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D5 – Final Report
Action C - Free Road Safety Traffic Information

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MANAGEMENT SUMMARY

On 16 December 2008 the European Commission adopted the ITS Action Plan (COM (2008) 886) for road transport and interfaces with other modes. The Action Plan aims to accelerate and coordinate the deployment of Intelligent Transport Systems (ITS) in road transport. One of the key priority areas involves optimal use of road, traffic and travel data. The scope of this study falls within that priority area.

Priority Action C of the ITS Directive [2] requires the European Commission to draft specifications for ‘data and procedures for the provision, where possible, of road safety related minimum universal traffic information free of charge to users’.

In March 2012 the EC commissioned a study entitled: “Support To Impact Assessment And Specifications” for “Priority Action C under the ITS Directive [2]: Free Road Safety Related Traffic Information”.

This document is the report of this study. It provides:

- An overview of the current situation of safety related traffic information (SRTI) in Member States
- Results of the inventory and SWOT analysis of data coding standards and distribution channels
- Results of the assessment of the impact of SRTI on road safety in the European Union
- The results of the impact assessment, evaluating 18 different deployment options for SRTI
- Comparison of key deployment options
- Description of Operational Objectives, Indicators and Methods for monitoring and evaluation of possible EC action

The overview of the existing situation indicates that in 3 Member States insufficient content is available to establish safety related traffic information services. In 7 more Member States, content is either limited or availability is unclear. This concerns in particular the smaller or less affluent Member States. In Member States with sufficient traffic information, DATEX is commonly used to code the information.

The broad availability and new deployments of TMC services, suggests that on short term TMC can deliver safety related traffic information to road users in all Member States of the EU. Limited DAB coverage hampers the deployment of TPEG over DAB as alternative to TMC. TPEG coded information is however available via mobile Internet in 16 EU Member States from two providers.

It seems that procedures and systems to monitor and manage quality in general are poorly developed in the Member States. Establishing commonly accepted methods of measuring and monitoring traffic information quality is considered to be an essential first step towards effective quality management of safety related traffic information.

In most Member States, both private and public organisations collect, aggregate and validate traffic data in parallel. The general consensus between both public and private stakeholders is that this dependency is likely to persist in the future.

In nearly all Member States, TMC services are free of charge at the point of use, meaning that once a device or vehicle is purchased, no additional payments by the end-user are required to receive real-time traffic updates. Subscription based traffic information services over mobile Internet are available in at least 18 Member States, with coverage expanding year by year.

The inventory and SWOT analyses of the data coding standards and distribution channels showed that TMC and TPEG (over DAB and IP) provide good solutions for delivering SRTI respectively in the short and medium term, and that DATEX is the preferred choice for the exchange of information between the different actors in the value chain.

DATEX is widely used and commonly accepted as standard for traffic information exchange between traffic management centres, traffic information centres and service providers throughout Europe. It provides a proven method for SRTI data exchange. Various companies offer DATEX encoding and decoding products in a competitive market, making it a cost efficient solution for both public and private organisations.

TMC services have been, or are being, deployed in most Member States. Compared to TPEG services, TMC has limited bandwidth, and low location granularity. The need for location table in the receiver further limits the effectiveness of TMC in delivering SRTI, and restricts possible road coverage. DAB/TPEG data casting is a technically superior alternative to RDS-TMC yet it currently has a marginal market penetration. TPEG over IP (mobile internet) allows for short term deployment but suffers from high data roaming costs.

Cooperative systems (V2I, V2V) could provide an efficient channel, not only for the delivery, but also the collection of SRTI. It is unclear how long wide-scale deployment of cooperative technology in all Member States will require.

Voice radio was considered unsuited as it does not support language independent use, has limited push capabilities and its bandwidth is suited for conveying only the most essential information. Further, VMS, TPEG over DVB-S, SMS/MMS were considered unsuited for various reasons (e.g. costs or too high delivery time).

Each of the assessed channels has specific advantages and disadvantages. Rather than selecting one specific channel for safety related traffic information it might be better to aim for maximum reach using multiple channels. Harmonisation could be achieved by recommending specific channels, while allowing for a controlled transition to new technologies.

The assessment of the impact of SRTI on road safety derived the theoretical maximum reduction to be 2.7% of all road traffic fatalities, and 1.8% of all traffic injuries.

In the detailed impact assessment, the operational costs for the deployment Options suggested limited variation, producing a limited influence on the benefit-cost ratios of the options. The options exhibit significant differences in the implementation costs and expected safety impact. These are the key differentiators in the benefit-cost ratios.

Of all assessed scenarios, scenario 1 to 5, 9, 10, 12 to 15, and 17 produce benefit-cost ratios higher than one. It should be noted that these are also the options that require the most substantial level of investment to realise the benefits, and that all except scenarios 1, 1bis, 2 and 3 exert a negative impact on some of the stakeholders in the existing markets.

The Options with the highest BCR limit SRTI on the Main/National Roads to the *Minimum SRTI*. Adopting Full SRTI for Main/National roads leads to low BCRs as the costs increased more than the savings.

It should also be noted that cooperative systems were not included in the impact assessment because it is highly uncertain when the number of cooperative vehicles on the roads reach a critical mass. Data collection for SRTI is assumed to be entirely based on roadside infrastructure in all options. Vehicle-based measurement of SRTI data was not considered. Such systems might in the future however provide a low-cost method for data collection and dissemination.

In terms of market impact none of the options was assessed as overall negative. However, the options that included end-of-queue information were classified as having a negative impact on some stakeholders, e.g. data aggregators, private service providers and private RTI broadcasters, because it is possible that such a free service affects their competitiveness.

None of the evaluated options has an impact on the Fundamental Rights of the European Union, or was considered to have an overall negative impact on the ITS Directive Principles.

A set of monitoring indicators was drafted to allow for a pragmatic way of monitoring the policy objectives. It is recommended that the Member States gather the required information by engaging relevant parties in the value chain via a series of workshops or web surveys.

TABLE OF CONTENT

1. Introduction

1.1. Scope

This document constitutes deliverable D5 – the Final Report - for the “Support To Impact Assessment And Specifications” for “Priority Action C under the ITS Directive: Free Road Safety Related Traffic Information”.

1.2. Reading Guide

Chapter 1, this Chapter, is the introduction and contains the scope definition and reading guide for the report. Chapter 2 describes the overall methodology.

Chapter 3 presents the overview of the existing situation in the EU Member States. It describes per Member State the content availability, operational and planned DATEX nodes and end-user services, data information and service quality, the organisational setup of the value chain and business models in use.

Chapters 4 and 5 present the results of the SWOT analyses of Data Formats/Standards and Communication Channels that can be used for safety related traffic information.

Chapter 6 presents the results of the safety impact analysis for safety related traffic information.

Chapter 7 presents the results of the impact assessment. First it describes the EC policy options and impact assessment options, and the scope of the impact assessment. Then it presents the results of the detailed impact assessment, the assessment of specific impacts, the assessment of the compliance with the ITS Directive, and finally the organisational models.

Chapter 8 presents the preliminary analysis, followed by the comparison of key deployment options in chapter 9. Chapter 10 elaborates on how to monitor and evaluate the results of possible action by the EC.

Chapter 11 presents the conclusions of the study. Chapter 12 contains the study’s management section.

Acronyms are explained on page 100. Literature references are numbered, marked by [square brackets], and refer to the Bibliography on page 102.

2. Methodology

2.1. Problem Definition and Intervention Logic

Road safety is one of the priorities of European transport policy. Although road fatalities have fallen by 42% since 2001, there were still more than 31,000 deaths on European Roads in 2010. The objective formulated in 2001 to halve road fatalities by 2010 has not been met. The annual number of injured people as a result of road accidents was around 1,500,000 – and did not reduce as strongly as the fatality figure. The new EU objective to further reduce the number of traffic casualties with 50% over the period 2010-2020 will be a great challenge and require the deployment of multiple instruments that have a positive effect on traffic safety. It is widely recognised that accidents on the road to a certain extent can be avoided by timely warning of motorists about unexpected and dangerous traffic incidents and situations.

For many years, the police and road authorities in Member States have collected traffic information to better inform motorists on immediate safety hazards such as ghost drivers, unprotected accident areas, road works etc. However, the current situation as to safety-related traffic information leaves much room for improvement.

In the first place, the information at disposal of road users varies between Member States in terms of content, format and quality. With the emergence or proliferation of traffic information and navigation applications, and an increasing share of private service providers with business models such as subscription and bundling of services, there is a danger services on critical incidents that are currently free of charge will no longer be available to the general public in the future.
Secondly, traffic information to road users is not necessarily made available through communication channels that are compatible and interoperable.

The current situation prevents that a major part of road users benefit from safety-critical universal warnings, allowing them to increase their vigilance. The potential to reduce accidents by effective communication on safety hazards is not exploited. Priority action C of the ITS Directive aims to significantly improve this situation on the medium term.

It will potentially affect all parties of the value chain of such a traffic information service: road authorities; traffic information centres; commercial traffic data/information providers; private road operators; telecom companies; broadcasting organisations; public/private traffic information service providers; automobile clubs; user associations; emergency services.

2.2. Study Objectives and Key Research Questions

As defined in the Terms of Reference [16], the study aims at:

- Providing quantitative and qualitative research and analysis to support and demonstrate the problem definition established by the Commission
- Measuring the potential economic, social and environmental consequences of the various policy options described in the Task Specification

- Consulting the various stakeholders on the envisaged options
- Proposing operational objectives supporting the implementation of the policy options and their long-term evaluation.

In doing so, the study shall enable the Commission to prepare the definition, scope and content of the specifications for the provision of road safety related minimum universal traffic information free of charge to users, in compliance with the obligations of the ITS Directive [2].

2.3. Workflow

To achieve the study objectives and answer the key research questions, a wide range of aspects had to be assessed. A methodology was elaborated to provide for an objective assessment of each aspect, and transparent propagation of analysis decisions. The diagram below presents the individual tasks and sub-tasks of the developed methodology as described in deliverable D1 – the Inception Report.

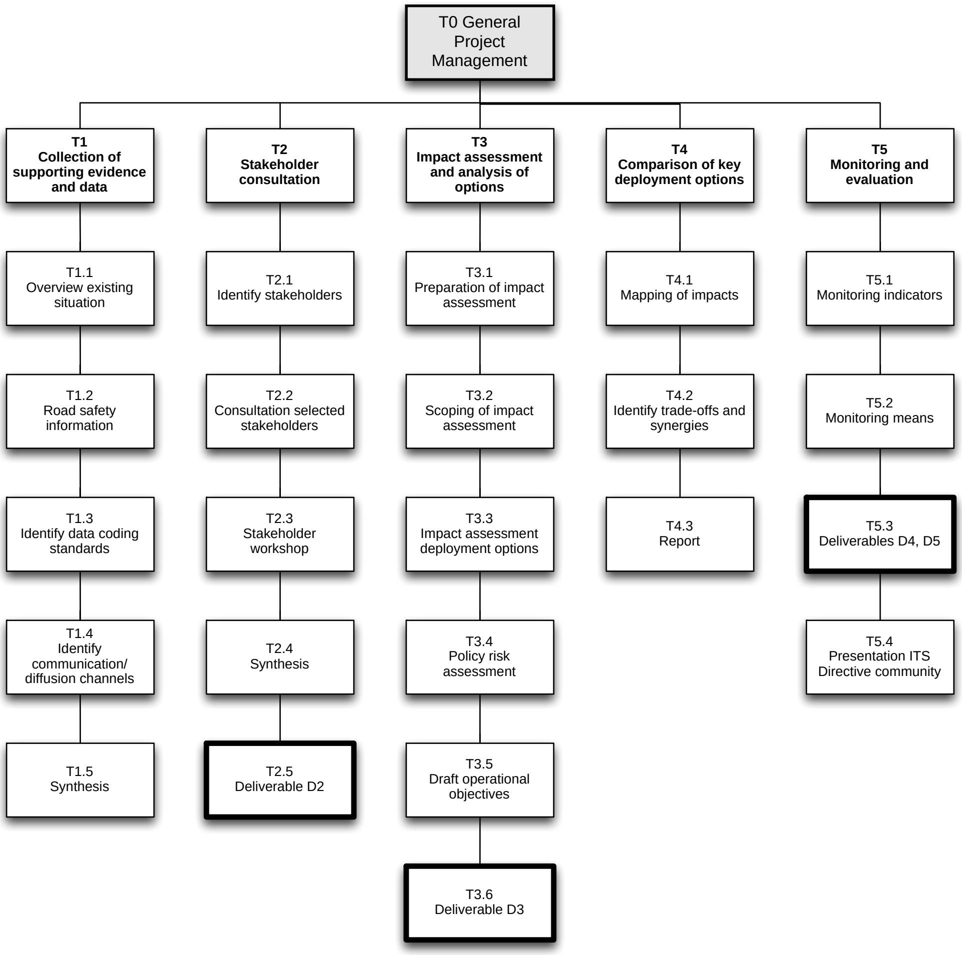

Figure 1 Scope of the study - Workflow diagram

3. Overview of Existing Situation

3.1. Scope

This section of the document presents the overview of the existing situation and business models for the provision of road safety related traffic information (SRTI) in the EU Member States.

