Harmonising European ITS Services

Traveller Information Services

SPEED LIMIT INFORMATION

Deployment Guideline

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The Deployment Guidelines have been developed in EasyWay, EIP and EIP+
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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

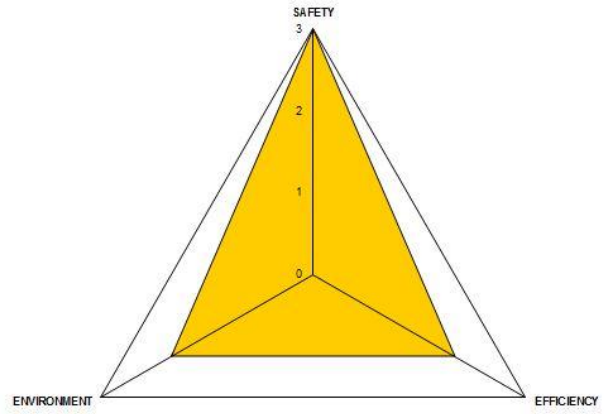
SERVICE DEFINITION

Speed limit information is a service which informs road users about prevailing speed limits. Static speed limits as well as variable speed limit information related to special conditions, such as bad weather, road work sites, congestion, etc. should be provided where appropriate.

SERVICE OBJECTIVE

One of the pre-requisites for achieving harmonisation on the TEN-T is that the driver must know, always and everywhere, the current speed limit which applies on the section of road he is using. Informing about speed limits plays an important role in increasing safety on roads as it contributes to the reduction of incidents caused by drivers failing to observe the relevant limits. It also has the potential to support ITS traffic management measures such as speed regulation for heavy traffic or pollution.

SERVICE BENEFIT RADAR



EUROPEAN DIMENSION

Speed limit information is a key safety related item on road network all over Europe. However, at present, each country determines and applies its own rules. Information about the current speed limit is not always signposted (implicit speed limits related to general speed limits that apply in a country) and it's a major difficulty for a European driver who doesn't know the rules in every country.

Furthermore, methods of regulating speed are very different in all European countries. Also there is no common method of collecting, storing and providing etc. data of speed limit information across Europe. This points to the need to harmonize data collection and exchange of speed limit information all over Europe in order to have continuous information for a driver who has to respect speed limits for his safety and to comply with the law. This is a significant challenge and points to further work by the ITS Community.

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List of abbreviations

ASF	Autoroutes du Sud de la France
ASFA	Association des Sociétés Françaises d'Autoroutes
ATMB	Autoroute et Tunnel du Mont Blanc
BALI	BAse de données LImites de vitesse
CEDR	Conference of European Directors of Roads
CL&F	Common Look and Feel
COOPERS	CO-OPERative Systems for intelligent Road Safety
DATEXII	Standard developed for information exchange between traffic management centres, traffic information centres and service providers
DG	Deployment Guideline
DG.INFSO	Directorate General for INFOrmationSOciety and media
EC	European Commission
ECE	Economic commission for Europe
ESG	European Study Group
ESG1	European Study Group 1
FR	Functional Requirement
ICT	Information and Communication Technology
ITS	Intelligent Transportation System
NPRA	Norwegian Public Road Administration
NRDB	National Road Data Base
OR	Organizational Requirement
QUANTIS	Quality Assessment and Assurance Methodology for Traffic data and Information Services
ROSATTE	Road Safety ATTributes exchange infrastructure in Europe
RDS-TMC	Radio Data System Traffic Message Channel
SETRA	Service d'Etudes sur les Transports, les Routes et leurs Aménagements
SL	Speed limit
TERN	Trans-European Road Network
TEN-T	Trans-European Network
TPEG	Transport Protocol Experts Group
TIS	Traffic Information Services
TR	Technical requirement
VMS	Variable Message Sign
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

Speed limit information deals with different ways to inform the driver that must know, always and wherever he is, the speed limit which applies on the section he's driving. This can be either

- static speed limit information or
- dynamic speed limit information used by road operators for traffic management measures (heavy traffic, road works, weather, pollution …).

Speed limit information can be provided in a variety of ways. Apart from the 'traditional' fixed metal road signs, this information can be conveyed to the driver in a number of other ways, for example, by the use of consistent roadside signing typically using Variable Message Signs, road markings or the use of in-vehicle systems to inform drivers about the speed limit in force and even send a warning if speeding.

Furthermore, the development and use of in-vehicle systems as a means of informing drivers about the speed limit in force on a road section continues to grow rapidly. This type of in-vehicle information system makes use of detailed speed limit databases that are linked to digital maps. In view of missing and/or poor quality speed limit information, some vehicle manufacturer use for their in-vehicle systems data collection by video cameras capable of detecting the speed limit values from the speed limit signs via image processing. Such systems, provided they are accurate, enable the drivers to get information on the speed limit in force, wherever they are on a network.

1.2.1.2 What is the Vision?

One of the pre-requisites for achieving harmonisation on the TEN-T is that the driver must know, always and everywhere, the current speed limit which applies on the section of road being used. Information about speed limits plays an important role in increasing safety on roads as it contributes to the reduction of incidents caused by drivers failing to observe the relevant limits. With the additional provision of the reasons for the speed limits in place the service has also the potential to support ITS traffic management measures such as speed regulation for heavy traffic or pollution. User acceptance is a key factor to achieve the desired results. If the drivers understand the reasons for the displayed speed limits and experience them as relevant, they are more motivated to observe them. A second main focus is to harmonise functionality, so that the "feel" is consistent.

1.2.1.3 What is the Mission?

The principal objectives of this service are:

- Improve road safety thanks to reduction of incidents and accidents dues to speeding or incorrect adjustment of speed in relation with traffic conditions (weather, traffic density…)
- Free the user of uncertainty of the speed limit in force, especially in cross border areas, thanks to a system remembering along the trip implicit speed limits as well as signposted speed limits, the driver may not remember.
- Facilitate traffic management measures like speed control for heavy traffic or pollution for example in displaying reinforced user information about the measure in place and speed limit contribution to this measure. Facilitate traffic management measures like speed control for heavy traffic or pollution for example by displaying reinforced user information about the measure in place and speed limit contribution to this measure

1.2.1.4 EasyWay harmonization focus

European challenges to harmonise methods of collecting, storing, providing and update data and information and having a common and closer cooperation between road operators and map providers. This under the condition that various road rules have to be respected and applied in the different countries/states and on different levels of development.

Hence the main focus lies in the interoperability between road operators having the knowledge of speed limits and national, regional or local broadcasters and service providers, which provide speed limit information to mass audiences like on-board navigation devices.

1.2.1.5 Distinctiveness from other ITS-services

Speed limit information service can be both linked and distinguished to other ITS services. On the one hand speed limit is specific information as it is police information, submitted to enforcement, and a safety attribute already provided on the roadside. Speed limit information is determined, stored and managed by police authority.

But speed limit is also used for traffic management measures and road works management and so is currently closely linked to traffic management service speed control and variable speed limit (see TMS-DG02).

1.2.2 Contribution to EasyWay Objectives

1.2.2.1 Service radar

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

The graph below provides a quantification of the added value of “Speed limit 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.

