institutional/organisational Legal Financial
Impacts assessment / results (Description of impacts in terms of safety, travel efficiency, environmental impacts, security, traffic management…)	

REFERENCES	
Documentation available on the project	Title: Contact: Language: Finnish

	☐ EW/TEMPO evaluation

ORGANISATIONAL ASPECTS

Classification (in accordance to Part A, chapter 2.3)	Organisation: A4 | public private partnership or concessionaires Obligations for provision: B2 | non mandatory service Data used: C2 | data under public and private scope Business model: D1 | free of charge - non commercial service

ILLUSTRATIONS

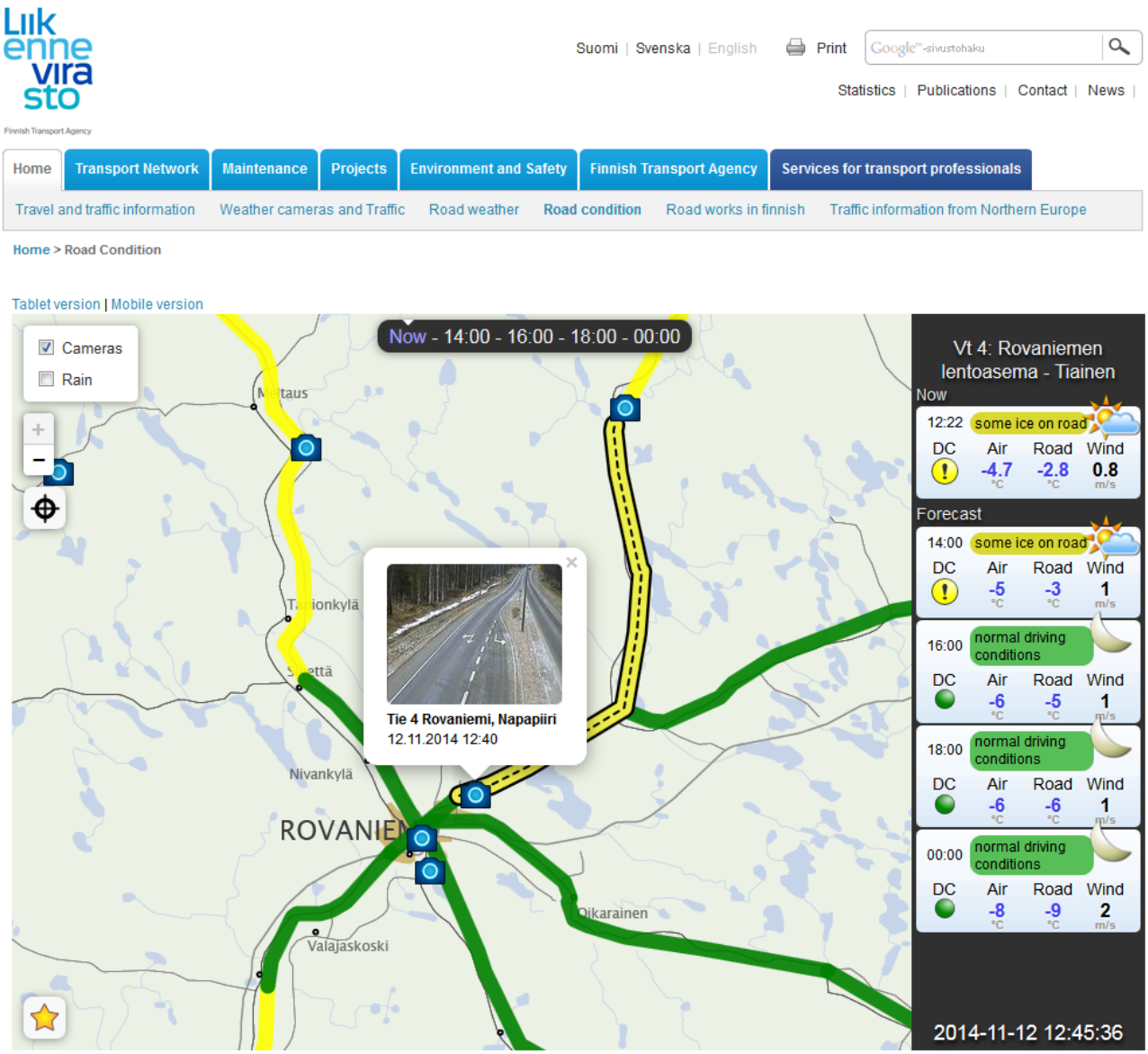

Figure 18: Finnish road section weather forecast service close-up with one link and camera selected.