3.2. Methodology

The overview is based on information from the study team's evidence base. The evidence base is a compilation of relevant documents and references:

- Information provided by the technical officer of the EC
- EasyWay deployment guidelines, outcomes of the expert study groups, and other relevant EasyWay documents
- The evidence base and deliverables of the previous study on action 1.4 of the ITS Action Plan
- Documents, press releases and web sites of European ITS R&D projects
- CEN/ISO & ETSI working groups on ITS standards
- Documents, press releases and web sites of ERTICO, TISA, CEDR, ARC, FEMA, ITS national organisations, telecom and navigation companies, etc.
- EU platforms such as the eSafety/iMobility RTTI Working Group, European Road Safety Associations (ESC), etc.
- The CARE Database
- The knowledge bases of the consortium partners
- Various professional ITS media
- Web searches

All documents in the evidence base are indexed and categorised to allow for easy reference for the various subtasks of the study.

Based on the evidence base's index, information on the following topics were collected from the various documents:

- Content availability (information types, road class coverage)
- Channels in use
- Traffic data and information quality
- Organisational setup
- Business models used for the provision of safety related traffic information

Each topic was summarised per Member State (Annex A), and per topic a Member State overview was created. Although the Study Team went to considerable lengths to collect relevant information, it should be noted that not for all topics and all Member States the information is complete.

When compiling the overviews, only technology, channels, services and business models were considered, that enable the language independent delivery of safety related traffic information (SRTI) to road users. This includes services based on RDS-TMC, DAB, mobile websites and data services, and smartphone apps. It excludes all information services that can be consulted pre-trip only (desktop web sites), and information presented on voice radio and VMS/DRIPs (not language independent). Services with sparse road coverage (less than the TERN) were also not included in the overviews.

3.3. Content Availability

Table 1 presents the overview of content availability in the Member States of the EU, in terms of road types and information types covered. It should be noted that:

- As information on spatial and temporal granularity of the collection methods in general is not available it is in some cases difficult to assess the level of availability of specific information types on specific road types.
    - A 'Yes' for an information type should therefore be interpreted as 'information of this type is likely to be available in sufficient detail to serve as a basis for a road safety related minimum universal traffic information service'.
    - A 'Yes' for road type coverage should be interpreted as 'most road safety related traffic information (SRTI) types are probably available to allow for a road safety related minimum universal traffic information service on all roads of this type'.
- The information type 'unexpected end-of-queue' is considered to mean information with a locational accuracy and reliability that allows for short-term warning of oncoming traffic. This information is considered a future category as described by TISA [17].

	Motorways	Secondary Roads	City Arteries	Ghost driver	Dangerous road surface	Reduced visibility	Animal / people / debris on the road	Unmanaged road blockage	Unprotected accident area	Short term roadworks	Unexpected end-of-queue
Austria	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Belgium	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Bulgaria	No	No	Yes	Unknown	Unknown	Unknown	Yes	Yes	Unknown	Yes	No
Cyprus	No	No	No	No	No	No	No	No	No	No	No
Czech Republic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Denmark	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Estonia	Some	No	Some	Unknown	Yes	Yes	Unknown	Unknown	Unknown	Unknown	No
Finland	Yes	Yes	Yes	Unknown	Yes	Yes	Unknown	Yes	Unknown	Yes	No
France	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Germany	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Greece	Unknown	No	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No
Hungary	Yes	Yes	Yes	Unknown	Yes	Yes	Unknown	Yes	Unknown	Yes	No
Ireland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Italy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Latvia	Yes	No	Yes	Unknown	Yes	Yes	Unknown	Unknown	Unknown	Yes	No
Lithuania	Yes	No	Yes	Unknown	Yes	Yes	Yes	Yes	Yes	Yes	No
Luxembourg	Yes	Yes	No	Unknown	Yes	Yes	Unknown	Unknown	Unknown	Yes	No
Malta	No	No	No	No	No	No	No	No	No	No	No
Poland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Portugal	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Romania	Yes	Unknown	Unknown	Unknown	Yes	Yes	Unknown	Yes	Unknown	Yes	No
Slovakia	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	No
Slovenia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Spain	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Sweden	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
The Netherlands	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
UK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No

Table 1 Overview of content availability per Member State.

Table 1 shows the different levels of development of traffic information services in Europe. From the table three groups can be distinguished:

1. Member States where safety related traffic information is largely or widely available on the major roads
2. Member States with limited coverage (or largely unclear)
3. Member States with no or very limited coverage

A map of the groupings is presented in Figure 2. Although the groupings are somewhat arbitrary, they do indicate that the content availability in the smaller or less affluent Member States is an issue that needs to be dealt with if a common service level is to be achieved for road safety related traffic information in the EU.

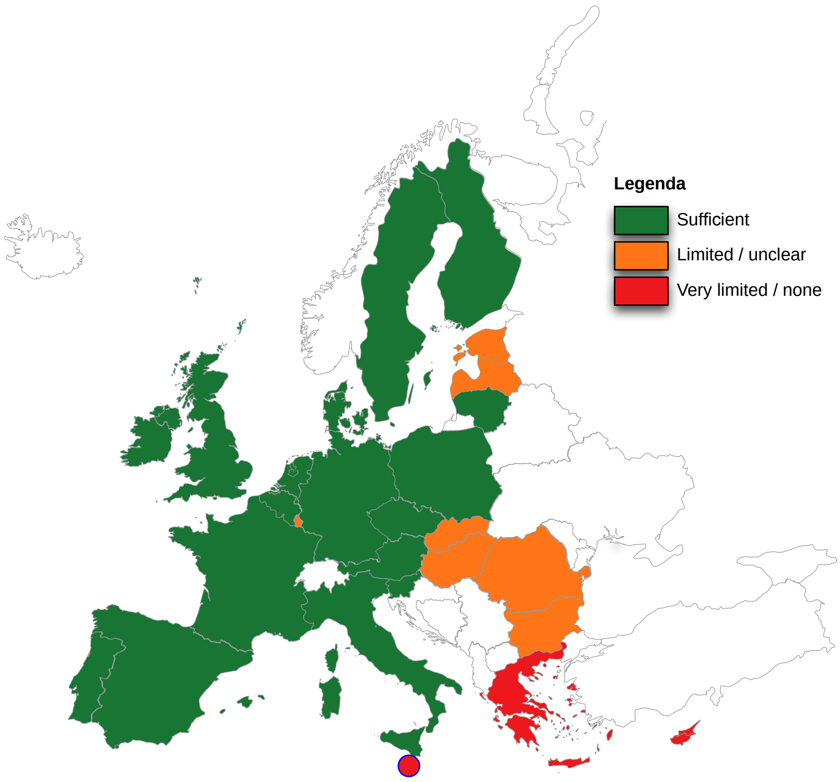

Figure 2 Availability of road safety related traffic information across Europe

What is less obvious from the table and map, but is clear when comparing the information on the Member States in the evidence base, is that the physical and social geography plays a clear role in the availability of content. Finland for example is an affluent Member State with few large conurbations. It therefore has a relatively low availability of real-time congestion and incident information. Because of its subarctic climate it does however have a sophisticated system for collecting weather and road surface data to provide detailed weather and road condition warnings to road users, even in the sparsely populated north of the country. A similar emphasis on weather information can be seen in all Nordic and Alpine countries.

3.4. Operational and Planned DATEX Nodes

Table 2 presents per Member State the current status in terms of the availability of:

- DATEX nodes (version I or II)
- Services that provide road safety related traffic information over:
  - Voice radio
  - RDS-TMC
  - TPEG over DAB
  - TPEG over a mobile internet connection
  - In a proprietary coding format over a mobile internet connection

	DATEX	Voice radio	RDS-TMC	DAB-TPEG	IP-TPEG	IP-proprietary
Austria	Yes	Yes	Yes	No	Yes	Yes
Belgium	Yes	Yes	Yes	No	Yes	Yes
Bulgaria	No	unknown	Pre-operational	No	No	Yes
Cyprus	No	No	No	No	No	No
Czech Republic	Yes	Yes	Yes	No	No	Yes
Denmark	Yes	Yes	Yes	No	Yes	Yes
Estonia	No	unknown	Pre-operational	No	No	No
Finland	Yes	unknown	Yes	No	Yes	Yes
France	Yes	Yes	Yes	Pre-operational	Yes	Yes
Germany	Yes	Yes	Yes	Pre-operational	Yes	Yes
Greece	Yes	unknown	Yes	No	No	No
Hungary	Yes	Yes	Yes	No	Yes	No
Ireland	Yes	Yes	Yes	No	Yes	Yes
Italy	Yes	Yes	Yes	Yes	Yes	Yes
Latvia	No	Yes	No	No	No	No
Lithuania	No	unknown	No	No	No	No
Luxembourg	No	unknown	Yes	Yes	Yes	Yes
Malta	No	No	No	No	No	No
Poland	No	unknown	Yes	No	Yes	Yes
Portugal	Yes	Yes	Yes	No	No	Yes
Romania	Yes	unknown	Yes	No	No	Yes
Slovakia	Yes	unknown	Yes	unknown	unknown	Yes
Slovenia	Yes	Yes	Yes	No	Yes	No
Spain	Yes	Yes	Yes	No	Yes	Yes
Sweden	Yes	Yes	Yes	Pre-operational	Yes	Yes
The Netherlands	Yes	Yes	Yes	No	Yes	Yes
UK	Yes	Yes	Yes	Yes	Yes	Yes

Table 2 Overview of the availability of DATEX-nodes and services on specific channels

From Table 2 follows that in most Member States road safety related traffic information is available, coded in DATEX, in one or more central systems. As with content availability, in particular the smaller or less affluent Member States in general do not yet have a DATEX node.

Figure 3 shows DATEX II finds increasing application all over Europe on different scales and stages of development.

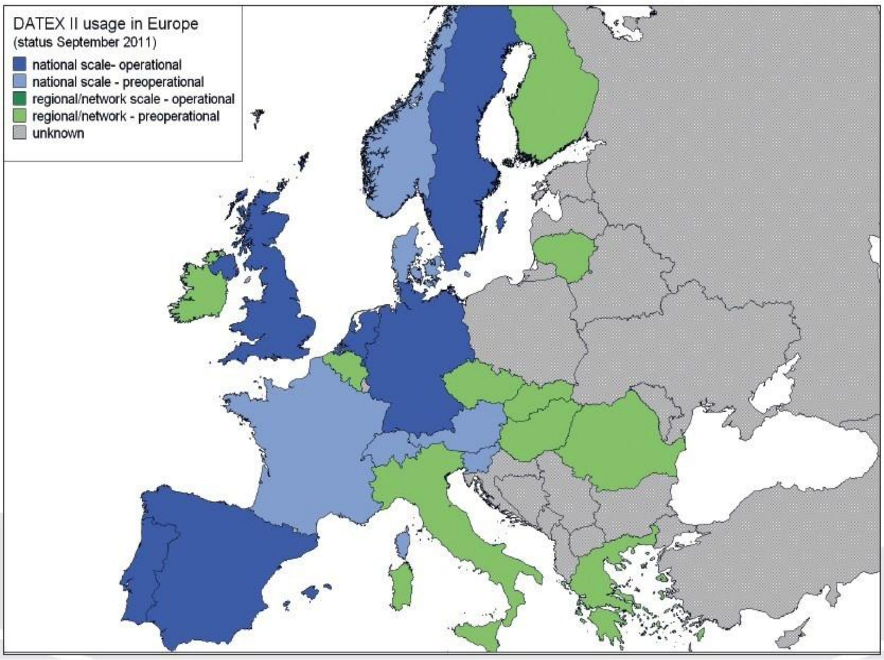

Figure 3 Current DATEX II usage in Europe [31]

3.5. Existing and Planned Services

3.5.1. RDS-TMC

Table 2 provides an up-to-date overview of TMC services in the EU.

- 21 Member States have one or more RDS-TMC services operational
- 2 Member States are testing an RDS-TMC service
- In only 4 Member States will TMC not be available in the near future. Of these, Latvia and Lithuania plan to set up an RDS-TMC service. This leaves Malta and Cyprus as the only Member States where a TMC service will not become available in the short term.

The broad availability and new deployments of TMC suggests TMC can in the short term provide a delivery of road safety related traffic information to road users in all Member States of the EU.

Figure 4 indicates the current application coverage in Europe where TMC and TPEG services are operational or planned.