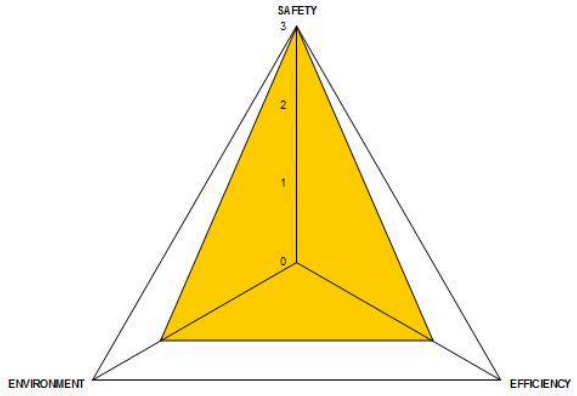


Figure 1: Service radar “Speed limit information”

1.2.2.2 Safety

Speed is at the core of ensuring road safety on any road network. This is principally because speed has a considerable impact on almost all accidents. According to the European Road Safety Observatory, in around 30% of the fatal accidents speed is an essential contributory factor. This is for two main reasons:

- Firstly, speed affects the risk of being involved in an accident. There are global statements made about the relationship between speed and accidents. At a higher speed, it is more difficult to react in time and prevent an accident. Generally speaking, deviation from the average speed on the section (generally the speed limit if needed adapted to traffic conditions of traffic circulation) entail the increase of the risk of accident

- Secondly, speed affects the injury consequences of an accident.

Whereas almost all drivers know what the general speed limits are in familiar areas, there is still often uncertainty about the speed limit in force when driving on unfamiliar road sections. This has even greater significance in cross-border areas where the driver can be confusing speed limits in place.
Easily identifiable and understandable Speed Limit information can contribute to a reduction in incidents. Reminding travellers to take into account the current "safe" speed according to the real time traffic, road and weather conditions will further improve road safety.

1.2.2.3 Environmental impact

Measures applied for network efficiency to reduce congestion have consequential secondary benefits for the environment through reducing the impact of associated air pollution whilst vehicles are at a standstill.

In case of pollution alerts, speed limit reduction information can also contribute to reduce traffic pollution impact during pollution alert periods.

1.2.2.4 Network efficiency

Dynamic speed limit information can also contribute to supporting traffic management when speed limits are used to regulate driver behaviour. For example, during incidences of heavy traffic it is possible to improve traffic flow by reducing speed limit and so reduce congestion. Speed harmonization of the flow can also contribute to optimization of the traffic flow.

1.2.3 Current status of deployment

Different ways of communicating speed limits are currently used: dynamic display systems (VMS), information into the vehicle via navigation systems or the vehicle itself.

Main practices provided by different member states are detailed in Part B.

<u>Dynamic display systems integrated to the infrastructure</u>

- Dynamic speed limit displaying management on VMS according to traffic level -
- Dynamic speed limit remote control in tunnels
- Dynamic speed limit remote control per lane

<u>Digital map speed limit database</u>

On one hand providers of digital maps for in-vehicle applications produce and continuously update their map databases containing speed limits information. This is done by driving the roads and using a multitude of sources of information. The quality of the information is sometimes hindered by poor update frequency resulting in speed limit changes on the network not being replicated on map databases.

On the other hand, road authorities are creating the changes of these road attributes and have a substantial need for digital road databases including speed limit information for the road network under their responsibility. They are also the most efficient source of such changes and some road managers already took the initiative to create speed limits databases for their own use.

It is therefore evident that a closer collaboration between the road authorities and digital map providers on the maintenance of such databases would lead to a much more reliable and trustworthy information source which would enhance the safety of the road user. However, this requires commitment by road authorities to report and notify updates in a timely and standardized manner and to make that available to map providers and for good communication between both parties.

There are various European services in operation, partly operated by public transport companies, public authorities, but also private providers

<u>Location referencing standardisation efforts</u>

Different Location referencing Standards have been tested in the definition of a specific format for speed limit information exchange are Open LR, OGC OpenLS - Core Services, Abstract Data Types (ADT) and ISO ISO 17572-3: AGORA-C through ROSATTE format.

Roadside communication with the vehicle

Another important development which is at the forefront of ITS development is in the area of using roadside infrastructure to communicate with vehicles.

1.2.4 European Dimension

Speed limit information is a key safety related item on the road network all over Europe. However, at present, each country determines and applies its own rules. Information about the current speed limit is not always signposted (implicit speed limits related to general speed limits that apply in a country) and it's a major difficulty for a European driver who doesn't know the rules in every country.

Furthermore, methods of regulating speed are very different in all European countries (different actors involved (private, public), authority, collecting or not into a database, pointed or included in paper orders,…). Also there is no common method of collecting, storing and providing etc. data of speed limit information across Europe. This points to the need to harmonize data collection and exchange of speed limit information all over Europe in order to have continuous information for a driver who has to respect speed limits for his safety and to comply with the law. This is a significant challenge and points to further work by the ITS Community.

INSPIRE directive

The INSPIRE directive came into force on 15 May 2007 and will be implemented in various stages, with full implementation required by 2019.

The INSPIRE directive aims to create a European Union (EU) spatial data infrastructure. This will enable the sharing of spatial information among public sector organisations and better facilitate public access to spatial information across Europe.

A European Spatial Data Infrastructure will assist in policy-making across boundaries. Therefore, the spatial information considered under the directive is extensive and includes a great variety of topical and technical themes.

INSPIRE is based on a number of common principles:

- Data should be collected only once and kept where it can be maintained most effectively.
- It should be possible to combine seamless spatial information from different sources across Europe and share it with many users and applications.
- It should be possible for information collected at one level/scale to be shared with all levels/scales; detailed for thorough investigations, general for strategic purposes.
- Geographic information needed for good governance at all levels must be readily and transparently available.
- It must be easy to find what geographic information is available, how it can be used to meet a particular need, and under which conditions it can be acquired and used.

But Inspire has been guided primarily from environmental aspects and thus not been given the precision in the spatial reference needed for speed limit information. If the positioning of Speed Limit information would be based on the thoughts from Inspire, more work has to be done on data model and geo-referencing.

2 Part A: Harmonization Requirements

2.1 Service Definition

"Speed limit information" is a service which dynamically informs road users about prevailing speed limits. Static speed limits as well as variable speed limit information related to special conditions, such as bad weather, road work sites, congestion, etc. should be provided where appropriate.

2.2 Functional Requirements

2.2.1 Functional architecture

The following diagram gives a schematic overview of the typical system architecture required to handle a speed limit information service. Main components are the Data Collection processes,

- on one hand for static speed limit information collection by road authorities and
- on the other hand, for dynamic speed limit information processes with their measurement equipment.

The current Deployment Guidelines is dealing with the service to make static **and** dynamic speed limit available to the driver through various media. Navigation systems have the ability to provide an improved update frequency and the proposed architecture allows the possibility to deal with dynamic speed limit information provided by infrastructure communicating systems, or to include dynamic speed limit updates into a speed limit database.

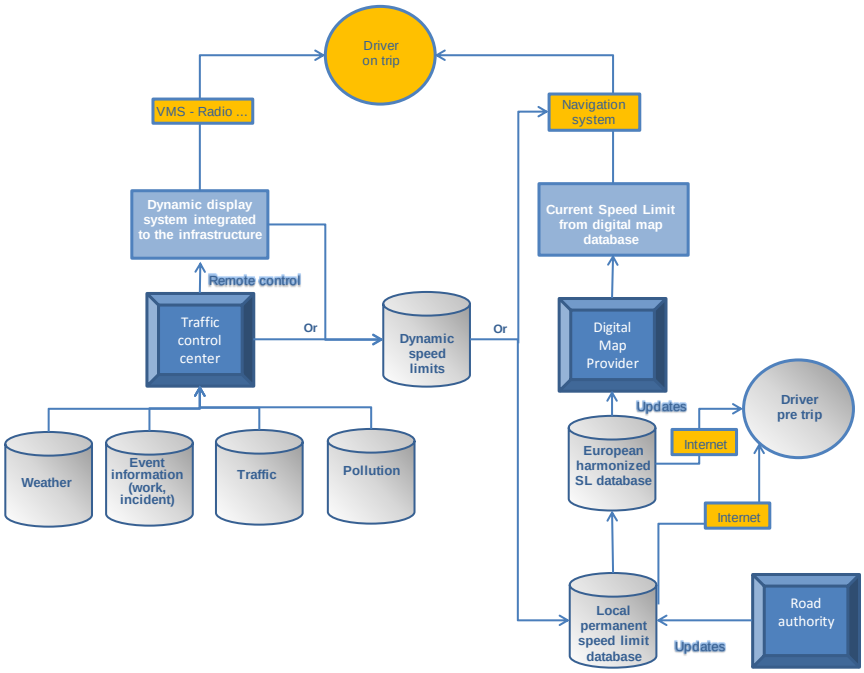


Figure 2: Diagram of a typical system architecture and information flow of a speed limit service

Note: Within Europe different methodologies exist to collect speed limit information and to store appropriate information in databases. These methodologies are not covered by the present Deployment Guideline and are left to the road operator/content owner to select. They depend amongst other things on the particular information collection used and the processing system applied.