Example Sweden

GENERAL INFORMATION	
Name of service/project	The Traffic Information Web Site "Läget i trafiken"
Name of operator/organisation	Trafikverket (the Swedish Transport Administration)
Web link	web-based: http://trafikinfo.trafikverket.se/LIT/#url=Vagtrafiken/English

	web-based optimised for mobile devices: http://trafikinfo.trafikverket.se/lit/mobile/
Contacts	Roberg, Clas
Other	Available languages of the service: Swedish, English

GEOGRAPHICAL ASPECTS	
Country	Sweden
Region of implementation	Nation wide
Networks concerned	TERN + main roads
Deployment indicators	Number of kilometres: 6097 km

SERVICE DESCRIPTION	
Problem(s) addressed / Objectives (Relation to EW objectives. Background/motivation to the ITS application - basic question: WHY)	☐ Reduction of congestion ☒ Increase of safety ☐ Reduction of environmental damage (%) ☒ Other: Increase travellers convenience
ITS service description	Weather information for travellers (end user service)
(Description of ITS application, example of systems used functionality and technologies used, users involved, location, context within wider ITS system, current status of the application.	Road conditions and weather situation is displayed on the web site “Läget i Trafiken”. The road condition data is mapped to meteorological sections. Those sections have been defined based on (a similar) meteorological/ thermal behaviour. The weather information displayed to the public is: Average wind, Max wind, Precipitation and Temperature. Public road weather information during winter: Wind, precipitation, temperature, road conditions (dry, wet, ice, snow, slush), prediction of slipperiness Warnings: Slipperiness, strong wind, heavy precipitation , reduced visibility Data quality: 220 Camera stations and approximately 1000 weather stations are delivering data every 30 minutes. The stations are positioned in cold spots and the mapping is performed with a measuring car. Data is combined with data from the Swedish Meteorological Institute and data from road maintenance operators. Support of road maintenance and infrastructure management (expert service). The expert service includes action planning for winter maintenance/operation and also support for payment for winter operation. The information used in the expert system is: Road surface temperature Humidity

	Dew point temperature (condensation temperature) Air temperature Precipitation (type and volume) Wind speed and direction
Service requirements (Which type of requirements specifications have been used during the service implementation)	☒Functional requirements ☐Organisational requirements ☒Technical requirements ☐Look & Feel for the end user ☐Level of Service criteria
Requirements specifications (If you have ticked any of the requirements above, can you provide information on how you have received or elicited the requirements, e.g. national recommendations, stakeholder sessions, etc.)	Continous harmonization with work carried out in Easyway/Viking and Frame.

IMPLEMENTATION ASPECTS	
Duration (start, end)	Service updated: Start: 1/1/2013 End: 11/7/2014
Lessons learnt / factor of success (Key lessons learnt in various aspects of the planning and implementation process; could be technical, institutional/organizational, legal, financial – basic questions: Was the implementation a success / Were the objectives met? Why? What could be done differently next time?)	Functional Technical Institutional/organisational This service is seen as safety related traveller information which should be delivered free of charge to the public. The usage of the service is very high during harsh weather conditions resulting in very high demands on the technical implementation and operation. Legal Financial
Impacts assessment / results (Description of impacts in terms of safety, travel efficiency, environmental impacts, security,	During harsh weather conditions the usage is very high, resulting in major impact on traveler behavior and thus traffic safety.

traffic management…)

REFERENCES

Documentation available on the project	Title: Contact: Language: Choose an item. ☐ EW/TEMPO evaluation

ORGANISATIONAL ASPECTS

Classification (in accordance to Part A, chapter 2.3)	Organisation: A4 | public private partnership or concessionaires Obligations for provision: B2 | non mandatory service Data used: C2 | data under public and private scope Business model: D1 | free of charge - non commercial service