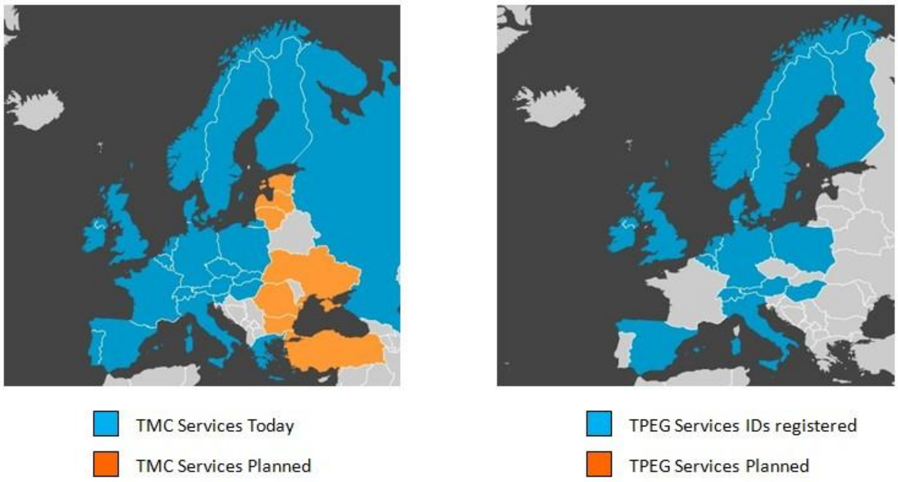

Figure 4 Current application coverage of TMC and TPEG in Europe (source: www.tisa.org)

3.5.2. DAB-TPEG

Table 2 provides an up-to-date overview of the currently available TPEG services over DAB and mobile Internet. The number of TPEG services over DAB (includes all variants of DAB; DAB, DAB+ and DMB) is still very limited. Only in Italy, Luxembourg and the UK are TPEG services operational with supra-regional coverage.

It should be noted that the DAB / DAB+ coverage varies widely between Member States [29] and that DAB network deployment in general is slow, as there is a large installed base of FM receivers, and only a very small installed base of DAB receivers. This has for example led to several years delays in setting up the DAB network in France, because commercial radio stations opposed to DAB [29]. It is unlikely that this issue will be resolved in all Member States in the short or medium term, hampering the deployment of TPEG over DAB as a superior alternative to TMC.

The table below presents some examples of the current status of DAB coverage in EU Member States [29]:

DAB Coverage	Country
90-100%	Belgium, Denmark, Malta
70-85%	UK, Italy, The Netherlands
50-60%	Germany, Ireland, Spain
30-35%	Hungary, Sweden
<10%	Poland

3.5.3. IP-TPEG

INRIX has developed a TPEG service that allows the delivery of traffic information to road users. The information is coded in TPEG and delivered to in-car devices and systems via a mobile Internet connection. This service is now available in 16 EU Member States, as well as Switzerland and Norway (see Table 2). TomTom recently announced that their HD Traffic service is now also available as TPEG service over IP networks.

3.5.4. Other IP-Based Services

Private companies, such as TomTom and Google, have developed data services that provide information to in-car and nomadic devices over mobile Internet. These services use proprietary data coding methods and hence require a device or smartphone *app* from a specific vendor. Such services are now available in 19 Member States. As demonstrated by TomTom these services can be migrated to a commonly supported coding standard such as TPEG.

3.6. Data, Information and Service Quality

In the evidence base, information on how traffic data, information and service quality is measured, monitored and managed is scarce. This suggests that procedures and systems to monitor and manage quality in general are poorly developed. This is confirmed by the results from the consultation phase of the study.

All stakeholders that were interviewed agreed that the quality of information and services is very important for road safety related traffic information, but also stressed that measuring quality is complicated, let alone monitoring and managing it.

The key stakeholders consider quality of road safety related traffic information and services important. But they also emphasize that measuring, monitoring and managing quality of traffic information and services is complex, and that ambitions should remain realistic [33].

3.7. Organisational Setup

Table 3 presents an overview of the way the traffic information value chain is organised in the Member States.

	Data collection	Data aggregation	Validation	Service providing
Austria	Private concessionaire, public road authorities, private companies	Public broadcaster, private companies	Public broadcaster, private companies	Public broadcaster, private companies
Belgium	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies	Public broadcasters, private companies
Bulgaria	unknown	Private companies	Private companies	Private companies
Cyprus	None	None	None	None
Czech Republic	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies
Denmark	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies
Estonia	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies	Private companies
Finland	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies
France	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies	Private companies
Germany	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies	Public broadcaster, private companies
Greece	Private concessionaires	unknown	unknown	Private companies
Hungary	Private concessionaire, public road authorities, private companies	unknown	unknown	Private companies
Ireland	Public road authorities, private companies	unknown	unknown	Private companies
Italy	Private concessionaire, public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies
Latvia	Public road authorities, private companies	Public road authorities	Public road authorities	None
Lithuania	Public road authorities	Public road authorities	Public road authorities	None
Luxembourg	Public road authorities, private companies	unknown	unknown	Private companies
Malta	None	None	None	None
Poland	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies	Private companies
Portugal	Private concessionaire, public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies	Private companies
Romania	Public road authorities, police, private companies	Public road authorities, police, private companies	Public road authorities, police, private companies	Private companies
Slovakia	unknown	unknown	unknown	Private companies
Slovenia	Private concessionaire, public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies	Private companies
Spain	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies	Public broadcaster, private companies
Sweden	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies
The Netherlands	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies	Private companies
UK	Public road authorities, private companies	Public road authorities, private companies	Public road authorities, private companies	Private companies

Table 3 **Role of public and private organisations in the traffic information value chain (colours indicate four groups: none, public only, public and private, private only)**

Table 3 seems to reflect the market developments of the past five to ten years. Private value chains have developed alongside the existing public value chains. This has resulted in a situation where in most Member States both private and public organisations collect, aggregate and validate traffic data in parallel. In these Member States, the end-user services in general rely on congestion information from private sources and journalistic information on incidents from public sources.

While road authorities in some Member States have decided to leave the service provisioning to private parties, others consider it important to have a public source of information to road users. There is no clear geographic grouping (Figure 5), other than that private parties seem to play a more dominant role in South-Eastern Member States.

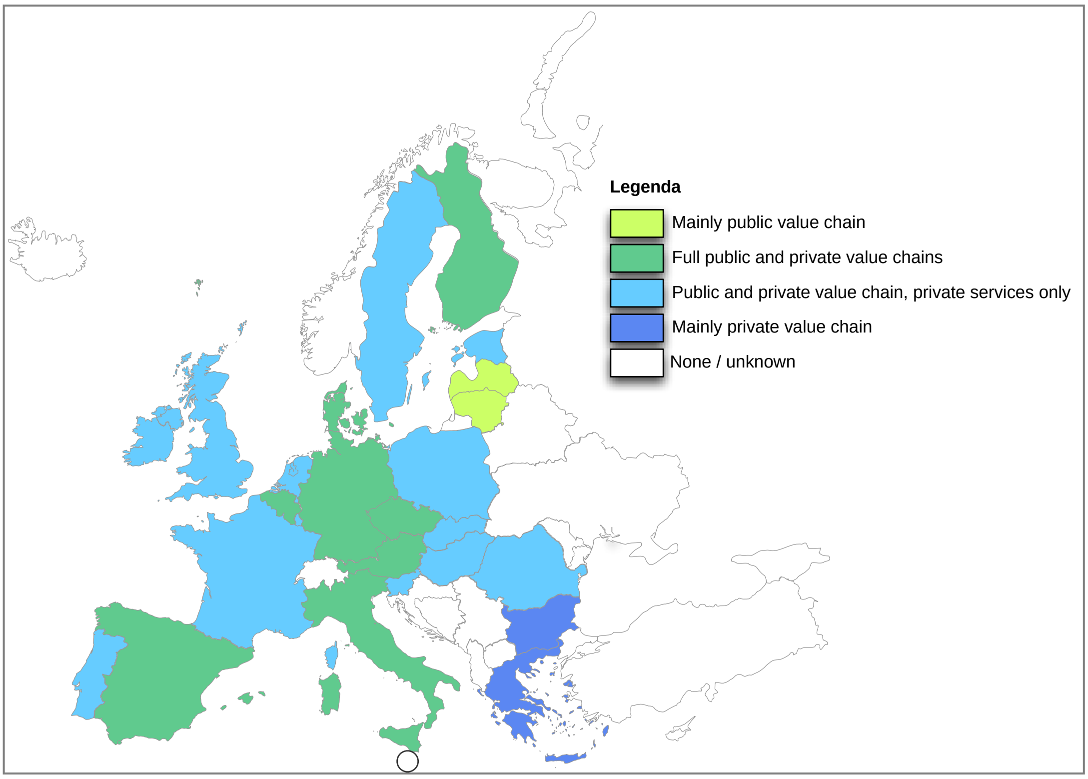

Figure 5 Organisation of road traffic information value chains

3.8. Business Models in Use

Table 4 provides a concise overview of the main business models used in the Member States. In about half of all Member States TMC-services are provided completely free of charge.

In nearly all Member States, TMC services are free of charge at the point of use. With this is meant that the service can be used for free once a personal or in-car device, such as a portable or factory fitted navigation device, is purchased.

Subscription based traffic information services over mobile Internet are available in at least 19 Member States, with coverage expanding year by year.

	Free	Free at point-of-use	Subscription
Austria	Yes	Yes	Yes
Belgium	Yes	Yes	Yes
Bulgaria	No	No	Yes
Cyprus	Not applicable	Not applicable	Not applicable
Czech Republic	Yes	Yes	Yes
Denmark	Yes	Yes	Yes
Estonia	No	No	No
Finland	No	Yes	Yes
France	No	Yes	Yes
Germany	Yes	Yes	Yes
Greece	No	Yes	No
Hungary	No	Yes	Yes
Ireland	No	Yes	Yes
Italy	Yes	Yes	Yes
Latvia	Not applicable	Not applicable	Not applicable
Lithuania	Not applicable	Not applicable	Not applicable
Luxembourg	No	Yes	Yes
Malta	Not applicable	Not applicable	Not applicable
Poland	No	Yes	Yes
Portugal	No	Yes	Yes
Romania	No	Yes	No
Slovakia	Yes	Yes	No
Slovenia	No	Yes	No
Spain	Yes	Yes	Yes
Sweden	Yes	Yes	Yes
The Netherlands	Yes	Yes	Yes
UK	Yes	Yes	Yes

Table 4 Business models in use per Member State

3.9. Synthesis

Content availability varies between Member States. While in most Member States (17) the key information components are available for at least the motorways, there are 3 Member States where insufficient content is currently available to establish road safety related traffic information services. In 7 more Member States, content is either limited or availability is unclear. This concerns in particular the smaller or less affluent Member States. Clearly content availability in these Member States is an issue that needs to be dealt with if a common service level is to be achieved for road safety related minimum universal traffic information services in the EU.

In most Member States traffic information is coded in DATEX, in one or more central systems. As with content availability, in particular the smaller or less affluent Member States in general do not yet have a DATEX node.

The broad availability and new deployments of TMC suggests TMC can in the short term provide a delivery of safety related traffic information to road users in all Member States of the EU.

The number of TPEG services over DAB is still very limited. Only in Italy, Luxembourg and the UK are TPEG services operational with supra-regional coverage. DAB network coverage varies widely between Member States and DAB network deployment in general is slow. It is unlikely that this issue will be resolved in all Member States in the short or medium term, hampering the deployment of TPEG over DAB as a superior alternative to TMC. TPEG coded information is available via mobile Internet in 16 EU Member States.

It seems that procedures and systems to monitor and manage quality in general are poorly developed.

In most Member States, both private and public organisations collect, aggregate and validate traffic data in parallel. While road authorities in some Member States have decided to leave the service provisioning to private parties, others consider it important to have a public source of information to road users. There is no clear geographic grouping other than that private parties seem to play a more dominant role in South-Eastern Member States.

In nearly all Member States, TMC services are free of charge at the point of use. Subscription based traffic information services over mobile Internet are available in at least 19 Member States, with coverage expanding year by year.

4. Data Coding Formats/Standards

4.1. Objective

Task 1.3 identified the suitability of currently available data coding standards for delivering road safety related traffic information (SRTI) services. The results of the SWOT analysis served as input to the definition of the Impact Assessment options.

4.2. Methodology

A number of data coding standards from around the world are covered in this analysis.

The standards have been described against a set of criteria including:

- Ownership
- Status
- Suitability per road type
- Suitability for user groups
- Suitability for value chain players
- SWOT criteria
- Suitability per Member State.

The basic information about the standards which includes description, ownership and status has been collected from their own websites (see section **Error! Reference source not found.**).

Then a series of suitability investigations have considered the aspects of different road types (Motorways, Main roads and city arteries, Rural roads and Urban roads), users groups (Car drivers, Motorcyclists, etc.), value chain players and Member States. The analysis also took account of the impact that the use of standards/coding methods might have on different members of the value chain (see section **Error! Reference source not found.**).

Finally, the analysis considered the technological maturity, and possible technological evolution in the short to medium term, and considered both existing and standards under development in the SWOT analysis.

4.3. Scope

The delivery of road safety related minimum universal traffic information services to the end-user, involves a sequence of processes: data collection, data aggregation, and information distribution. Together these processes are referred to as the *value chain.*

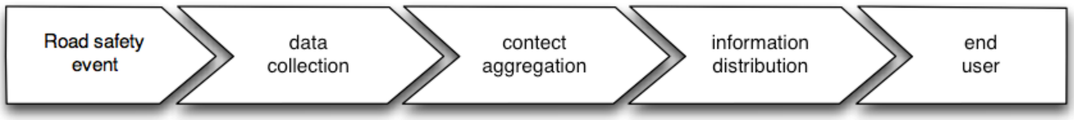

Figure 6 The Information and Services Value Chain

The scope of the SWOT analysis covers the data coding for the exchange of data between the three main processes.