Functional requirements:

- **FR1**: Source, scope and quality of speed limit information provided by content owners to content providers **must** both be defined and part of data interface descriptions.

- **FR2**: Speed limit information collected and information provided by content owners to content providers **must** be based upon both a consistent geographic reference model and a time validity model, which both **must** be agreed among parties participating in the service and part of data interface descriptions.
- **FR3**: If a speed limit information service involves road operators and service providers, information exchange platform systems between road operators and service providers **should** be implemented to update the databases
- **FR4**: The frequency of the updates of the speed limit databases **should** be agreed and ensured by parties participating in the service.
- **FR5:** A feedback loop between service providers and the road operators **should** be put in place to ensure correct data provision and integration in the speed limits databases.

2.2.2 Functional decomposition[1] and interfaces

The function of the service is to provide speed limit information to road users either pre-trip or on-trip. This may be demand responsive or led by the information providers. In Europe, both public and private information providers are involved in this information provision (see organisational requirements). Hence the decomposition of the whole service into sub-functions is necessary identifying interfaces to be standardised.

The following figure shows the typical functional architecture of a “Speed limit information service”. The vertical lines show the identification of interfaces to be optimised:

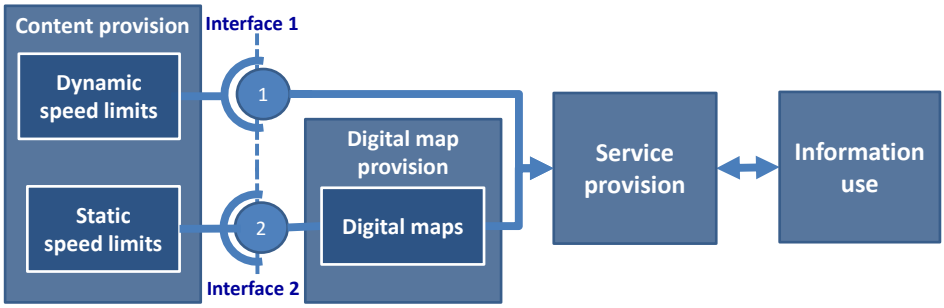


Figure 3: Functional architecture Speed limit information value chain

2.2.2.1 Interface Requirements

Interface requirement interface 1 - Dynamic speed limits (see also Technical requirements):

FR6: To foster interoperability between all involved parties the sub-functions service and content provision **should** require/provide an interface with the appropriate information structure for dynamic (variable) speed limits, which is specified in EW Deployment Guideline TMS-DG02 "variable speed limit".

Interface requirement interface 2 - Static speed limits (see also Technical requirements):

- **FR7**: To foster interoperability between all involved parties the sub-functions service provision and digital map provision **should** require/provide an interface with the appropriate information structure for static speed limits
  - Data content:
    - starting and ending point
    - direction
    - speed
  - physical exchange format
  - location reference

[1]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.

2.3 Organisational Requirements

A general overarching description of the key actors, their roles in the value chain and the related conditions for TIS-service provision is outlined in the "Traveller Information Services REFERENCE DOCUMENT, TIS Deployment Guideline Annex":

- Chapter 3.1 "Introduction to key actors in the traveller information chain" and
- Chapter 3.2 "Conditions for Service Provision - Business Model"

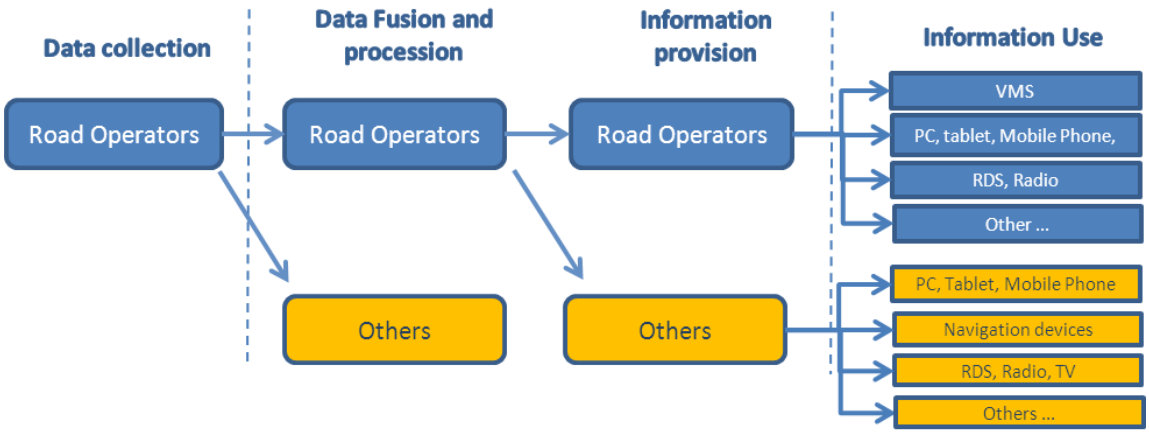


Figure 4: Speed limit information value chain

Note: For provision of dynamic speed limits via VMS please refer to the Deployment Guideline “TMS-DG02 - Variable speed limits” from Traffic management services Guideline. It will not be treated in this Deployment Guideline.

Note: The revision of qualified and up-to-date information of permanent and temporary/dynamic speed limits on board requires a complete organisation and good cooperation between different stakeholders from wide Europe and different entities involved as described on the value chain in figure 5.

The following figure gives an overview of the organizational characteristics of traveller Information Services

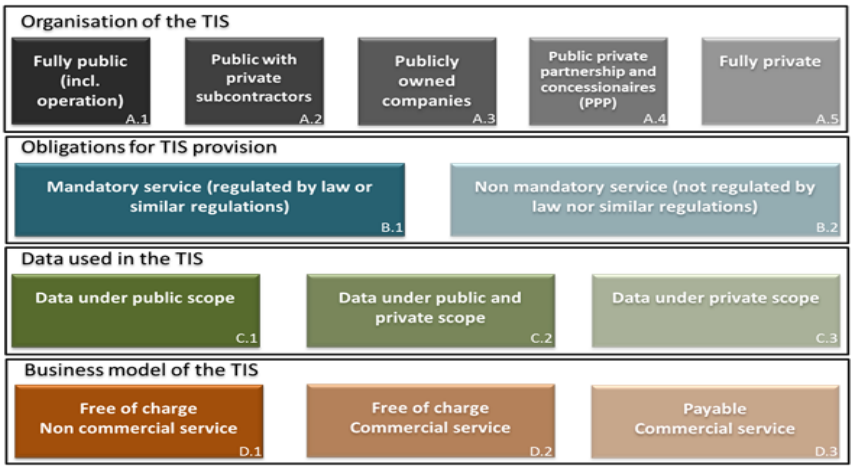


Figure 5: Organisational characteristics of traveller information services

Speed limit information service can be characterized with the criteria shown in figure 5 as following:

Organization of the TIS

This 5 categories A.1 to A.5, which shows responsibilities decomposition for the service, allows different organisations.