ILLUSTRATIONS

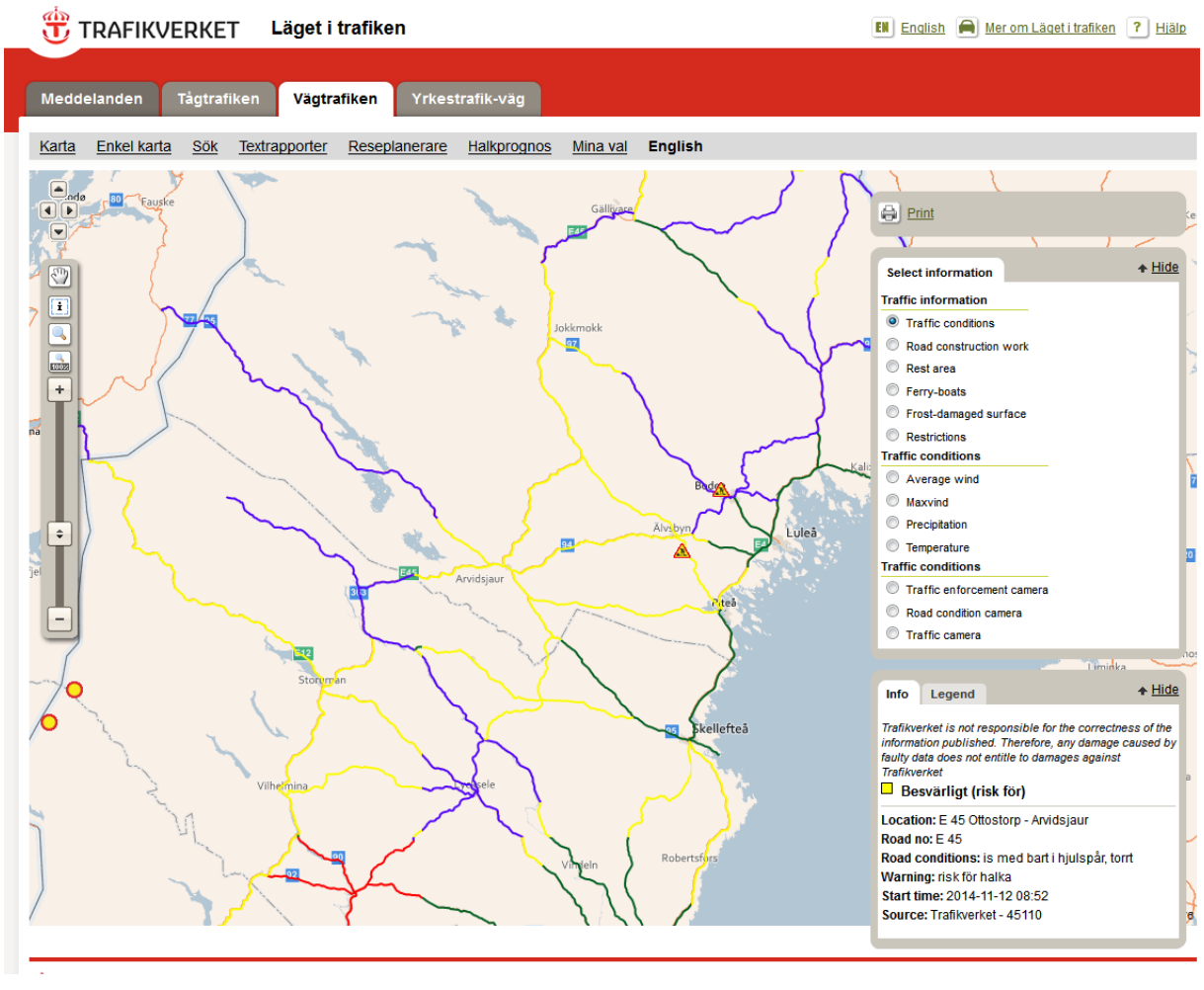

Figure 19: The public website with traffic conditions information and one road section with a warning

Example Finland – T-Loik, integrated UI + ICT platform for road traffic management