4.4. Analysis

Table 5 and Table 6 provide an overview of respectively the selected data coding and location referencing standards, with a short description, ownership and current status.

Standards	Description	Ownership	Status
Traffic Information Coding			
Traffic Message Channel (TMC) [76]	A specification for distributing real-time traffic and travel information through audio broadcast or data messages to drivers.	TISA	TMC is a mature technology. It has been widely deployed in the MS and all around the world.
Transport Protocol Experts Group (TPEG) [77][78]	TPEG is partly based on the RDS-TMC technology, but it does not require any large scale location table or pre-coded databases in the end user device. It is designed to transmit language independent and multimodal traffic and travel information.	TISA	TPEG could offer much wider range of services than TMC. It has been adopted in countries around the world. Some applications are still under development.
DATEX / DATEX II [79]	A standardised interface for exchanging data across boundaries, providers and types of information at system level.	EasyWay (www.datex2.eu)	DATEX is widely used as a common standard for traffic information exchange between traffic management centres, traffic information centres and service providers throughout Europe. Standardised in CEN TS 16157 Parts 1-3

Table 5 Overview of the selected Traffic Information data coding standards

Standards	Description	Ownership	Status
Location Referencing			
TMC location [80]	Location tables are designed to store pre-defined and pre-coded locations for RDS TMC, in order to interpret location information or events from RDS-TMC messages.	Public Authorities/Private Organisations (specify and update) TISA (standardise and certificate)	The location table is a mature method to support RDS-TMC technology. It is mandatory for TMC system and need to be maintained and renewed.
TPEG-Loc [77][78]	TPEG-Loc was designed as a common location referencing method. It allows every message to contain very rich location referencing information, and all types of end user device can understand the message and display the contents to users.	TPEG Forum	TPEG-Loc was finished in 2003, and has been adopted by OTAP and Datex. With promotion of the TPEG technology, the TPEF-Loc has been implemented in a large number of services and applications potentially for all types of users, regardless what the products and languages they use.
Open LR™ [81]	OpenLR™ location referencing is designed for transferring dynamic traffic information between different traffic centres, vehicles, and other users, without using a common reference map or location table.	TomTom International B.V.	TomTom launched it as a free technology and an open standard in 2009. They will lead the further development and invite the stakeholders in the ITS industry to enhance it.
Linear referencing [82]	Linear referencing defines the location feature as a point or a line along a linear element (often roads) by referencing that location to some other well-defined location, such as traffic network.	ISO19148:2012 Geographic information -- Linear referencing	It is a mature international standard and is applicable to transportation, GIS, location-based services and other applications which define locations relative to linear objects.
AGORA-C [83]	AGORA-C is designed for dynamic encoding and decoding and sharing location referencing information for traffic information, transportation management and other location based services.	It was created and developed by Panasonic Corporation, and ERTICO partners Robert Bosch GmbH, Siemens Aktiengesellschaft, Tele Atlas BV	AGORA-C was successfully approved as an International Standard by ISO (ISO 17572-3 Intelligent Transport System (ITS)—Location Referencing for Geographic Databases—Part 3: Dynamic Location References)

Table 6 Overview of the selected Location Referencing coding standards

The detailed results of the SWOT analysis have been included in Annex B.

4.5. Synthesis

All data coding standards are equally suitable for all Member States (MS).

DATEX is widely used and commonly accepted as standard for traffic information exchange between traffic management centres, traffic information centres and service providers throughout Europe. It provides a proven method for SRTI data exchange. Various companies offer DATEX encoding and decoding products in a competitive market, making it a cost efficient solution for both public and private organisations.

In the current situation, TMC is a proven technology and has been implemented widely. Drivers can obtain the real-time traffic information on accidents, road works, traffic jams, and weather and so on. Additional services have been widely provided by different service providers to help with the functions such as navigation and emergency reactions. However, TMC is essentially designed for inter-urban road events. It compresses the traffic information and then a decoder is used to interpret the provided information prior to its use. The location table which helps to determine the position of the events is required by the end users' devices but these tables are not always updated with the same level of frequency by the responsible organisation. This could be considered as a disadvantage of TMC technology and limit the usage of TMC in the future.

Although there are certain similarities between TPEG and TMC, there are certain aspects that differentiate it from TMC. Firstly, TPEG does not require a pre-defined location database in the client device. By introducing the various location referencing methods, TPEG technology can deliver dynamic and rich location information over the air. Secondly, the TPEG specification allows for more detailed coding of traffic information than TMC. Thirdly, TPEG can be applied to various modes of transport. Finally, through explicit coding, TPEG could set up a filter by users with some criteria that allow them to obtain information more effectively.

In TISA's view, RDS-TMC will follow ISO EN14819-series to provide standardised traffic information by using VHF/FM broadcast to drivers in short term. With the introduction of DAB/DAB+/DMB broadcast, other technologies are expected to gradually take over the role of RDS-TMC [17].

Thus, RDS-TMC could be considered as the minimum level taking into account market and cost. TPEG and DATEX/DATEX 2 are proven technologies and have good coverage. They could be introduced to Member States step by step, depending on their current implementation situation.

The two open standards OpenLR™ and AGORA-C, which offer dynamic location referencing services, might have better prospects. They do not have the restriction on the amount of pre-defined locations and can ensure highly accurate location referencing regardless of map differences between the sending and receiving party. Although there is uncertainty in their development in terms of policy support, cost and technical development, they could be expected to enhance current ITS and location-based systems and services and applications in the future.

5. Communication Channels

5.1. Objective

The objective of task 1.4 is to provide an objective assessment of the suitability of distribution channels, that are currently available or being developed, for the implementation and operation of road safety related minimum universal traffic information services. The results of this task serve as input to task 1.5, to produce the 'deployment options'.

5.2. Methodology

The first step is to define the SWOT criteria, i.e. what characteristics of the channels are to be used to determine their strengths, weaknesses, opportunities and threats. The criteria were defined based on:

- The Inception Report of this study [32]
- Work of the previous study [19]
- Report of the eSafety Working Group on RTTI [21]
- The QUANTIS assessment method [25]
- Expert input from TISA and the consortium [17]
- First results of field tests with the DAB single frequency network in Bavaria [28]
- Global Broadcasting Update – DAB/DAB+/DMB [29]

The following criteria were used in the assessment (Annex C contains a detailed description). For each dissemination channel, the full set of criteria was assessed:

- Bandwidth
- Push
- Cross-border
- Delivery on-trip
- Information conveyance
- Multilingual
- Suitability for users groups
- Locational awareness
- Safety of use
- Geographic availability
- Road type coverage
- Installed base
- Reliability
- Topographic restrictions
- Technological maturity

A pre-selection of distribution channels was made based on reference documents [18, 19, 30, 26, 27, 29], expert input from TISA and consortium partners.

Per channel an assessment was made of each of the criteria. This assessment was then translated to the strengths, weaknesses, opportunities and threats per channel, differentiating between deployment on TERN, motorways and secondary roads, as well as per road users type.

5.3. Scope

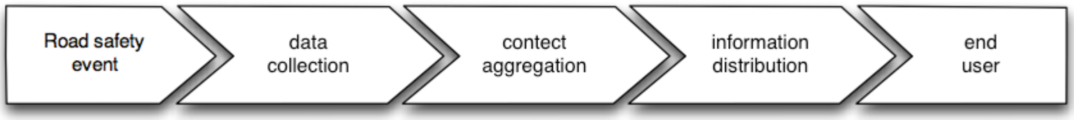

Figure 7 The Information and Services Value Chain

The scope of the SWOT analysis covers only the information distribution process, including its interfaces with the content aggregation process and the end-user.

5.4. Analysis

The following distribution channels were considered in the SWOT analysis:

Channel Name	Description
Road side VMS	Roadside panels that can display safety related information, based on graph and text information
SMS/MMS services	Services that send information to drivers by SMS or MMS messages. 2 possibilities are available: 1°) Profiling/registration is required first through a web interface. Then information is sent to all subscribers. 2°) by pushing information through cell broadcasting to all mobile phones in a cell of the cellular network
RDS-TMC data casting via FM	Services that broadcast digitally encoded information over the radio data system. The in-vehicle device decodes and presents the information to the driver.
Radio VHF/FM or DAB	Spoken radio bulletins with safety related information.
DAB/DAB+/DMB with TPEG data casting	Services that distribute digitally encoded information via terrestrial digital audio broadcasting. The in-vehicle device decodes and presents the information to the driver.
DVB-S(H) with TPEG data casting	Services that distribute digitally encoded information via satellite broadcasting. The in-vehicle device decodes and presents the information to the driver.
Mobile internet	Services that exchange information with in-car or handheld devices through terrestrial mobile internet connections such as GPRS, UMTS, WiMAX and LTE-A.
V2I protocols	Services that exchange information from the infrastructure to the vehicles and vice versa. The in-vehicle device decodes and presents the information to the driver.
V2V protocols	Services that exchange information between vehicles. The in-vehicle device decodes and presents the information to the driver

Table 7 Overview of the selected distribution channels

A more elaborate description of the channels, with a short description of current ownership of the specifications, infrastructure and services, can be found in Annex C. The detailed results of this assessment are also enclosed in Annex C. The following tables summarises the results of the criteria assessment.

	Strengths	Weaknesses	Opportunities	Threats
Road side VMS	VMS have a strong implicit connection to their location on the road network, allowing conveyance of relevant information to all passing drivers	The short time window to convey the information to drivers, and the fact that multilingualism can only be achieved by using graphs, means that VMS can only transmit a very limited amount of information	VMS can reach all types of road drivers that cannot be reached through other channels. Easyway is working on harmonisation of VMS use at a European level.	The implementation and operational costs of VMS are very high
SMS/MMS services	Excellent European network coverage, very large installed base, multilingual delivery, proven technology	Subscription based services require a preliminary subscription or a declaration of roads followed. Cell broadcasting in general also needs to be explicitly turned on by the end-user The limited bandwidth poses severe restrictions on the service's functionality	Mobile phones have a huge penetration amongst drivers and GSM networks provide nearly 100% coverage in the EU	Services on this channel are likely to encourage mobile phone use while driving which is contrary to road safety objectives/principles
RDS/TMC data casting	Multilingual delivery, proven technology, infrastructure available in all Member States, moderately large installed base	Limited bandwidth, which also constrains deployment on roads other than motorways and secondary roads Reception is poor when using an antenna inside a vehicle.	TMC can be implemented on radio networks in less developed Member States	The analogue signal is likely to be replaced by DAB in some of the more developed Member States in the coming decade.
Radio VHF/FM or DAB	Operational in many countries and on many radio stations. Ubiquitous in vehicles. Well understood by all types of road users.	No multilingual support. Timely diffusion is only possible for urgent safety related information due to lack of bandwidth. Requires user knowledge of road topology.	Very large installed base of devices and extensive coverage of infrastructure. In most Member States radio still is the most popular channel for RTI.	The analogue signal is likely to be replaced by DAB in some of the more developed Member States in the coming decade, rendering the large installed base obsolete.

	Strengths	Weaknesses	Opportunities	Threats
DAB/DAB+ with TPEG data casting	Multilingual delivery, large bandwidth, proven technology	Small installed base only	The analogue signal is likely to be replaced by DAB in some of the more developed Member State in the coming decade. Chance to establish certification procedure and quality management for devices.	The transition from analogue radio to DAB is slow, and depends mainly on the business case of spoken radio. EU-wide coverage is unlikely to materialise in the coming decade.
DVB- TPEG	Multilingual delivery, large bandwidth, proven technology	Costly operation. Poor reception at higher latitudes, in particular in urban areas.	With one service a very large area of the EU can be covered.	The installed base is very low.
Mobile internet	Multilingual delivery, large bandwidth, proven technology, international coverage	Data roaming costs can lead to serious costs for the users. Requires a preliminary set-up of the device by the end-user	With one service a very large area of the EU can be covered, but national services can also be defined. The technology and infrastructure is likely to be around for many more years as LTE will be introduced in the coming years in many Member States.	Data roaming costs may hamper cross-border use.
V2I protocols	Multilingual, large bandwidth, fast delivery	The installed base is almost zero. Protocols are not yet standardised. High costs severely constrain deployment on roads other than motorways.	Allow fast delivery of large amounts of local data	Costs of implementation are very high.
V2V protocols	Multilingual, large bandwidth, fast delivery, low costs	The installed base is almost zero. Protocols are not yet standardised.	Allow fast delivery of large amounts of local data	There is a risk of a diversion of standards. For V2V to be successful a critical mass of vehicles needs to be equipped. It is thus far unclear if this tipping point will be reached.

Table 8 Summary of strengths, weaknesses, opportunities and threats for each of the distribution channels.

5.5. Synthesis

Each of the examined channels has specific benefits and drawbacks. For the road safety related minimum universal traffic information services, a channel is required that provides sufficient installed base, bandwidth, coverage and reliability to allow for fast and reliable delivery of road safety related traffic information to the end users.