Organisational Advice:

- It is recommended that the Public authority, that is responsible for regulations, would be involved in Organisation of the speed limit information service.

Obligation for TIS provision, data used in the TIS

Organisational Advices:

- As basic safety road data regulated by public authorities, the static speed limit information service may be considered as service free of charge for the user
- Concerning dynamic speed limit information - some characteristics related to the speed limit in place as road works or speed control measures for example - can be managed by private companies. This data issued by different sources may be under public and private scope

For dynamic speed limit communication through VMS

- Traffic data that can impact the speed limit can be collected through a real time traffic management system (traffic events, driving conditions, pollution, weather…)
- An appropriate density of VMS along the section concerned should allow the driver to know where the measure applies, starts and ends (one can find more details in paragraph 2.6.3 in table “Level of service related to operating environments”)
- The VMS remote control system is controlled by a traffic control centre
- Speed control measure may be accompanied by a communication campaign initiated by the road operator through different media (VMS, flyers, radio, television, internet…)

For communicating permanent speed limits inside the car

- Qualified and updated speed limits should be stored in a database. Speed limit entered in the database can be explicit, implicit, recommended or “free”. The Minimum requisite speed limit that applies on some road networks should not be integrated into the database to avoid confusions.

For communicating variable/dynamic speed limits inside the car

- In order to be able to ensure variable/dynamic speed limits information service, data on events should be collected through a real time system (traffic, accidents, pollution, weather…)
- Exchange systems should be deployed to communicate events in real time
- A communication media should update changes in real time in vehicle

Enforcement

Numerous concerns regarding the implementation of speed limit information service involves the issue of enforcement. At this stage legal effects (enforcement) only result from traffic signs and not from their representation on board with information systems (e.g. navigation devices).

Monitoring and enforceable obligations arise only in connection with the first one (traffic signs). Static signs and variable message signs count to the legal arrangement of speed limits. In addition, the information about the arranged Speed limits may be given via information systems provided in the vehicle, however this information does not supersede or change the traffic law arrangement; the in-vehicle presentation does not relieve the driver of the responsibility to obey the current traffic law arrangement from VMS and static signs."

Organisational Advice:

- It must be decided, whether the further specification shall be limited to board information systems. At least, an accurate differentiation between the legal effects of traffic signs and pure information by on-board systems must be made. It is recommended to exclude Speed limit information of enforcement reliability without complete quality check of the information provided.

2.4 Technical Requirements

2.4.1 ICT Infrastructure requirements

No specific requirements or advice apart from what is mentioned in 2.2.1 and 2.2.2 See also 3.1.2 for current best practices.

2.4.2 Standards and Agreements: Existing and Required

2.4.2.1 Preliminary remarks

Standardisation in this context is a vital constituent to ensure interoperability, reduction of risk, reduction of the cost base, promotion of an open market and many social, economic and community benefits are to be gained from more informed travellers, network managers and transport operators.

In order to foster data exchange and services interoperability between road operators the use of standards is recommended. A list of different standards is presented within the "Traveller Information Services REFERENCE DOCUMENT, TIS Deployment Guideline Annex, ".

Note: From this list some standards can be extracted, which could be relevant for Speed limit information services, in particular standards linked to location referencing.

- For interface 1 - Dynamic (variable) speed limits: an appropriate DATEXII-Profile is documented in EW-DG TMS-DG02 " VARIABLE SPEED LIMITS"
- For interface 2 - Static speed limits: the available location referencing standards have either not the sufficient consensus at European level or do not have the necessary maturity to be used as binding requirement within an EasyWay Guideline. Hence there is still the need for additional specifications.

2.4.2.2 DATEXII-Profiles

Interoperable interfaces between systems are essential for the delivery of many EasyWay objectives such as continuity of services and cross-border traffic management cooperation. Hence, EasyWay has itself decided to actively contribute to the establishment of the required standardisation effort by launching a dedicated working group ESG5 and liaising with the relevant European standardisation body, namely with CEN TC278 WG8 (“Road Traffic Data”). The result of this cooperation is the “DATEX II” specification for interoperable machine-to-machine communication of ITS services, available as European Standard CEN/TS 16157. This specification is used throughout EasyWay for interoperable access to dynamic traffic and travel data.

Technical requirement:

- **TR1**: To enable interoperability between different organisations[2] involved in the speed limit information value chain the corresponding DATEXII-Profiles[3] **should** be used for interface 1 as specified in "TRAFFIC MANAGEMENT SERVICES - VARIABLE SPEED LIMITS Deployment Guideline TMS-DG02", chapter "2.4 Technical requirements TR4" When service is operating it **should** be disseminated via DATEX II”.

[2] In the TIS context, ‘organisations’ mean Traffic and Traveller Data providers and Services providers
[3] 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

2.4.2.3 Need for Additional Specifications

Speed limit information service allowing the communication of speed limit information into navigations systems (static, temporary or dynamic), is based on exchange of spatial data. Data providing information on the speed limit in force must be linked to its spatial reference. To enable interoperability between the different content owners and service providers' of static speed limits location references must be compliant with map providers' requirements. This problem has not been solved until now, but there are already different efforts dealing with standardisation of location referencing.

2.5 Common Look & Feel

2.5.1 Pre-eminence of VMS signing or of the lowest current speed limit over fixed message signing

In certain countries, the use of variable signing requires that all signing must be variable. That can lead to problems in the event of electrical failure, for example, but under these conditions there is no inconsistency between fixed signing and variable signing. However, for economic reasons, other countries often use both types of signing, which can sometimes lead to inconsistencies. This obviously damages the credibility of signage in the eyes of the road user and weakens the influence on driver behaviour. It also leads to enforcement difficulties, for example, in the case of speed control measures.

This is why it is be desirable to introduce the notion of pre-eminence of variable message signing over fixed message signing, or pre-eminence of the lowest current speed limit:

- In the Netherlands the issue of inconsistency of signing has been solved by an explicit and new arrangement in Dutch traffic laws: both ways of signing have equal value and that the lowest speed always must be obeyed. This solution can avoid problems of inconsistency between road signs and variable signs, as in practice, the variable speed limits are in general lower than the permanent one. So the VMS, when active, will have a natural pre-eminence over fixed signs but not a pre-eminence by regulation or by law
- One country (Spain) has introduced the pre-eminence of variable message signing into its traffic regulations, but the design and location of VMS in this country are such that there is no ambiguity.

For other countries, a solution needs to be found: this could for example be to say: when both types of signing exist, variable message signing is designed "with a reverse black background", in conformity with article 8 of the Vienna Convention, and it has priority over fixed message signs. Or as in the Netherlands, introduce a natural pre-eminence of the variable speed limit on VMS by making it mandatory to observe the lowest current speed limit. the problem of having fixed panels between VMS panels can be solved by the careful and proper placing of fixed signs and VMS panels, or by replacing the fixed panels thus preventing confusing situations for drivers.

<u>Common look & feel advice:</u>

- The problem of having fixed panels between VMS panels can be solved by a careful and proper placing of fixed signs and VMS panels, or by replacing the fixed panels thus preventing confusing situations for drivers.

2.5.2 Speed limit display harmonisation

Speed limit itself can be language independent represented by original metal road signs but using light on a dark background. Dynamic/temporary speed limit information may be completed by a danger warning sign or information sign (square) representing road works, heavy traffic, raining, slippery road, fog or pollution. This specific complementary signing should be language independent to avoid situations where the European traveller may not be able to understand information concerning his/her safety or the interest of the measure.