GENERAL INFORMATION	
Name of service/project	T-LOIK (TieLiikenteen Ohjauksen Integroitu Käyttöliittymä) Integrated UI + ICT Platform for road traffic management
Name of operator/organisation	The Finnish Transport Agency (FTA)
Web link	N/A, meant for internal users in FTA
Contacts	Markus Nilsson (Jani Laiho)
Other	Available languages of the service: Finnish The service is being used by operators in FTA´s Traffic Management Centres in Finland

GEOGRAPHICAL ASPECTS	
Country	Finland
Region of implementation	
Networks concerned	All of main road network
Deployment indicators	

SERVICE DESCRIPTION	
Problem(s) addressed / Objectives (Relation to EW objectives. Background/motivation to the ITS application - basic question: WHY)	☒Reduction of congestion ☒Increase of safety ☐Reduction of environmental damage (%) ☒Other: Increase travellers convenience
ITS service description (Description of ITS application, example of systems used functionality and technologies used, users involved, location, context within wider ITS system, current status of the application.	Integrated UI + ICT platform for road traffic management. Replaces and/ or integrates 30+ separate systems - Road traffic management systems - Camera systems - Traffic information systems - Road weather information systems - Event management and handling - GIS-system and operational snapshot Aims to provide one coherent user interface for TMC operators that can be operated from one work station and from any geographical location. Centralized alarms and alerts, offers tools to prioritize tasks and allocate resources. In the future will be used to data fusion to provide data analysis, forecasts and different kind of alerts. Also aims to increase

	automation level in TMC operations. Main goal is to shift from reactive processes to proactive processes. Deployment 2013-2018. First phase in operational use 9/2015
Service requirements (Which type of requirements specifications have been used during the service implementation)	☒Functional requirements ☒Organisational requirements ☒Technical requirements ☒Look & Feel for the end user ☒Level of Service criteria
Requirements specifications (If you have ticked any of the requirements above, can you provide information on how you have received or elicited the requirements, e.g. national recommendations, stakeholder sessions, etc.)	Meets the EU directive in SRTI and RTTI.

IMPLEMENTATION ASPECTS	
Duration (start, end)	T-Loik deployment 2013-2018. First phase in operational use 9/2015, second phase to operational use in 1/2016. Start: 2013 End: 2018
Lessons learnt / factor of success (Key lessons learnt in various aspects of the planning and implementation process; could be technical, institutional/organizational, legal, financial – basic questions: Was the implementation a success / Were the objectives met? Why? What could be done differently next time?)	Functional Agile software development methods have been a good way to manage the project. End users (in FTA´s TMC) have been involved since the beginning and that has been helpful in the development process and in the introduction of T-Loik. Technical FTA is the integrator and owns development platforms and the source code. Open source, generic and reusable services used as much as possible. As this is a system for TMC operators, not for end-users, therefore most of the weather information deployment guideline requirements are not valid for this implementation. Institutional/organisational Legal Financial

Impacts assessment / results (Description of impacts in terms of safety, travel efficiency, environmental impacts, security, traffic management…)	Impact assessment has not been done for T-Loik yet.

REFERENCES

Documentation available on the project	Title: Contact: Markus Nilsson (Jani Laiho) Language: Finnish ☐ EW/TEMPO evaluation

ORGANISATIONAL ASPECTS

Classification (in accordance to Part A, chapter 2.3)	Organisation: A4 | public private partnership or concessionaires Obligations for provision: B2 | non mandatory service Data used: C2 | data under public and private scope Business model: D1 | free of charge - non commercial service