Because of the deployment and operational costs, VMSs do not provide a solution that can be scaled sufficiently to meet the criteria for safety related traffic information.

Although the infrastructure and installed base of mobile phone networks provide excellent coverage for SMS/MMS services, the limited bandwidth poses severe restrictions on the service's functionality. Further, SMS/MMS services are likely to encourage mobile phone use while driving, and are therefore not considered a suitable channel for road safety.

Although voice radio today is a popular channel for RTTI, it is considered not suited for road safety related traffic information. It does not support language independent use, has limited push capabilities and its bandwidth is suited for conveying only the most essential information.

RDS/TMC has a good coverage and many road users have a receiver devices suited for decoding this information in many countries. Yet the limited bandwidth will constrain deployment on roads other than motorways and secondary roads. Where RDS-TMC services do not exist, there is at least FM/VHF radio transmission in place allowing the deployment of such a service at relatively low cost. It seems a good solution for achieving EU wide coverage in the short run.

DAB/TPEG data casting is a technically superior alternative to RDS-TMC yet it currently has a market penetration that is marginal. If adequate coverage is reached (not only urban areas) and sufficient capacity for traffic information is reserved, it could provide a reliable channel to timely deliver road safety related traffic information to the end users. DAB/TPEG seems the best solution for the dissemination of road safety related traffic information in the medium term.

DAB-S/TPEG data casting has the benefit of achieving wide EU-coverage but requires operation of a single road safety related traffic information service for all Member States. Besides the organisational complexities it is also less reliable at higher latitude, in particular in urban areas. It therefore seems less suited considering Europe's latitude.

Mobile Internet has a high potential in terms of installed base and coverage. Several issues exist, such as data roaming costs, network load, and end-user device set-up. It seems a good additional channel for achieving EU wide coverage in the short run.

V2I and V2V protocols are not yet ready for wide-scale deployment, but will definitely improve and ease the diffusion of road safety information when they will be operational. These channels might be the most appropriate channels for road safety related traffic information in the long run.

Each of these channels has specific advantages and disadvantages that might be emphasised over the coming years. It is expected that the oldest technologies will be gradually replaced by another technology but it will take some years. Rather than selecting one specific channel for road safety related traffic information it might be better to aim for maximum reach using multiple channels. Harmonisation could be achieved by recommending specific channels, while allowing for a controlled transition to new technologies.

6. Safety Impact of Road Safety Related Traffic Information

6.1. Introduction

The main objective of providing road safety-related traffic information is increasing road safety, i.e. reducing road accidents that result in fatalities, injuries and economic loss. It is of vital importance to assess the potential of SRTI in reducing the number of such accidents.

While it is very likely that there is a positive safety impact of SRTI, it is not straightforward to assess the impact in quantitative terms for a number of reasons:

- The ‘application’ SRTI is not sharply defined. In fact, the scope of SRTI as defined for this study does not include how the information is presented to the user. There is limited research on drivers’ behaviour in response to SRTI, and specific ways of presenting SRTI.
- No empirical results exist that relate the effect of SRTI on the avoidance of traffic accidents or reducing of the severity of the consequences.
- Useful research results exist for related applications such as LDW (Local Danger Warnings), ISA (Intelligent Speed Adaptation), Variable Speed Limits and Dynamic Speed Adaptation. It is clear that a part of the underlying analyses for these applications would equally hold for SRTI but this does not apply to all steps of the assessment.
- It will take time before SRTI will be available to road users on a wide scale across Europe. At the same time, other traffic management, traffic control and (cooperative) vehicle safety systems / measures are being developed, improved and deployed. A considerable part of these, target the same safety factors as SRTI: reducing speed and/or creating increased awareness under high-risk road/traffic/weather conditions. Assuming that it is possible to predict the effect of SRTI in the absence of other measures, it would still be quite a challenge to assess the incremental effect on top of other measures.

It is noted that the direct effect of SRTI on driver behaviour – and this is the main source of impact to be expected – strongly depends on the quality, granularity and timeliness of the information. As an example a radio broadcast indicating a traffic jam somewhere on a road section of 30 km will have a very limited influence on driver behaviour compared to e.g. a dedicated warning ‘approaching end of queue within 1000 meters’ delivered on an on-board platform. Specific and local warnings are more effective to influence driver behaviour than generic/global ones. It is likely that cooperative technology (involving local vehicle to vehicle and roadside to vehicle communications) is the best approach for local danger warnings. A combination of early more generic warnings (e.g. broadcasted via DAB or RDS) and local specific ‘real-time’ warnings is expected to be an effective solution.

6.2. Methodology

When assessing the potential of a measure/service to reduce traffic victims, the following factors have to be taken into account:

- *Effectiveness*. How effective is the service (in this case the provisioning of explicit information on a certain type of road/traffic hazard), given that the circumstances that are addressed by the service occur, and provided that correct information is presented to the user in an appropriate form at the appropriate moment. Effectiveness is often the result of multiple and partially related effects, including potential adverse effects when drivers will act with less caution when they have learned to rely on a specific safety system/service.
- *Coverage of the service*. If information is only available concerning a part of the network, effects can only be expected on that part of the network.
- *Addressed fraction of all accidents*. Only certain types of accidents are potentially affected by the service. This factor represents the fraction of accidents under the specific circumstances where the service would be relevant.

It is noted that an assessment is often done per road type when the effectiveness is expected to differ between road types.

As a fictitious example to illustrate the above, suppose that a) a timely and accurate warning message would be able to result in avoiding 20% of accidents on slippery roads, b) that the information is only available for main roads, c) that slippery road accidents constitute 5% of traffic fatalities on main roads, and d) that 25% of accidents take place on main roads. The overall effect in reducing traffic fatalities could in this example be estimated as 0.20 x 0.2 x 0.05 x 0.25 = 0.125% of all traffic fatalities.

The safety impact assessment in this study is largely based on methodology and results of earlier studies. Annex D summarises the results of the literature review, and a detailed elaboration can be found in [4], [12] and [14].

6.3. Results for safety impact of SRTI

6.3.1. Overall maximum safety impact

On the basis of the following assumptions:
1. full coverage of the road network
2. a resolution and accuracy in time and location as can be expected to become available through cooperative technology for
3. a near to 100% penetration of the service, i.e. all vehicles have equipment that delivers the information in an adequate/effective way.
4. no other measures are taken that are also influencing the occurrence of the type of accidents that SRTI is expect to impact on.

The overall effect of SRTI can be estimated to be 7% for fatalities and 6.3% for injuries relative to all road fatalities/injuries. These figures are based on the EasyWay assessment of a cooperative service with similar information content, and a small mark up for wrong-way driving accidents (see synthesis in Annex D).

It is however clear that the assumptions above are purely theoretical and not possible in practice for (the deployment of) SRTI. As discussed in Annex D, in the absence of a cooperative technology approach the requirement on resolution and accuracy (assumption

2) cannot be met and other results are considered to be more applicable to SRTI. **These indicate a maximum reduction of all road traffic fatalities of 2.7% and a reduction of traffic injuries of 1.8%,** when maintaining assumptions 1, 3 and 4.

6.3.2. Road coverage scenarios

These maximum reductions for fatalities and injuries need to be corrected for road coverage. SRTI will gradually evolve and will not likely ever cover the entire road network, at least not through a centralised architecture as assumed. In the impact assessment different scenarios of road type and content coverage are defined.

The impact of SRTI is calculated from the calculated effects for each road type (e.g. motorways, interurban non motorways, urban roads), by multiplying with the coverage percentage and the relative portion of traffic fatalities / injuries per road type from [69]. This means that the overall impact is a weighted average of the figures for the different road types, to cater for the effect that the number of fatalities is quite different for each of these road types. The overall reduction percentage allows multiplying with the total number of fatalities to find the number of avoided fatalities. In formula:

R(fatalities, overall) * N(all fatalities) = R(fatalities, motorway) * N(fatalities, motorway) + R(fatalities, interurban non-motorway) * N(fatalities, interurban non-motorway) + R(fatalities, urban) * N(fatalities, urban)

These percentages are expressed as a percentage of the number of *all* traffic fatalities and injuries respectively. They were input to the impact assessment in the next section. As to road coverage, the impact assessment includes a number of different scenarios. The corresponding fatality/injury figures were derived from the same source and using the same method as explained in this subsection.

6.3.3. Road user types affected

SRTI has a main effect on drivers and passengers of cars, buses and lorries. Drivers of motorcycles will also be positively affected by SRTI. Friction-related warnings are especially relevant to motorcyclists and are likely to have a greater effect as such conditions induce a greater accident risk for motorcycles. On the other hand, there are some constraints to deliver SRTI to motorcycles which are likely to lead to a much lower penetration than for passenger cars, at least on the short and medium term. However, motorcyclists will profit from behaviour more adapted to local danger by car drivers as a result of SRTI.

6.3.4. User coverage

The estimates in the previous subsections assume that the service is available to all road users. As a crude estimate the effects can be multiplied with the percentage of users that are ‘equipped’. There is a possibility however that equipped vehicles responding to a warning message will influence the non-equipped vehicle drivers, causing those vehicles also to slow down or keep longer headway distances.

This effect is assumed to be small for low and high penetration rates, and at a maximum for 50% penetration, see [14].

6.4. Estimated monetary equivalent of safety impact

Monetising the cost of traffic fatalities, accidents and injuries is not straightforward because no standardised values exist across Europe. Member States have their own values and methods for reporting and policy making. The official monetary valuation of the prevention of a road crash fatality ranges from € 60,000 in Portugal to € 3,000,000 in Norway, see [9]. These differences are caused by:

- The cost factors included - some countries/assessments include immaterial costs, others do not at all and some do this partially.
- The different methods applied to assess the non-material damage - for immaterial damage no exact or generally accepted valuation methods exist.
- Differences in GDP and national socio-economic arrangements - this is the only category that represents factual differences between countries.

When comparing between 6 European countries that take into account immaterial costs the differences are still considerable but much smaller: ranging from 1.7M€ (NL) to 3.0M€ for NO for a fatality, and from 170k€ (CH) to 470k€ (NO) for injuries.

As an example, the relative magnitude of cost factors for a traffic casualty in Norway are listed in Table 9 below.

Cost category	*Fraction of total cost*
Medical cost	4%
Cost of lost productive capacity	22%
Valuation of lost quality of life	43%
Cost of property damage	22%
Administrative cost	10%
Cost of inferred traffic delays	Not taken into account in Norway

Table 9 Overview of cost factors and relative importance for a traffic casualty in Norway

To overcome the challenge of different cost assessments, this study uses the same figures as utilised for the eCall Impact Assessment [75] which adopted an average cost for Europe for fatal (€1,361,262), serious (€214,074) and injury (€16,428) accidents. As an illustration, in the tables below, the eCall Impact Assessment valuation is applied to the values presented in sections 6.3.1 and 6.3.2 and applied to the EU-27 accident statistics.

	Reduction percentage	*Absolute Number*	*Unit value*	*Total value*
Fatalities	2.7	842	1,361,262	1,146,727,109
Severe Injuries	1.8	3539	214,074	757,565,071
Minor Injuries	1.8	17667	16,428	290,233,476
Total				**2,194,525,656**

Table 10 Monetised value (in €) of annually prevented traffic victims, based on the maximum reductions of 6.3.1, for the EU-27.

These figures are used in the impact assessment to calculate the savings per scenario.

7. Impact assessment

7.1. Methodology

The methodology that was used for the impact Assessment was based on the European Commission's Impact Assessment Guidelines and followed the following 5 step process:

Options Identification	• Identification of the elements of the IA Options (Policy, Functional, Technical, Dissemination, Network Coverage)
IA Scoping	• Identification of the Key Benefits • Identification of the Key Costs Drivers
IA Options Shortlisting	• Stakeholder Consultation Feedback • Current Network Coverage of SR~~-T~~TI • Elimination of non-Viable Options

Baseline Scenario Generation	• Generation of the Do-Nothing Scenario
	  • Accident Rates
	  • Costs of Delay
	  • Equipped Users

Detailed Impact Assessment	• Analysis against baseline scenario • Impact on existing markets • Assessment of fundamental rights • Assessment against ITS Principles • Assessment of budgetary implications

Figure 8 Impact Assessment Methodology

7.2. Developing the Impact Assessment Options to be considered

7.2.1. Approach

The identified policy options, specifications (on functional, technical and organisational levels), and the deployment options are combined to generate a set of potential Impact Assessment Options. The following table indicates the way in which the different functional, technical, organisational and deployment options can relate to the policy options.

	No requirements	TERN + Motorways	TERN + Motorways + Primary/National Roads	…
No Requirements	1-Do nothing	N/A	N/A	NA
Functional Reqs including DATEX II Feed	2a	3a	3a	3a
Mini SRTI + RDS-TMC	2b	3b	3b	3b
Full SRTI + RDS-TMC	2b	3b	3b	3b
Full SRTI + RDS-TMC/TPEG DAB	2b	3b	3b	3b
Full SRTI + RDS-TMC/TPEG DAB/TPEG IP	2b	3b	3b	3b
…	2b	3b	3b	3b

Table 11 Illustration of method to cover the potential Impact Assessment Options

Table 11 illustrates the range of options that could be investigated further (it does not provide a complete overview of all options). For the purposes of the Impact Assessment it is necessary to identify a shortlist of options which will be analysed against a set of criteria in the Impact Assessment.