ECE communicated a consolidated resolution on road signs and signals (ECE/TRANS/WP.1/119/Rev.2) which contains all the recommendations on road signs that have been adopted by the WP.1 up to and including its fifty-ninth session (22-24 march 2010) and replaces all the previous versions. The fifth part is dedicated to VMS and recommends the use of a selection of signs. The ones concerning speed limit information are represented in figure 10 below.

Complementary signing (examples)

C,14 Speed limit

C, 17b End of speed limit

A,16 Road works

A, 24 Heavy traffic

G, 27 Congestion

A, 36 fog

Figure 6: Signs required for speed limit information taken from ECE/TRANS/WP.1/119/Rev.2

Common Look & feel requirements:

- **CL&FR1**: Speed limits **must** be consistent and there must be no discrepancies between the static and dynamic signage of speed limits. If this cannot be achieved, speed limit will not be displayed.
- **CL&FR2: S**pecific complementary signing of speed limit signings **should** be language independent.

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 Speed limit services follows the general Levels of Service definition (core criteria) outlined in the "Traveller Information Services REFERENCE DOCUMENT, TIS Deployment Guideline Annex" chapter 5.1 "Levels of service and quality"

Levels of Service Table: Speed Limit information				
Core Criteria		**A**	**B**	**C**
User interface		One fixed language (official language)	Information available in a common and shared language	Information provided independent of language (speed limit sign)
Neighbouring Provision		No information exchange	Information exchange to neighbouring network only	Neighbouring network and beyond information provider exchange
Local and secondary Network Information		*Non applicable. There is no need to be informed about local and secondary network speed limit in place*		
Level of Detail* (Location Reference)	**Display on infrastructure (1) recurrence**	To geographic area	Route specific segments (between 2 junctions)	Road segment specific (approx. 10 km)
	Navigation systems (2) completeness	Not complete lots of gaps	Some gaps	No gaps
Static / Dynamic		Static only	Static and partly dynamic/temporary	Static and fully dynamic
Legend: **Note**: For some service level definition, differences appear concerning dynamic speed limit displaying systems integrated to road side equipment or speed limit databases information provided by in-vehicle systems, that's why both items are treated in two separated cells.				

Table 2: Level of Service

The "Levels of quality table" reflects the requirements of the information quality which are needed for Speed limit information Services. This table is not end-user oriented as the Table 2: Level of Service. The definitions of the below-mentioned table are according to the ISO/PDTR 21707[i] standard.

Levels of Quality Table: Speed Limit Information				
Criteria	**0**	**1**	**2**	**3**
Accessibility	From existing equipment	Only at event hotspots	On main routes	On all routes
Availability	Not guaranteed	Guaranteed to a minimum amount of time	Guaranteed all the time	
Timeliness	Not guaranteed	Guaranteed to a time interval	In real time	
Update frequency	Static	Only when requested	On a regular basis	As frequent as a change occurs
Quality Assurance	No regulation	Either input or output (partial check)	Service chain check (full)	Quality Assurance label
Cross verified	No verification	Information from one source – no reliability	Information from one or more sources with reliability confirmed	Data fusion from different sources with reliability confirmed
Accuracy	No consistency/not correct	Consistent/correct, spatial accuracy <1km	Consistent/ correct, spatial accuracy minimum to identify a speed limit (3 sec travel time : depend on speed limit))	Exact reflexion of information on the field/regulations (less than 1 sec travel time)

Definitions:

- **Accessibility**: Qualifies the user's exposure to the information service
- **Availability**: Qualifies the period during which the availability of the service to the specified standards is defined/guaranteed
- **Timeliness**: Time delay between the event detection and the provision of the information to the end-user
- **Update frequency**: Qualifies the frequency of updating information or update interval
- **Information Quality Assurance**: Incorporates the need to undertake check in the data chain
- **Accuracy**: Degree of adherence of (geographic) data to the most plausible respective true value (can be absolute, relative, quantitative, and temporal) this includes for speed limit information: spatial accuracy, correctness and consistency of information, compared to information in the regulations or on the field.

Table of examples travel times/speed:

Speed / Travel time	130 km/h	110 km/h	120 km/h	90 km/h	80 km/h	50 km/h	80 miles/h
1 s	36	31	33	25	22	14	36
3 s	108	92	100	75	67	42	107

Table 3: Levels of Quality table

2.6.3 Level of Service Criteria related to Operating Environment

Level of service requirement:

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

Name of Service / Criteria for the Levels of Service [reference <DG spec>]			EasyWay OPERATING ENVIRONMENT																
			C1	T1	T2	T3	T4	R1	R2	R3	R4	R5	R6	R7	R8	S1	S2	N1	N2	P1
User interface	C	Data provided independent of language (speed limit sign)	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	B	Data available in different or common shared languages																		
	A	One fixed language	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Neighbouring Provision	C	Exchange with Neighbouring and beyond Information Provider	NR																	
	B	Beyon information provider exchange	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	A	No exchange	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Local and secondary information	C / B / A	*Non relevant :There is no need to be informed about local and secondary network speed limit in place*	NR																	
Level of detail – Display on infrastructure (1) recurrence	C	Road segment specific (approx 10 km)	OM	O	O	O	OM	O	O	O	O	O	O	O	O	O	O	O	O	O
	B	Route specific segments (between 2 junctions)		M	M	M		M	M	M	M	M	M	M	M	M	M	M	M	M
	A	To geographic area	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Level of detail – Navigation systems (2) completeness	C	Complete no gap	OM	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	B	Mostly complete Some gaps		M	M	M	M			M	M			M	M	M	M	M	M	M
	A	Not complete lots of gaps						M	M			M	M							
Static / Dynamic	C	Static and full dynamic											O			O	O	O	O	O
	B	static and part dynamic/temporary	OM		O	O	O		O	O	O			O	O					
	A	Static only		OM	M	M	M	OM	M	M	M	OM	M	M	M	M	M	M	M	M

Recommendations for LoS per OE:				
	M	Minimum LoS recommended	O	Optimum LoS recommended
	OM	Minimum = Optimum	NR	Non relevant

Table 4: 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 5 : 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 Sweden

GENERAL INFORMATION	
Name of service/project	Speed limit information services based on RDT (a

	national database for traffic regulations).
Name of operator/organisation	Service providers, receiving speed limit data from the Swedish Transport Agency.
Web link	www.rdt.se
Contacts	rdt@transportstyrelsen.se
Other	Government authorities and municipalities deciding on certain traffic regulations (e.g. speed limits) are obliged to publish the regulations on a dedicated website, operated by the Swedish Transport Agency. The interpreted and road net positioned traffic rules are distributed via the national road database channels to service providers for use in their services.
Applicable Deployment Guideline	DG04 Speed limit Information

GEOGRAPHICAL ASPECTS	
Country	Sweden
Region of implementation	Sweden
Networks concerned	All road networks
Deployment indicators	Number of service providers (20) Percentage of vehicles using speed limit services (1%)

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: To modernise the handling of traffic regulations, make it easier to find regulations and improve the rule of law. To be able to offer machine interpretable regulations with the position connected to the road-network.
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. (maximum 50 words)	The database is aiming at giving service providers access to legally valid speed limit information through NVDB-channels. Use of the information in services and penetration in equipment is still at an initial stage but rapidly increasing. Services are introduced in e.g. fleet management systems, navigation systems and mobile phone applications.
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.)	Current requirements (ticked above) mainly refer to back end system e.g. structure of info and database, means of, and responsibility for providing data and requirements on connection to road network.

IMPLEMENTATION ASPECTS	
Duration (start, end)	Start: 1990'th (beginning of ISA) End: 2012 (back end phase implemented) and continuing, with user adaptation.
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 Back end system with judicial implications have very high demands on security issues Institutional/organisational Investigating institutional and organisational roles and responsibilities and arranging cooperation between the actors has been a key issue. Legal The Swedish legislation has been changed. The traffic regulations have to be registered in the database to be legally valid. All regulations had to be rewritten to achieve this and have been a prerequisite for a successful project. Financial Costs have been distributed to all stakeholders
Impacts assessment / results (Description of impacts in terms of safety, travel efficiency, environmental impacts, security, traffic management…)	Can be seen as a first step in a full scale implementation of ISA and expected results can be found in ISA assessment reports.