ILLUSTRATIONS

T-Loik workstation

3.2 Business Model

3.2.1 Stakeholders in Service Provision

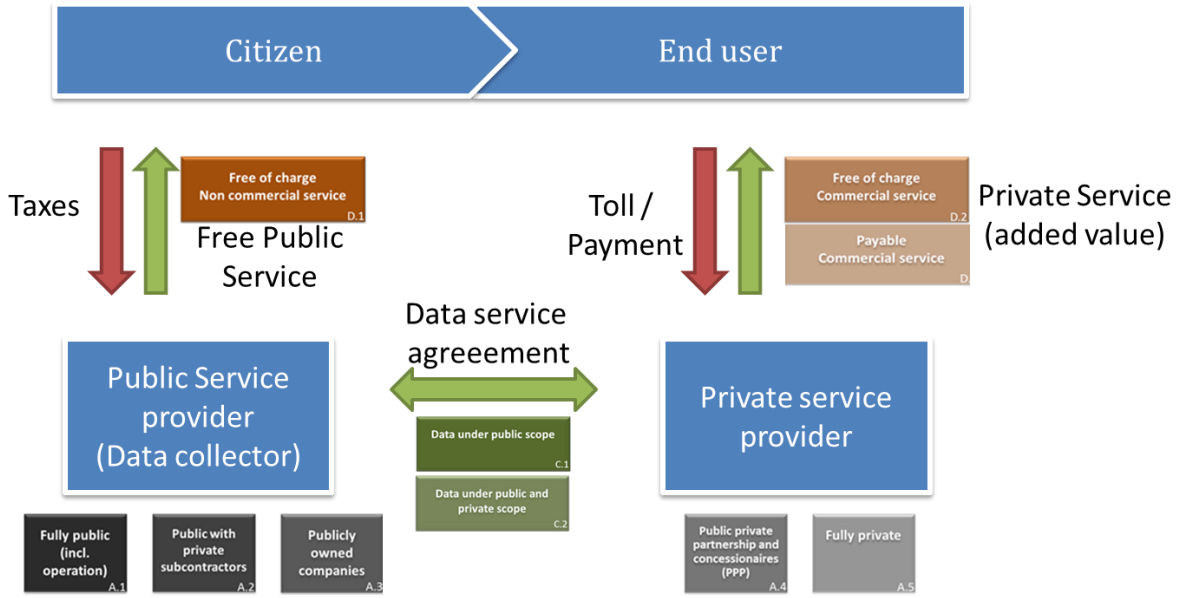

Figure 20: Stakeholders in Service Provision (Source: EasyWay TIS Expert Group)

3.2.2 Cost / Benefit Analysis

A universally valid statement cannot give due to the different models which exist across European member states. The following cost/benefit statement is meant to give a general introduction of C/B for a weather information service based on the existing German RWIS service. It is provided by EasyWay EEG and 2DECIDE project.

A Weather monitoring itself does not provide any monetised benefits unless it is combined with information services such as weather centres and information systems. As an example, monitoring ITS in Finland consists of 11 central stations, about 200 workstations, and about 150 observation stations which provide information to the system users. The associated road weather information system (monitoring and information services) was projected to yield a benefit-to-cost ratio of 5:1 by reducing annual vehicle costs, and improving motorist travel time and safety. In non-European cases, through the Utah DOT Weather Operations Program, meteorologists based at the TOC use information from environmental sensing stations in the field to provide detailed forecasts to winter maintenance personnel, saving $2.2 million per year in labour and materials for snow and ice control activities. That is, approximately 18 percent of the 2004-2005 labour and material costs. The program had an estimated benefit-to-cost ratio of 10:1. Finally, the Wisconsin DOT used an ice detection system and a snow forecasting model to aid in the dispatch of snow ploughs and de-icers saving 4 hours per person for each significant storm (a value of around $144,000/storm), and approximately $75,000 in salt.

4 Annex A: Compliance Checklist

4.1 Compliance checklist "**must**"

#	Requirement	Fulfilled?		If no – quote of insurmountable reasons
		Yes	No	
Functional requirements				
None				
Organisational requirements				
None				
Technical requirements				
None				
Common Look & Feel requirements				
None				
Level of Service requirements				
None				

4.2 Compliance checklist "**should**"

#	Requirement	Fulfilled?		If no – explanation of deviation
		Yes	No	
Functional requirements				
FR1	The system **should** support road maintenance and infrastructure management (expert service) and **should** be able to collect, process and disseminate weather information for travellers (end user service)			
FR2	The system **should** provide information in the native language(s) at the output location, and from a user selected choice of other appropriate foreign languages, when applicable			
FR3	A written system **should** provide information using graphical representation or text. Graphical form **should** include the use of maps as well as text			
Organisational requirements				
None				
Technical requirements				
None				
Common Look & Feel requirements				
None				
Level of Service requirements				
LoSR1	In the case that pre-deployment surveys / evaluations provide the necessary evidence to proceed with the deployment of the ITS-service "Weather Information", the minimum and optimum LoS **should** respect the following Level of Service to Operating Environment mapping table.			