7.2.2. Description of the 5 EU policy options

The ITS Directive sets out the measures available to the EC in supporting the deployment of ITS in Europe. In the context of this study, 5 policy options have been identified. They are described below:

Number	Policy Option	Key points
P1	Baseline - No EU intervention	No change to current arrangements
P2a	Adoption of specifications covering functional provisions	'Voluntary' deployment in accordance with functional specifications
P2b	Adoption of specifications covering functional, technical and organisational provisions	'Voluntary' deployment in accordance with detailed specifications

Number	Policy Option	Key points
P3a	Adoption of specifications covering functional provisions and proposal on the deployment in the MS	Mandatory deployment (i.e. EC proposal) in accordance with functional specifications
P3b	Adoption of specifications covering functional, technical and organisational provisions, and proposal on the deployment in the MS	Mandatory deployment (i.e. EC proposal) in accordance with detailed specifications

Table 12 Policy Options available to the EC

The adoption of the above policy options would likely have an impact on the ITS market in Europe (for both the public and private sector), in particular for options implying a mandatory deployment.

The policy options will be combined with specifications (extent of content) and deployment options to create Impact Assessment Options. The detailed impact of those options will be discussed and assessed in subsequent sections.

7.2.3. Functional & Technical Specification Options

The following 10 options for Functional Specifications were identified:

	Definition of SRTI Categories	Definition of minimum quality levels for detection[1]	Definition of SRTI Service Quality Levels[2]	Definition of Member State Node for provision of SRTI	Definition of national broadcast channel for distribution of SRTI
FS1	X				
FS2	X	X			
FS3	X	X	X		
FS4	X			X	
FS5	X	X		X	
FS6	X	X	X	X	
FS7	X				X
FS8	X	X			X
FS9	X	X	X		X
FS10	X	X	X	X	X

Table 13 Functional Specification Options

[1] Such as maximum distance between measurement points, detection probability, etc.
[2] Such as maximum delivery period, uptime, accuracy of location referencing, etc.

The following 6 options for Technical Specifications were identified:-

	None (Functional Only)	DATEX II SRTI Profile	RDS-TMC Specification	TPEG-DAB Specification	TPEG-IP Specification
TS1	X				
TS2	X	X			
TS3	X	X	X		
TS4	X	X	X		X
TS5	X	X	X	X	
TS6		X	X	X	X

Table 14 Technical Specification Options

The following 8 Dissemination Channel options were identified:-

	None	DATEX II Node	RDS-TMC	VMS	Smartphone App	TPEG-DAB
DC1	X					
DC2		X				
DC3		X	X			
DC4		X	X	X		
DC5		X	X		X	
DC6		X	X			X
DC7		X	X		X	X
DC8		X	X	X	X	X

Table 15 Dissemination Channel Options

7.2.4. ORGANISATIONAL OPTIONS

The following 6 organisational options were identified:-

	None	National Registry of SRTI Sources	Single National Node for SRTI (DATEX II)	Single Public National Node for SRTI (DATEX II)	National Broadcast Channel for SRTI	National Public Broadcast Channel for SRTI + Private Sector Dissemination
O1	X					
O2		X				
O3			X			
O4				X		
O5		X	X		X	
O6		X	X			X

Table 16 Organisational Model Options

7.2.5. DEPLOYMENT/COVERAGE OPTIONS

The Impact Assessment Options will include some scenarios that incorporate a mandatory definition of the network coverage for SRTI. The following 6 Deployment / Coverage options were identified:-

	None	TERN	All Motorways	National / Primary roads	City Arteries	Secondary Roads
C1	X					
C2		X				
C3		X	X			
C4		X	X	X		
C5		X	X	X	X	
C6		X	X	X	X	X

Table 17 Network Coverage Options

7.2.6. DEVELOPING THE SHORTLIST OF IMPACT ASSESSMENT OPTIONS

The identified options for

- Policy Options
- Functional Specifications
- Technical Specifications
- Organisational Models

- Dissemination Channels
- Network Coverage

can be combined into a potential 348 different options for consideration in the Impact Assessment (see Annex F). The following information was used to shortlist the options to be taken forward for the detailed impact assessment:-

1. Stakeholder feedback on identified potential options for each area
2. Current network coverage for SRTI data collection from State of Art Review
3. Discussion between Study Team and Project Officer on viable combinations of options

The following feedback from the stakeholder consultation and the assessment of the existing situation for the collection of the data required to produce SRTI was taken into account during the option short listing process:

- That there are well-established organisational models which vary across Member States – mandating a particular organisational model may have adverse effects on existing models.
- DATEX II is an established standard for the back-office exchange of traffic information.
- RDS-TMC is a proven technology with a large existing user base.
- That any specifications proposed by the Commission should remain at a functional level, as organisations such as TISA have a role in the development of related technical specifications.
- In the short to medium term smartphone applications are likely to have a greater penetration rate than TPEG-DAB.
- In most Member States, only motorways and parts of the primary road networks currently have sufficient monitoring to enable the detection and provision of high quality SRTI. A requirement for all roads would require a disproportionate investment.
- That there are differences in the accident levels between different road types, relative to their traffic levels and length. For example, motorways account for approximately 5-6% of fatal accidents, but carry approximately 20% of the traffic.

Based on the above the following decisions were made:

1. Not to include scenarios with Policy Options 3A in the shortlisted IA Options as these will have less of a safety impact than those that involve Policy Options 3B, and because Policy Options 3A provide less insight into the different effects than Policy Options 3B.
2. Only to include one Functional Specification FS6 in combination with Policy Option 2A and Organisation Option O3
3. Only to consider Organisation Option O1 and O3 in shortlisted IA Options
4. Only to consider Network Coverage Options C1, C3, C4 in the shortlisted IA Options, as the difference in road network length is marginal between C2 & C3 (although variable across Member States).

7.2.7. Shortlisted Impact Assessment Options

The following table provides an overview of the options that have been taken forward for the detailed Impact Assessment in section 7.4.1. A detailed description of the scenarios can be found in Annex F.

ID	Name	Description
0	Baseline Scenario	No additional action by the Commission above what is already required by the ITS Directive
1	Functional Specifications Only (i.e. no mandatory deployment)	Functional description of SRTI Types (TISA + Extreme Weather) Definition of a minimum quality level for each SRTI Type (not including definition of coverage) Functional requirement to make SRTI information available for publication and dissemination via DATEXII on a non-discriminatory basis.
1bis	Functional Specifications mandatory for existing services	Functional specifications + obligation to Member States whom already have an SRTI service in place, to make it compliant with the functional specifications requirements (e.g. SRTI types, DATEX II node, data quality requirements).
2	Mini SRTI on TERN* (= TERN + other motorways)	Functional specifications + Mandated deployment of mini SRTI (i.e. excluding end of queue) on TERN* Shared via all existing channels
3	Mini SRTI on TERN* & Main/National Roads	Functional specifications + Mandated deployment of mini SRTI (i.e. not including end-of-queue) on TERN* & Main/National Roads Shared via all existing channels
4	Full SRTI on TERN* & Mini SRTI on Main/National Roads	Functional specifications + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* & mandated deployment of mini SRTI (i.e. not including end-of-queue) on Main/National Roads Shared via all existing channels
5	Mini SRTI on TERN* + mandatory broadcast via RDS-TMC	Functional specifications + Mandated deployment of mini SRTI (i.e. excluding end of queue) on TERN* Mandatory broadcast via RDS-TMC
6	Full SRTI on TERN* + mandatory broadcast via VMS and existing channels	Functional specifications + Mandated deployment of full SRTI Types (i.e. including end-of-queue) on TERN* Mandatory broadcast via VMS on the road & shared via all existing channels
7	Full SRTI on TERN* + mandatory broadcast via SRTI smartphone app	Functional specifications + Mandated deployment of full SRTI Types (i.e. including end-of-queue) on TERN* Mandatory broadcast via an SRTI app for smartphone users & shared via all existing channels

ID	Name	Description
8	Full SRTI on TERN* + mandatory broadcast via RDS-TMC	Functional specifications + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* Mandatory broadcast via RDS-TMC
9	Full SRTI on TERN* & Mini SRTI on Main/National Roads + mandatory broadcast via RDS-TMC & TPEG-DAB	Functional specifications + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* & mandated deployment of mini SRTI (i.e. not including end-of-queue) on Main/National Roads Mandatory broadcast via RDS-TMC & TPEG-DAB
10	Full SRTI on TERN* & Mini SRTI on Main/National Roads + mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG-IP	Functional specifications + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* & mandated deployment of mini SRTI (i.e. not including end-of-queue) on Main/National Roads Mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG-IP Service
11	Full SRTI on TERN*	Functional specifications + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* Shared via all existing channels
12	Full SRTI on TERN* & Mini SRTI on Main/National Roads + mandatory broadcast via TPEG DAB	Functional specifications + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* & mandated deployment of mini SRTI (i.e. not including end-of-queue) on Main/National Roads Mandatory Broadcast via TPEG DAB
13	Full SRTI on TERN* + main/national roads + mandatory broadcast via RDS-TMC & TPEG DAB & TPEG IP	Functional specifications + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* & Main/National Roads Mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG-IP
14	Full SRTI on TERN* and main/national roads	Functional specifications + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* & Main/National Roads Shared via all existing channels
15	Full SRTI on TERN* + main/national roads + mandatory broadcast via RDS-TMC	Functional specifications + Mandated deployment of Full SRTI (i.e. including end-of-queue) on TERN* & Main/National Roads Mandatory broadcast via RDS-TMC
16	Full SRTI on TERN* + mandatory broadcast via TPEG DAB	Functional specifications + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* Mandatory broadcast via TPEG DAB
17	Full SRTI on TERN*	Functional specifications +

ID	Name	Description
	and SRTI lite on national/main roads + mandatory broadcast via RDS-TMC	Mandated deployment of all SRTI types (i.e. including end-of-queue) on TERN* & mandated deployment of SRTI lite (i.e. weather warnings and accident notifications only) on Main/National Roads Mandatory broadcast via RDS-TMC
18	Full SRTI on TERN* + mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG SRTI app	Functional specifications + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* Mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG-IP

Table 18 Overview of the impact assessment options

7.3. Scoping the Impact Assessment

In accordance with the Commission's Impact Assessment Guidelines the following Table 19, Table 20 and Table 21 present the results of the identification of the potential impacts that are likely to occur as a result of intervention by the Commission relating to development of specifications for the provision of road safety related minimum universal traffic information across Europe in accordance with the ITS Directive.

The identified areas of potential impacts are then taken forward into the detailed impact assessment.

7.3.1. ECONOMIC IMPACTS

Area	Key Questions	Expected impacts
Functioning of the internal market and competition	What impact (positive or negative) does the option have on the free movement of goods, services, capital and workers? Will it lead to a reduction in consumer choice, higher prices due to less competition, the creation of barriers for new suppliers and service providers, the facilitation of anti-competitive behaviour or emergence of monopolies, market segmentation, etc.?	Yes - Reduction of delays and secondary incidents as a result of information about safety related incidents - Interoperability supports the internal market
Competitiveness, trade and investment flows	What impact does the option have on the global competitive position of EU firms? Does it impact on productivity? What impact does the option have on trade barriers? Does it provoke cross-border investment flows (including relocation of economic activity)?	Yes - Reduction of delays and secondary incidents as a result of information about safety related incidents - Possible increase in ITS R&D + ITS market development (e.g. new services, devices, technologies)
Operating costs and conduct of business / Small and Medium Enterprises	Will it impose additional adjustment, compliance or transaction costs on businesses? How does the option affect the cost or availability of essential inputs (raw materials, machinery, labour, energy, etc.)? Does it affect access to finance? Does it impact on the investment cycle?	No significant impacts

Area	Key Questions	Expected impacts
	Will it entail the withdrawal of certain products from the market? Is the marketing of products limited or prohibited? Will it entail stricter regulation of the conduct of a particular business? Will it lead to new or the closing down of businesses? Are some products or businesses treated differently from others in a comparable situation?	
Administrative burdens on businesses	Does it affect the nature of information obligations placed on businesses (for example, the type of data required, reporting frequency, the complexity of submission process)? What is the impact of these burdens on SMEs in particular?	No expected impacts
Public authorities	Does the option have budgetary consequences for public authorities at different levels of government (national, regional, local), both immediately and in the long run? Does it bring additional governmental administrative burden? Does the option require the creation of new or restructuring of existing public authorities?	Yes - Options that place an obligation on Member States to provide SRTI on the network and via particular channels, or set up a central data node or registry will have budgetary consequences for public authorities - The reduction of road accidents can drive costs of repair and maintenance of infrastructure down
Property rights	Are property rights affected (land, movable property, tangible/intangible assets)? Is acquisition, sale or use of property rights limited? Or will there be a complete loss of property?	No expected impacts
Innovation and research	Does the option stimulate or hinder research and development? Does it facilitate the introduction and dissemination of new production methods, technologies and products? Does it affect intellectual property rights (patents, trademarks, copyright, other know-	Yes - Options which mandate a particular technology may hinder the deployment of new technology for

Area	Key Questions	Expected impacts
	how rights)? Does it promote or limit academic or industrial research? Does it promote greater productivity/resource efficiency?	provision of SRTI - Might also foster innovation for these particular technologies/ channels
Consumers and house-holds	Does the option affect the prices consumers pay? Does it impact on consumers' ability to benefit from the internal market? Does it have an impact on the quality and availability of the goods/services they buy, on consumer choice and confidence? (cf. in particular non-existing and incomplete markets) Does it affect consumer information and protection? Does it have significant consequences for the financial situation of individuals / households, both immediately and in the long run? Does it affect the economic protection of the family and of children?	Yes - If services are free of charge at the point of use this might affect service prices
Specific regions or sectors	Does the option have significant effects on certain sectors? Will it have a specific impact on certain regions, for instance in terms of jobs created or lost? Is there a single Member State, region or sector which is disproportionately affected (so-called 'outlier' impact)?	Yes - Potential impact on existing value chains for provision of SRTI - Some options may require some Member States to make significant investments
Third countries and international relations	How does the option affect trade or investment flows between the EU and third countries? How does it affect EU trade policy and its international obligations, including in the WTO? Does the option affect specific groups (foreign and domestic businesses and consumers) and if so in what way? Does the option concern an area in which international standards, common regulatory approaches or international regulatory dialogues exist? Does it affect EU foreign policy and EU/EC development policy?	No expected impacts, although non-EU countries might voluntarily align with the EC's specifications.