3.1.1.2 Examples France

Carte des vitesses limites ASFA/autoroutes Trafic

BALI

Vinci Autoroutes application

ASF speed control on A7 A9 motorway

GENERAL INFORMATION	
Name of service/project	*Speed control on A7 motorway*
Name of operator/organisation	*ASF (Vinci Autoroutes)*
Web link	*www.asf.fr/programmea7-a9.htm*

Contacts	*Laurent Nazzani*
Other	
Applicable Deployment Guideline	Speed limit information service, speed control

GEOGRAPHICAL ASPECTS	
Country	*France*
Region of implementation	*South*
Networks concerned	*Motorway*
Deployment indicators	*330 km*

SERVICE DESCRIPTION	
Problem(s) addressed / Objectives (**Relation** to EW objectives. Background/motivation to the ITS application - basic question: WHY)	*x☐Reduction of congestion* *x☐Increase of safety* *x☐Reduction of environmental damage (%)* *☐Other:*
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. (maximum 50 words)	In order to optimize traffic conditions on A7 motorway during periods of heavy traffic, ASF has since summer 2004 been deploying a real time speed control system. The arrangement in place is based on sophisticated real time information systems that permit to detect traffic saturation 30 to 45 minutes before it appears. According to traffic density in real time, Speed limit is incrementally reduced from 130 km/h to 110 or 90 km/h Drivers are then informed of the speed reduction through numerous Variable Message Sign (VMS) and frequent messages broadcasted Via “radio 107.7” (general traffic information frequency on French motorways). The main benefits from this application have been evaluated and the findings are as follows:
Service requirements **(Which type of requirements specifications have been used during the service implementation)**	Numerous VMS panels have been set up in order to inform the driver regularly as well as a automatic traffic jam detection thanks to loops. A system calculating optimization of speed control and some media to communicate about the operation.
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.)	

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

3.1.2.1 Results “Concept and Practicability” questionnaire

Based on the feedback for the Speed Limit Deployment Guideline in terms of practicability, the Functional, Technical and Common Look & Feel requirements of the guideline are considered easy to apply and highly acceptable. However, the costs associated with the implementation of the speed limit display harmonisation are considered high.

3.1.2.2 Results "Compliance checklists" questionnaire

The responses to the TIS DG04 questionnaire received from the following two Arc Atlantique corridor projects can be summarized as follows:

- Forth Replacement Crossing (FRC) project – This managed motorway project involves the deployment of an innovative Intelligent Transport System to help regulate the flow of traffic approaching and crossing the Forth Crossing Bridge. This project is expected to increased road operational efficiency, capacity and safety.
- M8 M73 M74 Motorway Corridor – This project comprises a package of improvements to the Scotland’s transport networks. It aims to tackle congestion problems on the A8/M8, M73, M74 and at key junctions. The project is expected to deliver wide range of benefits including less congestion and safer, quicker journeys.

It should be noted that some sections of the questionnaire were not fully completed, mainly those that are specific to the requirements of the TIS DG04 guideline document. However, the project teams have acknowledged the need to provide ongoing feedback on the application of DG requirements.

A review of the project team responses to the TIS DG04 questionnaire indicated the following:

Forth Replacement Crossing (FRC) project

- CL&FR1 speed limits must be consistent and there must be no discrepancies between the static and the dynamic signage of speed limits.
- CL&FR2 specific complementary signing of speed limit should be language independent.
- The separation between motorway and non-motorway is important due to a variety of reasons including the fact that in a UK context mandatory speed signals cannot be deployed on a non-motorway class. As an example, the M90&M9 MM corridor is a mix of AP2, 3 and 4 lane roads and is thus treated in the same manner in the deployment of mandatory speed signals.
- The non-motorway context is only relevant to the M90&M9 MM corridor in the case of the legacy FRB carriageway area where advisory speed signals are deployed instead of mandatory speed signals since variable mandatory speed signalling can only be deployed on motorway-class road. In the case of advisory speed signalling then the deployment should be consistent whether dual or single also. This is of particular relevance in rural routes such as the current A9 which is a mix of single and dual carriageway. In this sense, no separation is relevant.
- The separation the class of peri-urban network from the rest of the road network is not considered an important separation in a Scottish motorway context.
- Road classification types are not perceived difficult to understand or use
- OE classes or attributes are perceived to be exhaustive with no obvious missing classes or attributes
- Awareness of the existence of the VMS-DG01 and use of its 32 design principles
- VMS-DG01 is mainly used as an infrequent reference for VMS design
- No knowledge of document forming part of your national legal documents
- All drivers have priorites concerning VMS harmonisation deployment in the corridor

- The following types of road/traffic situation needs international attention
    - Tactical, short term actions (e.g., road works, congestion, fog… 0-5 km ahead)
    - Tactical, middle term actions (e.g., road works, congestion, fog… 5-25 km ahead)
    - Location of events (e.g., Road works between City A and City B)
    - Rerouting: indicating event, exit and alternative way to destination.
    - Detour: indicating event, exit and way to come back to original road to destination
- The following type of specific road situations needs attention on the M90&M9 MM corridor
    - Road works management
    - Congestion management
    - Bad visibility/fog issues
    - Broad weather issues (slippery road, snow-ice, rain)
    - Park and ride
    - Connection to ports, airports
- The VMS deployed along the corridor are capable of displaying both text (T) and pictograms (P)
- Increased use of the pictogram capability in MS4 type VMS may make it feasible to have a VMS that can be used by any driver regardless of language spoken. However use of pictograms on the corridor has been fairly limited to date
- The principles of design and the contents exhibited by posted road signs, and VMS can be very similar or the same in the near future (within 5 years). This would not be the case for in-car displays. However, all three signing means will coexist in the future
- The national public traffic authorities and international traffic authorities should be responsible for regulating the design of in- car displays presenting road signs
- The DATEX II Questionnaire was not completed

M8 M73 M74 Motorway Corridor

- CL&FR1 speed limits must be consistent and there must be no discrepancies between the static and the dynamic signage of speed limits.
- CL&FR2 specific complementary signing of speed limit should be language independent.
- The Operating Environment criteria associated with current and future traffic conditions provide valuable input to the design and implementation of major road projects as well as input to environmental, economic and social impact analyses and would consider using the OE criteria that the majority of the Member States favour, however such OE criteria must be adaptable to meet different local standards applicable within Member States
- It is important for OE criteria to be responsive to local needs within Member States, in terms of reflecting the nature and scope of problems occurring on their specific road networks to enable such problems to be assessed and addressed through cost effective solutions such as single site and route treatments.
- Road classification is an important process that facilitates the grouping of roads into a hierarchy of classes according to the level of service they are intended to provide. As the functions, standards and service levels vary significantly between motorway and non-motorway roads, it is important for classes between motorway and non-motorway roads to be separated. Within the M8 M73 M74 motorway corridor, there is a mix of 2- and 3/4-lane roads. 2 and 3/4-lane roads which are not typically separated when implementing ITS standards and solutions including the management and delivery of speed limit information.