4.3 Compliance checklist "**may**"

#	Requirement	Fulfilled?		If no – explanation of deviation
		Yes	No	
Functional requirements				
FR4	Functional decomposition and the provision of interfaces **may** be carried out to ensure interoperability in those cases that the service is carried out by more than one organisation (and is recommended in any case to be prepared for an easy functional decomposition as may be the case in the future)			
FR5	Data exchange between the content provider, service operators and service provider **may** follow the common agreed interface (CAI) specifications, developed under the FP7 co-financed In-Time project			
FR6	The following information **may** be provided for weather information and weather warnings			
FR7	The weather information services **may** be able to provide weather information and warnings pre-trip (e.g. web-based ...) as well as on-trip (e.g. road-side equipment like VMS or mobile internet/ APPs ...) to be integrated into the traffic predicting programs			
Organisational requirements				
None				
Technical requirements				
TR1	The European standard EN 15518:2011 Winter Maintenance Equipment – Road Weather Information Systems as well as the German technical bulletin “Technische Lieferbedingungen für Streckenstationen” (TLS, draft version 2010) as well as the “Hinweise zur Erfassung und Nutzung von Umfelddaten in Streckenstationen“ (FGSV 306, 2010) **may** be considered particularly in relation to the collection of road weather station data			
TR2	To enable interoperability between different actors involved in the traffic information condition service value chain the following Data collection DATEXII-Profiles **may** be used (If DATEX I protocol is in place this can be seen as equivalent substitution)			

Common Look & Feel requirements				
CL&FR1	Three or four levels **may** be indicated based on seriousness/ probability of the event when providing a web-based information service			
CL&FR2	A graphical representation **may** use a pictogram + a coloured bar to indicate the level of seriousness/ probability when providing a web-based information service			
CL&FR3	As content for pictograms the defined set of content for pictograms **may** be used when providing a web-based information service			
Level of Service requirements				
None				

5 Annex B: Bibliography

1. **S. Bradner, (Network Working Group).** Key words for use in RFCs to Indicate Requirement Levels. *The Internet Engineering Task Force (IETF).* [Online] March 1997. http://www.ietf.org/rfc/rfc2119.txt.

6 Annex C: Weather relevant ALERT-C Event Codes

Weather relevant events	ALERT-C Event Code
LEVEL OF SERVICE	
flooding. Stationary traffic	928
flooding. Danger of stationary traffic	929
flooding. Queuing traffic	930
flooding. Danger of queuing traffic	931
flooding. Slow traffic	932
flooding. Heavy traffic	934
flooding. Traffic flowing freely	936
flooding. Traffic building up	937
EXPECTED LEVEL OF SERVICE	
flooding. Slow traffic expected	933
flooding. Heavy traffic expected	935
CLOSURES AND LANE RESTRICTIONS	
blocked by storm damage	925
TRAFFIC RESTRICTIONS	
closed due to flooding	938
closed due to avalanches	943
closed due to avalanche risk	993
closed due to ice build-up	995
closed due to rockfalls	945
OBSTRUCTION HAZARDS	
storm damage	904
storm damage. Danger	986
storm damage expected	972
flooding	907
flooding expected	900
flooding. Danger	908
flash floods	909
danger of flash floods	910
flash floods. Danger	991
avalanches	911
avalanches. Danger	992
avalanche risk	912
avalanche risk. Danger	994
ice build-up	975
rockfalls	913
rockfalls. Danger	998
landslips	914
landslips. Danger	999
mud slide	976
flooding. Passable with care	942
avalanches. Passable with care (above Q hundred metres)	944
ice build-up. Passable with care (above Q hundred metres)	996
rockfalls. Passable with care	946
landslips. Passable with care	948
ice build-up. Single alternate traffic	997
ROAD CONDITIONS	
extremely hazardous driving conditions (above Q hundred metres)	1037
extremely hazardous driving conditions expected (above Q hundred meters)	1073
hazardous driving conditions (above Q hundred metres)	1001
difficult driving conditions (above Q hundred metres)	1038
passable with care (up to Q hundred metres)	1039