Area	Key Questions	Expected impacts
	What are the impacts on third countries with which the EU has preferential trade arrangements? Does it affect developing countries at different stages of development (least developed and other low-income and middle income countries) in a different manner? Does the option impose adjustment costs on developing countries? Does the option affect goods or services that are produced or consumed by developing countries?	
Macroeconomic environment	Does it have overall consequences of the option for economic growth and employment? How does the option contribute to improving the conditions for investment and the proper functioning of markets? Does the option have direct impacts on macro-economic stabilisation?	Yes - Efficient transport linked to economic growth - Safer roads linked to economic growth

Table 19 Identification of Potential Economic Impacts

7.3.2. Social Impacts

Area	Key Questions	Expected impacts
Employment & Labour Markets	Does the option facilitate new job creation? Does it lead directly or indirectly to a loss of jobs? Does it have specific negative consequences for particular professions, groups of workers, or self-employed persons? Does it affect particular age groups? Does it affect the demand for labour? Does it have an impact on the functioning of the labour market? Does it have an impact on the reconciliation between private, family and professional life?	Yes - A possible extra data collection effort would create jobs in the ITS industry. - Harmonisation can lead to new RTTI services, which would create jobs, but could also economise operations for RTTI content and service providers and road authorities, possibly leading to a job reduction.

Area	Key Questions	Expected impacts
Standards and rights related to job quality	Does the option impact on job quality? Does the option affect the access of workers or job-seekers to vocational or continuous training? Will it affect workers' health, safety and dignity? Does the option directly or indirectly affect workers' existing rights and obligations, in particular as regards information and consultation within their undertaking and protection against dismissal? Does it affect the protection of young people at work? Does it directly or indirectly affect employers' existing rights and obligations? Does it bring about minimum employment standards across the EU? Does the option facilitate or restrict restructuring, adaptation to change and the use of technological innovations in the workplace?	No expected impacts
Social inclusion and protection of particular groups	Does the option affect access to the labour market or transitions into/out of the labour market? Does it lead directly or indirectly to greater equality or inequality? Does it affect equal access to services and goods? Does it affect access to placement services or to services of general economic interest? Does the option make the public better informed about a particular issue? Does the option affect specific groups of individuals (for example the most vulnerable or the most at risk of poverty, children, women, elderly, the disabled, unemployed or ethnic, linguistic and religious minorities, asylum seekers), firms or other organisations (for example churches) or localities more than others? Does the option significantly affect third country nationals?	No expected impacts
Gender equality, equality treatment and opportunities, non –	Does the option affect the principle of non-discrimination, equal treatment and equal opportunities for all? Does the option have a different impact on women and men?	No expected impacts, all users will be accommodated

Area	Key Questions	Expected impacts
discrimination	Does the option promote equality between women and men? Does the option entail any different treatment of groups or individuals directly on grounds of sex, racial or ethnic origin, religion or belief, disability, age, and sexual orientation? Or could it lead to indirect discrimination?	
Individuals, private and family life, personal data	Does the option impose additional administrative requirements on individuals or increase administrative complexity? Does the option affect the privacy, of individuals (including their home and communications)? Does it affect the right to liberty of individuals? Does it affect their right to move freely within the EU? Does it affect family life or the legal, economic or social protection of the family? Does it affect the rights of the child? Does the option involve the processing of personal data or the concerned individual's right of access to personal data	No expected impacts
Governance, participation, good administration, access to justice, media and ethics	Does the option affect the involvement of stakeholders in issues of governance as provided for in the Treaty and the new governance approach? Are all actors and stakeholders treated on an equal footing, with due respect for their diversity? Does the option impact on cultural and linguistic diversity? Does it affect the autonomy of the social partners in the areas for which they are competent? Does it, for example, affect the right of collective bargaining at any level or the right to take collective action? Does the implementation of the proposed measures affect public institutions and administrations, for example in regard to their responsibilities? Will the option affect the individual's rights and relations with the public administration? Does it affect the individual's access to justice? Does it foresee the right to an effective remedy before a tribunal?	Yes - Some options may require additional responsibilities for Public Authorities - All users will have greater access to SRTI - Issue of data sharing between public and private (need for license, agreement, right of access, at a cost or not)

Area	Key Questions	Expected impacts
	Does the option make the public better informed about a particular issue? Does it affect the public's access to information? Does the option affect political parties or civic organisations? Does the option affect the media, media pluralism and freedom of expression? Does the option raise (bio) ethical issues (cloning, use of human body or its parts for financial gain, genetic research/testing, use of genetic information)?	
Public health and Safety	Does the option affect the health and safety of individuals/populations, including life expectancy, mortality and morbidity, through impacts on the socio-economic environment (working environment, income, education, occupation, nutrition)? Does the option increase or decrease the likelihood of health risks due to substances harmful to the natural environment? Does it affect health due to changes in the amount of noise, air, water or soil quality? Will it affect health due to changes energy use and/or waste disposal? Does the option affect lifestyle-related determinants of health such as diet, physical activity or use of tobacco, alcohol, or drugs? Are there specific effects on particular risk groups (determined by age, gender, disability, social group, mobility, region, etc.)?	Yes - Reduction in primary and secondary accidents
Crime, Terrorism and Security	Does the option have an effect on security, crime or terrorism? Does the option affect the criminal's chances of detection or his/her potential gain from the crime? Is the option likely to increase the number of criminal acts? Does it affect law enforcement capacity? Will it have an impact on security interests? Will it have an impact on the right to liberty and security, right to fair trial and the right of defence? Does it affect the rights of victims of crime and witnesses?	No expected impacts
Access to and effects on	Does the option have an impact on services in terms of quality/access for all?	No expected impacts

Area	Key Questions	Expected impacts
social protection, health and educational systems	Does it have an effect on the education and mobility of workers (health, education, etc.)? Does the option affect the access of individuals to public/private education or vocational and continuing training? Does it affect the cross-border provision of services, referrals across borders and co-operation in border regions? Does the option affect the financing / organisation / access to social, health and care services? Does it affect universities and academic freedom / self-governance?	
Culture	Does the proposal have an impact on the preservation of cultural heritage? Does the proposal have an impact on cultural diversity? Does the proposal have an impact on citizens' participation in cultural manifestations, or their access to cultural resources?	No expected impacts
Social impacts in third countries	Does the option have a social impact on third countries that would be relevant for overarching EU policies, such as development policy? Does it affect international obligations and commitments of the EU arising from e.g. the ACP-EC Partnership Agreement or the Millennium Development Goals? Does it increase poverty in developing countries or have an impact on income of the poorest populations?	No expected impacts

Table 20 Identification of Potential Social Impacts

7.3.3. ENVIRONMENTAL IMPACTS

Area	Key Questions	Expected impacts
The Climate	Does the option affect the emission of greenhouse gases (e.g. carbon dioxide, methane etc.) into the atmosphere? Does the option affect the emission of ozone-depleting substances (CFCs, HCFCs)? Does the option affect our ability to adapt to climate change?	Yes - Reduction of emissions (marginal) from reduced congestion as a result of avoided incidents
Transport and the use of energy	Will the option increase/decrease energy and fuel needs/consumption? Does the option affect the energy intensity of the economy? Does the option affect the fuel mix (between coal, gas, nuclear, renewables etc.)used in energy production? Will it increase or decrease the demand for transport (passenger or freight), or influence its modal split? Does it increase or decrease vehicle emissions?	Yes - Reduction of emissions from reduced congestion as a result of avoided incidents
Air Quality	Does the option have an effect on emissions of acidifying, eutrophying, photochemical or harmful air pollutants that might affect human health, damage crops or buildings or lead to deterioration in the environment (soil or rivers etc.)?	Yes - Reduction of emissions from reduced congestion as a result of avoided incidents
Biodiversity, flora, fauna and landscapes	Does the option reduce the number of species/varieties/races in any area (i.e. reduce biological diversity) or increase the range of species (e.g. by promoting conservation)? Does it affect protected or endangered species or their habitats or ecologically sensitive areas? Does it split the landscape into smaller areas or in other ways affect migration routes, ecological corridors or buffer zones? Does the option affect the scenic value of protected landscape?	No expected impacts

Area	Key Questions	Expected impacts
Water quality and resources	Does the option decrease or increase the quality or quantity of freshwater and groundwater? Does it raise or lower the quality of waters in coastal and marine areas (e.g. through discharges of sewage, nutrients, oil, heavy metals, and other pollutants)? Does it affect drinking water resources?	No expected impacts
Soil quality or resources	Does the option affect the acidification, contamination or salinity of soil, and soil erosion rates? Does it lead to loss of available soil (e.g. through building or construction works) or increase the amount of usable soil (e.g. through land decontamination)?	No expected impacts
Land use	Does the option have the effect of bringing new areas of land ('greenfields') into use for the first time? Does it affect land designated as sensitive for ecological reasons? Does it lead to a change in land use (for example, the divide between rural and urban, or change in type of agriculture)?	No expected impacts
Renewable of non-renewable resources	Does the option affect the use of renewable resources (fish etc.) and lead to their use being faster than they can regenerate? Does it reduce or increase use of non-renewable resources (groundwater,minerals etc.)?	No expected impacts
The environmental consequences of firms and consumers	Does the option lead to more sustainable production and consumption? Does the option change the relative prices of environmental friendly and unfriendly products? Does the option promote or restrict environmentally un/friendly goods and services through changes in the rules on capital investments, loans, insurance services etc.? Will it lead to businesses becoming more or less polluting through changes in the way in which they operate?	Yes - More efficient movement of people & goods on roads
Waste production / generation / recycling	Does the option affect waste production (solid, urban, agricultural, industrial, mining, radioactive or toxic waste) or how waste is treated, disposed of or recycled?	No expected impacts

Area	Key Questions	Expected impacts
The likelihood or scale of environmental risks	Does the option affect the likelihood or prevention of fire, explosions, breakdowns, accidents and accidental emissions? Does it affect the risk of unauthorised or unintentional dissemination of environmentally alien or genetically modified organisms?	Yes - Reduction in accidents leads to a reduction in fires and accidental spillages (and a s a result, less risk of potential damages on air/water/soil)
Animal welfare	Does the option have an impact on health of animals? Does the option affect animal welfare (i.e. humane treatment of animals)? Does the option affect the safety of food and feed?	No expected impacts
International environmental impacts	Does the option have an impact on the environment in third countries that would be relevant for overarching EU policies, such as development policy?	No expected impacts

Table 21 Identification of Potential Environmental Impacts

7.4. Description of the Baseline Scenario

The impact assessment will consider the impact that the different scenarios might have against a set of key criteria. The process for judging this is set out below.

The first step will be to identify what might happen if there is no intervention by the EC. The topics that will be assessed to generate this scenario will include:

- The accident rate in Europe
- The costs associated with accidents (in terms of loss of life, human injury and the impact on wider society caused by delays)
- The number of users capable of receiving SRTI
- The current level of data that is collected that could be used to support SRTI
- The current state of play in each MS regarding the elements needed to support SRTI
- The network lengths for each MS

Table 22 expands on the above:

Topic	Notes / information source
Number of accidents by severity (fatal/injury accidents) by MS	• Actual accident rates by MS from 2000 to present (dependent on availability of data) • Predicted accident rates to 2030 (based on year on year changes over the past years) • Analysis of accident types by road types
Cost of accidents	• Number of accidents (by severity) combined with the cost of accidents (varied by severity)
Cost of delays	• Number of accidents (by severity) combined with the cost of delay (varied by severity)
Expected deployment of services without intervention	• % of equipped users capable of receiving SRTI via RDS-TMC • % of equipped users capable of receiving SRTI via TPEG (DAB/IP) • Projections of market penetration rates of RDS-TMC ready devices (now to 2030) • Projections of market penetration rates of TPEG ready devices (DAB/IP) (now to 2030) • Market penetration of SRTI services by MS
Current level of data collection by MS	• Current level of data collection to support SRTI
Elements needed to support SRTI by MS	• Existence of a DATEX II node • Existence of an Unrestricted Access TMC service • Existence of an Unrestricted Access TPEG service
Network length	• Length of motorways by MS • Length of main/national roads by MS • Length of other roads by MS

Table 22 Topics to describe the baseline scenario and information sources

7.4.1. ACCIDENT RATES

The baseline scenario assumes that no additional intervention is taken beyond those already required by the ITS Directive.