- The management and dissemination of speed limit information should be consistent across both single and dual carriageway roads. However, in scenarios where a route comprises a mix of single and dual carriageway roads, the applicable design standards relating to some aspects of deployment of speed limit infrastructure such as static signs may vary between the two road types. This scenario does not apply to the M8 M73 M74 corridor.
- The separation the class of peri-urban network from the rest of the road network is not considered an important separation in a Scottish motorway context.
- Road classification types are not perceived difficult to understand or use
- No OE class or attribute was considered missing
- Knowledge of the existence of a Deployment Guideline named “Variable Message Signs Harmonisation. Principles of VMS Messages Design.” (VMS-DG01) and the use of its 32 design principles)
- No knowledge of VMS document forming part of national legal documents
- VMS document mainly used as an infrequent reference for VMS design
- All drivers have priorites concerning VMS harmonisation deployment in the corridor
- The following types of road/traffic situation needs international attention
    - Tactical, short term actions (e.g., road works, congestion, fog… 0-5 km ahead)
    - Tactical, middle term actions (e.g., road works, congestion, fog… 5-25 km ahead)
    - Location of events (e.g., Road works between City A and City B)
    - Rerouting: indicating event, exit and alternative way to destination.
    - Detour: indicating event, exit and way to come back to original road to destination
- The following types of specific road situations require attention on the M8 M73 M74 corridor
    - Road works management
    - Congestion management
    - Bad visibility/fog issues
    - Broad weather issues (slippery road, snow-ice, rain)
    - Park and ride
    - Connection to ports, airports
- The VMS deployed along the corridor are capable of displaying both text (T) and pictograms (P)
- Increased use of the pictogram capability in MS4 type VMS may make it feasible to have a VMS that can be used by any driver regardless of language spoken. However, use of pictograms on the corridor has been fairly limited to date
- The principles of design and the contents exhibited by posted road signs, and VMS can be very similar or the same in the near future (within 5 years). This would not be the case for in-car displays. However, all three signing means will coexist in the future
- The national public traffic authorities and international traffic authorities should be responsible for regulating the design of in- car displays presenting road signs
- The DATEX II Questionnaire was not completed.

3.1.2.3 New best practice examples of deployment 2013-2015

Average speed control on toll motorways in Italy (Tutor)

The Safety Tutor system is an average speed camera enforcement system currently deployed on Italy's Autostrade per I'Italia SpA (ASPI) motorway network. The Safety Tutor currently provides speed limit enforcement on over 2700 km of highways (equivalent to approximately 39% of the ASPI network). The system was jointly developed and delivered by ASPI and the Italian Road Police and it is the first permanent deployment of an automatic speed limit enforcement system on Italy's road network.

Figure 7: Safety Tutor system

The primary purpose of the Safety Tutor system is to improve road safety on the ASPI road network. This is achieved through the automatic enforcement of the legal speed limit of a particular section of motorway to prevent speed limit violations as well as encourage road users to consistently travel within the legal speed limit. This innovative system is operational 24 hours a day, 365 days a year.

The deployment of the Safety Tutor system has been targeted at road sections with higher-than average fatality rates and on roads with multi-lane carriageways with high traffic density at speeds of up to 255 km/h. The system uses linked Automatic Number Plate Recognition (ANPR) cameras to monitor the average speed of traffic over a particular section of motorway network. The cameras are installed at targeted locations to capture image of vehicles passing through their field of view. The number plates are read using ANPR technology and, when the same vehicle is recorded by any other camera connected to the system, the average speed of the vehicle is calculated over the known baseline distance. The system verifies speeding offences in two modes: average speed on a motorway stretch and instantaneous speed in a particular time and place. The locations of the cameras are clearly sign posted and an updated location map of the Tutor System cameras is made available via multiple websites. The number plate data of all vehicles which have kept an average speed compliant with legal speed limits are immediately deleted from the database.

The core components of the system include vehicle detection units, image capture and license plate recognition units; safety module, timetable synchronisation unit and communication unit. In term of its core functionality, the system is capable of delivering the following:

- Data detection on all vehicles (plate, vehicle class, speed)
- Automatic search of vehicle owner by means of the MTC Database
- Automatic verification, and print of the speed limit violation
- Automatic transfer of the violation data to the Police server
- Statistics analysis of data
- Speed measurement modes
- Average speeds calculation
- Instantaneous speed calculation

In terms of performance, during its first year of operation, the Safety Tutor system delivered a significant 15% reduction in average speeds and a 25% reduction in peak speeds. In addition, the systems delivered a significant 19% reduction in accident rates and a 51% in accident fatalities.

M90 and M9 Managed Motorway – Intelligent Transport System project

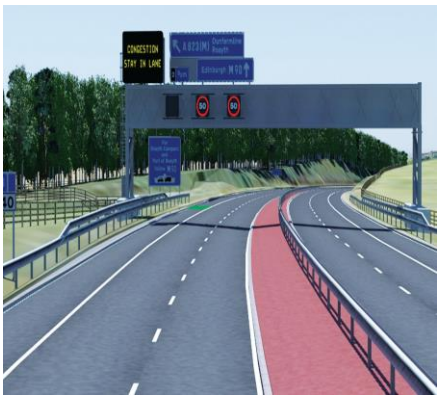
The Forth Replacement Crossing (FRC) project will create a managed motorway system using an Intelligent Transport System (ITS) to regulate the flow of traffic approaching and crossing the Forth Bridge.

Phases 1 and 2 of the Intelligent Transport System will help to manage the flow of traffic on the M90 on the approach to roadworks associated with construction of the new bridge (until 2016) and through M9 Junction 1A (during and after its construction period). The final phase (phase 3) will become operational on completion of the new crossing. The FRC Intelligent Transport System will be monitored and controlled through the Traffic Scotland Control Centre.

The Intelligent Transport System will then extend along a 22km corridor from the M90 Halbeath Junction over the new bridge to the M9 north of Newbridge Junction. Overhead gantries spaced regularly along the corridor will provide lane control, variable mandatory speed control and bus lane control. Variable message signs on the gantries will provide drivers with a wide range of traffic information.

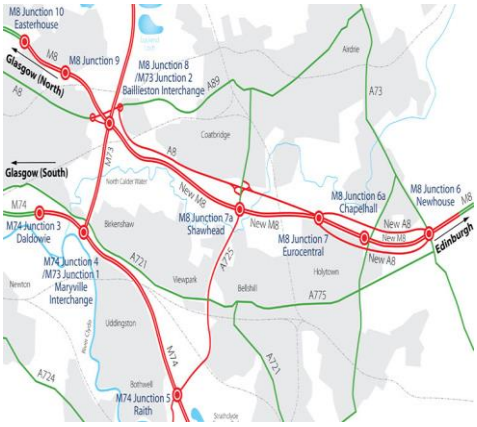
The Intelligent Transport System will allow variable mandatory speed limits to be applied so that vehicle speeds can be managed during congested periods and in response to incidents such as vehicle breakdowns. The system can automatically detect incidents and provide information regarding the road network. The lane-specific motorway signals on the gantries will normally be blank. As traffic congestion builds up, or if there is an incident, the Intelligent Transport System will reduce the normal speed limit. The speed limits displayed will be mandatory and will have a red ring surrounding the speed display. Cameras will be used to enforce the displayed speed limit. Once the level of congestion eases, or the relevant incident ends, the system will restore the speed limit to its normal level

Key Benefits



- There is clear evidence from similar schemes in the UK and across the world that Intelligent Transport Systems increase road operational efficiency, capacity and safety.
- During incidents or periods of congestion when demand exceeds capacity the system will set signals and message signs to inform and advise drivers to effectively manage incidents and reduce queues.
- Variable mandatory speed control will help maintain a steady flow of traffic and limit congestion to make journey times more reliable.
- Evidence indicates that systems which reduce vehicle queues can reduce accidents resulting in injury by up to 13%.

M8 M73 M74 Motorway Improvements



The £500m M8 M73 M74 Motorway Improvements Project represents a significant investment in Scotland's trunk roads, and aims to tackle congestion problems on the A8/M8, M73, M74 and at key junctions including Raith (M74) and Shawhead (A725/A8). This project is delivering the biggest ever package of improvements to the Scotland's transport networks, with benefits including less congestion and safer, quicker journeys. It will also boost Scotland's economy by improving connections between the commercial centres of Glasgow and Edinburgh and beyond.