passable (up to Q hundred metres)	1040
surface water hazard	1041
danger of aquaplaning	1002
slippery road (above Q hundred metres)	1003
mud on road	1004
mud on road. Danger	1055
leaves on road	1005
loose sand on road	1042
ice (above Q hundred metres)	1006
danger of ice (above Q hundred metres)	1007
icy patches (above Q hundred metres)	1047
danger of icy patches (above Q hundred metres)	1048
black ice (above Q hundred metres)	1008
danger of black ice (above Q hundred metres)	1050
freezing rain (above Q hundred metres)	1009
freezing rain expected (above Q hundred metres)	1074
wet and icy roads (above Q hundred metres)	1010
slush (above Q hundred metres)	1011
snow on the road (above Q hundred metres)	1012
packed snow (above Q hundred metres)	1013
fresh snow (above Q hundred metres)	1014
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snow drifts (above Q hundred metres)	1016
slippery road (above Q hundred metres) due to snow	1018
slippery road (above Q hundred metres) due to frost	1019
slippery due to spillage on roadway	1017
slippery due to loose sand on roadway	1054
icy patches (above Q hundred metres) on bridges	1060
danger of icy patches (above Q hundred metres) on bridges	1061
icy patches (above Q hundred metres) on bridges, in shaded areas and on slip roads	1062
road blocked by snow (above Q hundred metres)	1020
danger of road being blocked by snow (above Q hundred metres)	1075
snow cleared	1070
driving conditions improved	1065
skid hazard reduced	1069
conditions of road surface improved	1024
TEMPERATURES	
current temperature (Q)	1083
heavy frost	1115
frost	1116
temperature falling rapidly (to Q)	1079
extreme heat (up to Q)	1080
extreme cold (of Q)	1081
less extreme temperatures	1082
PRECIPITATION AND VISIBILITY	
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damaging hail (with visibility reduced to Q) expected	1174
hail (visibility reduced to Q)	1106
sleet (visibility reduced to Q)	1107
thunderstorms (visibility reduced to Q)	1108
winter storm (visibility reduced	1128

to Q)	
blizzard (visibility reduced to Q)	1130
blizzard (with visibility reduced to Q) expected	1173
heavy snowfall (Q)	1101
heavy snowfall (Q) expected	1170
heavy snowfall. Visibility reduced (to Q)	1134
heavy snowfall (Q). Visibility reduced to <30 m	1102
heavy snowfall (Q). Visibility reduced to <50 m	1103
snowfall (Q)	1104
snowfall. Visibility reduced (to Q)	1135
snowfall (Q). Visibility reduced to <100 m	1105
heavy rain (Q)	1109
heavy rain (Q) expected	1171
heavy rain. Visibility reduced (to Q)	1136
heavy rain (Q). Visibility reduced to <30 m	1110
heavy rain (Q). Visibility reduced to <50 m	1111
rain (Q)	1112
rain. Visibility reduced (to Q)	1137
rain (Q). Visibility reduced to <100 m	1113
showers. Visibility reduced (to Q)	1114
visibility reduced (to Q)	1318
visibility reduced to <30 m	1319
visibility reduced to <50 m	1320
visibility reduced to <100 m	1321
reduced visibility (to Q) expected	1175
white out (visibility reduced to Q)	1322
blowing snow (visibility reduced to Q)	1323

smoke hazard (visibility reduced to Q)	1309
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blowing dust (visibility reduced to Q)	1310
sandstorms (visibility reduced to Q)	1326
swarms of insects (visibility reduced to Q)	1340
dense fog (visibility reduced to Q)	1301
dense fog (with visibility reduced to Q) expected	1177
fog (visibility reduced to Q)	1304
patchy fog (visibility reduced to Q)	1307
patchy fog (with visibility reduced to Q) expected	1178
freezing fog (visibility reduced to Q)	1308
freezing fog (visibility reduced to Q). Slippery roads	1337
freezing fog expected (with visibility reduced to Q). Danger of slippery roads	1176
dense fog. Visibility reduced to <30 m	1302
dense fog. Visibility reduced to <50 m	1303
fog. Visibility reduced to <100 m	1305
snowfall and fog (visibility reduced to Q)	1312
fog forecast withdrawn	1346
fog clearing	1345
visibility improved	1313
visibility expected to improve	1179
weather expected to improve	1172
weather situation improved	1126
adverse weather warning	1180

withdrawn	
WIND AND AIR QUALITY	
tornadoes	1201
hurricane force winds (Q)	1202
gales (Q)	1203
storm force winds (Q)	1204
strong winds (Q)	1205
gusty winds (Q)	1209
crosswinds (Q)	1210
strong winds (Q) affecting high-sided vehicles	1211
severe smog	1190
severe exhaust pollution	1191
tornado warning ended	1217
strong winds easing	1213
DELAYS	
flooding. Delays (Q)	939
flooding. Delays (Q) expected	940
flooding. Long delays (Q)	941
WEATHER FORECAST	
(Q probability of) heavy snowfall	1151
(Q probability of) snowfall	1152
(Q probability of) winter storm	1129
(Q probability of) blizzard	1131
(Q probability of) damaging hail	1133
(Q probability of) hail	1153
(Q probability of) sleet	1154
(Q probability of) thunderstorms	1155
(Q probability of) sandstorms	1327
(Q probability of) heavy rain	1156
(Q probability of) rain	1157
(Q probability of) showers	1158
(Q probability of) heavy frost	1159
(Q probability of) frost	1160
(Q probability of) overcast weather	1117
(Q probability of) mostly cloudy	1118
(Q probability of) partly cloudy	1119
(Q probability of) sunny periods	1120
(Q probability of) clear weather	1121
(Q probability of) sunny weather	1122
(Q probability of) mostly dry weather	1123
(Q probability of) dry weather	1124
sunny periods and with (Q probability of) showers	1125
(Q probability of) dense fog	1315
(Q probability of) fog	1306
(Q probability of) patchy fog	1316
(Q probability of) freezing fog	1317
snowfall and fog (visibility reduced to Q) expected	1300
weather forecast withdrawn	1140
fog forecast withdrawn	1141
severe weather warnings cancelled	1138
ROAD CONDITIONS FORECAST	
ice expected (above Q hundred metres)	1046
icy patches expected (above Q hundred metres)	1049
black ice expected (above Q hundred metres)	1051
freezing rain expected (above Q hundred metres)	1052
snow drifts expected (above Q hundred metres)	1053
slippery road expected (above Q hundred metres)	1143
road conditions forecast withdrawn	1071
ENVIRONMENT	
(Q probability of) air quality: good	1328
(Q probability of) air quality: fair	1329

(Q probability of) air quality: poor	1330
(Q probability of) air quality: very poor	1331
(Q probability of) severe exhaust pollution	1311
(Q probability of) smog	1333
air quality improved	1339
WIND FORECAST	
(Q probability of) tornadoes	1251
hurricane force winds (Q)	1252
gales (Q)	1253
storm force winds (Q)	1254
strong winds (Q)	1255
moderate winds (Q)	1206
light winds (Q)	1207
calm weather	1208
strong wind forecast withdrawn	1256
tornado watch cancelled	1216
wind forecast withdrawn	1218
TEMPERATURE FORECAST	
maximum temperature (of Q)	1351
temperature rising (to Q)	1359
minimum temperature (of Q)	1401
temperature falling rapidly (to Q)	1360
temperature (Q)	1361
effective temperature, with wind chill (Q)	1362
extreme heat (up to Q)	1364
hot, (maximum temperature Q)	1352
warm, (maximum temperature Q)	1353
mild, (maximum temperature Q)	1354
cool, (maximum temperature Q)	1355
cold, (maximum temperature Q)	1356
very cold, (maximum temperature Q)	1357
extreme cold (of Q)	1365
very warm (minimum temperature Q)	1402
warm (minimum temperature Q)	1403
mild (minimum temperature Q)	1404
cool (minimum temperature Q)	1405
cold (minimum temperature Q)	1406
very cold (minimum temperature Q)	1407
less extreme temperatures expected	1408
DELAY FORECAST	
flooding. Delays (Q) have to be expected	1684

Table 12: Weather related ALERT-C Event Codes

7 Annex D: End notes

i Draft ISO/PDTR 21707 Intelligent Transport Systems – Integrated Transport Information, Management and Control – Data Quality in ITS Systems, 30. March 2007