Sophisticated computer software is used to model complex traffic management scenarios to minimise disruption. Roads users are being warned to expect some disruption as traffic restrictions come into force across affected roads, and are advised to plan journeys according, especially during peak times.

Temporary Traffic Management (TTM) is used to ensure the safety of road users by creating a safe zone whenever it is necessary to work on, or near, a road or footpath which is open to the travelling public. A safe defined route through work areas for all traffic, reducing risk to road users while minimising disruption to the road network. The TTM is designed and implemented to minimise disruption on the existing network as much as possible. A number of complex TTM systems are used during construction. These include lane closures, contraflows, road closures and diversions, temporary traffic signals, reduced speed limits and pedestrian walkway diversions. Average speed cameras have also been introduced to encourage driver compliance and safe driving throughout the project works.

A variety of methods is used to provide members of the public advance notification of major traffic management. Details are available on the Transport Scotland and Traffic Scotland websites / twitter feeds (see info box) and additionally, Traffic Scotland radio broadcasts. At a local level, messages on the overhead gantries and signage is displayed on trunk roads and surrounding local roads where appropriate. Scottish Roads Partnership has a dedicated telephone number and email address, detailed below, which members of the public can contact for specific information.

Key Benefits

- Improving road safety through the reduction of traffic on local roads, reducing lane changing and helping prevent weaving between lanes.
- Improving journey times and journey time reliability through the motorway network
- Helping promote sustainable economic growth by improving access to facilities and employment areas
- Reducing emissions and tackling climate change by improving air quality and providing health improvement
- Reducing the time to transport goods and services
- Cutting congestion

3.2 Business Model

A policy road data regulated by public authorities, speed limit information service should by free of charge for the user.

Nowadays, suppliers of digital maps for direct use in the vehicle must continually update their map databases by covering different networks or through a multitude of information sources (constant surveys, map sharing, feedback …). Nowadays, the updates of databases are typically issued on the basis of a full update about every quarter on a CD or DVD. The future brings us to evolve into a system update instantaneously and progressively incremented, which means that changes will be uploaded onto a server and integrated into the map inside the vehicle. When this reality is reached, providing the data to map providers will be required, particularly in regard to safety road data such as speed limits. Given that public authorities and network operators are the only masters of changes to the signage on their networks, they are more likely to be the source of updates.

So, certain model business considering savings realized by the suppliers of maps seeing itself provided with road dated updates with a qualified information should be envisaged as shown in following figure.

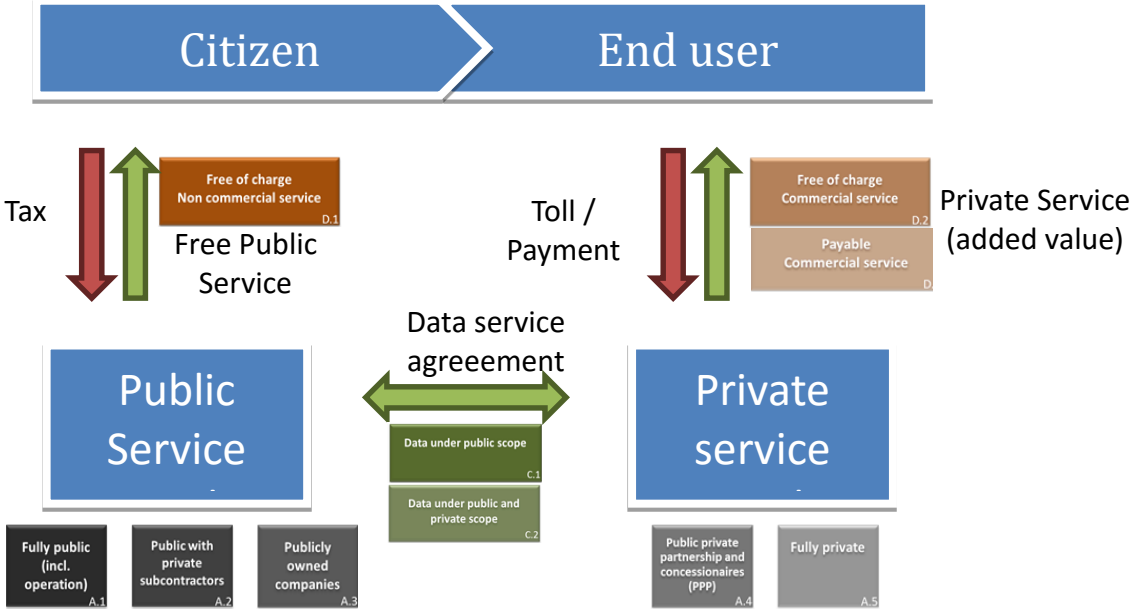


Figure 8: Stakeholders in Service Provision

4 Annex A: Compliance Checklist

4.1 Compliance checklist "**must**"

#	Requirement	Fulfilled?		If no – quote of insurmountable reasons
		Yes	No	
Functional requirements				
FR1	Source, scope and quality of speed limit information provided by content owners to content providers both **must** be defined and part of data interface descriptions.			
FR2	Speed limit information collected and information provided by content owners to content providers **must** be based upon both a consistent geographic reference model and a time validity model, which both **must** be agreed among parties participating in the service and part of data interface descriptions			
Functional requirements: interfaces				
none				
Organisational requirements				
none				
Technical requirements				
none				
Common Look & Feel requirements				
CL&FR1	Speed limits **must** be consistent and there must be no discrepancies between the static and the dynamic signage of speed limits. If this cannot be achieved, speed limit will not be displayed			
Level of Service Requirements				
none				

4.2 Compliance checklist "**should**"

#	Requirement	Fulfilled?		If no – explanation of deviation
		Yes	No	
Functional requirements				
FR3	Information exchange platform systems between road operators and service providers **should** be implemented to update the databases			
FR4	The frequency of the updates of the speed limit databases **should** be agreed and ensured by parties participating in the service.			
FR5	A feedback loop between service providers and the road operators **should** be put in place to ensure correct data provision and integration in the speed limit databases.			
FR6	To foster interoperability between all involved parties the sub-functions service and content provision **should** require/provide an interface with the appropriate information structure for dynamic (variable) speed limits, which is specified in EW Deployment Guideline TMS-DG02 "variable speed limit", that is to say : o Location of variable speed limit o Length affected by the measure			
FR7	To foster interoperability between all involved parties the sub-functions service provision and digital map provision **should** require/provide an interface with the appropriate information structure for static speed limits : o Data content : ▪ starting and ending point ▪ direction ▪ speed o Physical exchange format o Location reference			
Organisational requirements:				
None				
Technical requirements				
TR1	To enable interoperability between different organisations involved in the speed limit information value chain the			

	corresponding DATEXII-Profiles **should** be used for interface 1 as specified in "TRAFFIC MANAGEMENT SERVICES - VARIABLE SPEED LIMITS Deployment Guideline TMS-DG02", chapter "2.4 Technical requirements« 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.			
Common Look & Feel requirements				
CL&FR2	**S**pecific complementary signing of speed limit to indicate reason or condition of application of the speed limit **should** be language independent.			
Level of Service requirements				
LOSR1	In case that pre-deployment surveys/evaluations provide the necessary evidence to proceed with the deployment of ITS-service "SPEED LIMIT INFORMATION SERVICE", 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 yes –remarks
		Yes	No	
Functional requirements				
none				
Organisational requirements				
none				
Technical requirements				
none				
Common Look & Feel requirements				
none				
Level of Service requirements				
none				

5 Annex B: Bibliography

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6 Annex C: Endnotes

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