Consideration has been given to the accident rates for each MS, and summarised at an EU level. This provides us with an overview of how the baseline may develop without any additional interventions at an EU level (i.e. without SRTI being introduced).

CARE is the Community database on Road Accidents in Europe and it contains statistics on road accidents resulting in death or injury. The statistics do not cover accidents that only result in damage. The CARE database has been used as the basis for identifying the current number of fatal and injury accidents for each Member State. The CARE Annual Statistical Report 2011[84] contains data sets for the years 2000-2009 for each MS in the EU-27 (with the exception of Lithuania and Bulgaria).

The outlook for the Impact Assessment includes the years up to 2030. Therefore, it is necessary to identify the projected accident rates for the baseline scenario. The fatal/injury accident rate projection has been formed by:

- Identifying the year on year change in accident rate for each MS from 2000 to 2009
- Identifying the average rate of change across that period (10 year trend) for each MS
- Applying the average rate of change (10 year trend) from the 2009 actual figures to provide estimates for the accident rates for 2010-2030

The table below describes the average number of fatal and injury accidents per Member State per year for EU-27.

	2006	2009	2012	2015	2020	2025	2030
Fatal	1,416	1,295	968	759	601	455	431
Injury	53,848	55,353	45,750	42,593	37,257	34,068	29,036

Table 23 Average number of fatal and injury accidents per Member State for EU-27 (actual and projections) - 2006-2030

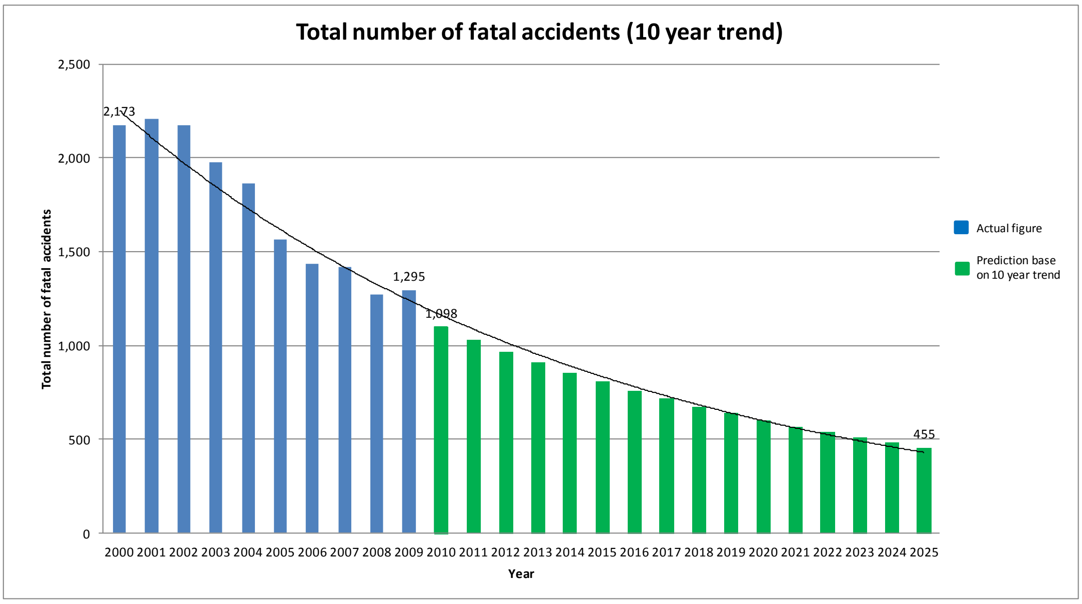

Figure 9 Average number of fatal accidents per Member State for EU27 (source: CARE, 2011)

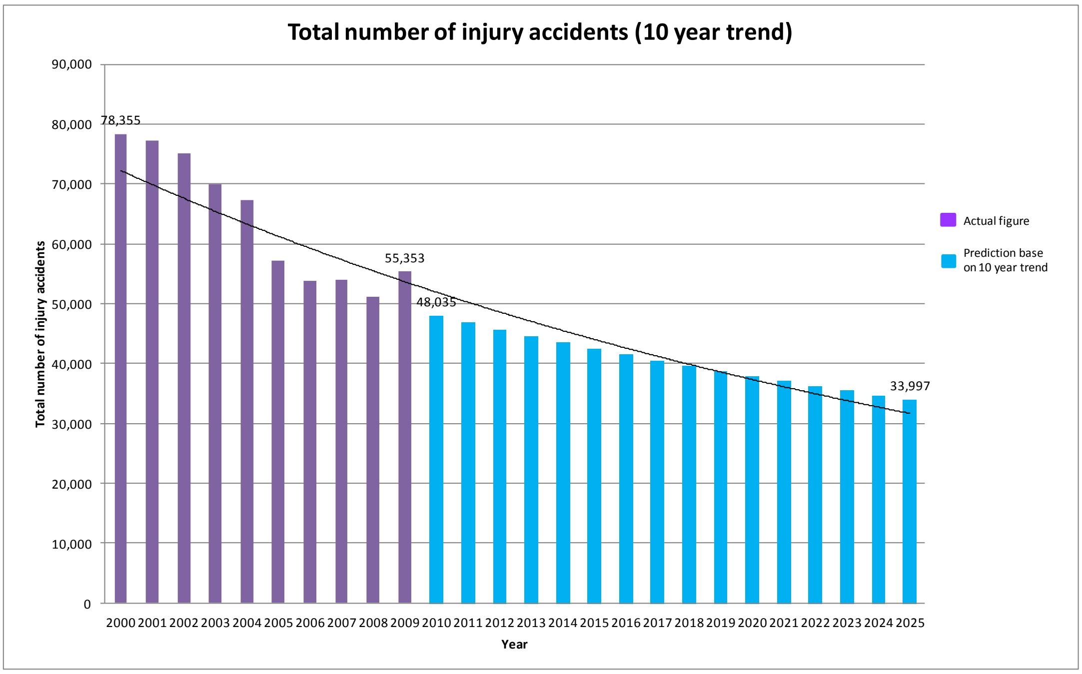

Figure 10 Average number of injury accidents per Member State for EU27 (source: CARE, 2011)

Table 23, Figure 9 and Figure 10 demonstrate that the number of fatal and injury accidents are expected to reduce over the coming years. There has been a significant reduction in the number of fatal accidents from 2000 to 2009. It is acknowledged that the reductions in accident rates in future years may not be as pronounced as they have been from 2000-2009. However, in the absence of data that provides a firm projection to the contrary, the above has been used as a basis for the analysis in this study.

The review of relevant documents indicated that correction factors should be applied to provide a more accurate reflection of the number of fatalities and injuries that result from accidents. This is due to the fact that road accidents tend to be underreported.

The accident figures used as a basis of this analysis were derived from the CARE database. CARE apply their own adjustments to the data that they collate from the different national accident databases and other sources. Therefore no additional adjustments have been made.

7.4.2. Accident costs

This Impact Assessment utilises the monetary valuation of road accidents that was adopted by the eCall Impact Assessment (the eCall Impact Assessment contained monetary values from 2008) [75]. The eCall Impact Assessment in turn calculated the monetary values by using the average value of the amounts recommended by the European Road Safety Observatory. The monetary values proposed by eCall were as follows:

	Road Fatality	Serious Injury	Light Injury
EU value (€)	1,361,262	214,074	16,428

Table 24 Estimated value of road accidents consequences for 2008 (source: eCall 2011)

As previously mentioned, this study has drawn upon the CARE database which separates the accident statistics into ‘fatal’ and ‘injury’.

Based on a review of individual national accident databases (Belgium [85], Czech Republic [86], Germany [87], Malta [88], Netherlands [89], Portugal [90], Slovenia [91], Spain [92], and United Kingdom [93]) for the period 2000-2011, it was identified that of those accidents that resulted in injuries, approximately 13.2% were classified as severe/serious, and 86.8% were classified as slight/minor. Based on this information, the cost of an injury accident (to use the CARE terminology) is assumed to be €42,517.

Therefore, for the purpose of analysing the costs of accidents in relation to the statistics garnered from the CARE database, the following monetary values have been used:

	Road Fatality	Injury
EU value (€)	1,361,262	42,517

Table 25 Estimated monetary value for road accidents (fatality and injury) (2008 figures)

The information in Table 25 is based on 2008 prices (eCall, 2011). To enable these monetary valuations to be used to assess the impact on accident cost projections for future years it is necessary to apply a factor to account for inflation. Table 26 contains the monetary values for multiple years.

	Fatality	Injury accident
EU Value (€) 2002	1,300,005	40,604
EU Value (€) 2006	1,368,068	42,730
EU Value (€) 2008	1,361,262	42,517
EU Value (€) 2009	1,363,985	42,602
EU Value (€) 2012	1,388,911	43,381
EU Value (€) 2015	1,420,023	44,353
EU Value (€) 2020	1,455,737	45,468
EU Value (€) 2025	1,502,356	46,924
EU Value (€) 2030	1,548,976	48,380

Table 26 Monetary value of accidents (based on eCall IA figure for 2008, other years adjusted for inflation)

The costs in Table 26 have been combined with the accident figures from the CARE database. The table below provides an overview of the total costs for the injury and fatal accidents by MS cumulative for the whole Europe and the period from 2006 to 2030.

Year	Status	Cost (€)
2006	Actual	100,751,789,279
2008	Actual	92,471,793,640
2009	Actual	84,888,618,927
2012	Predicted	78,735,821,532
2015	Predicted	71,736,885,168
2020	Predicted	61,527,894,145
2025	Predicted	53,959,511,725
2030	Predicted	46,391,129,305

Table 27 Total costs for injury and fatal accidents for EU-27

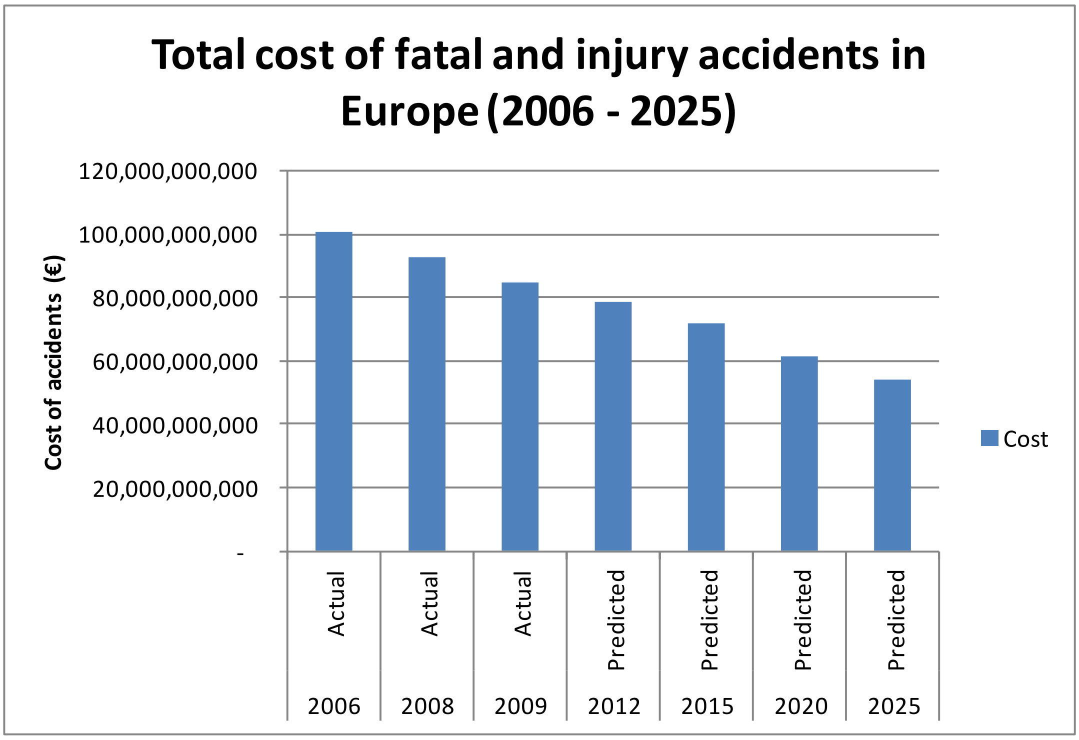

Figure 11 Total cost of fatal and injury accidents in EU-27 (2006 - 2025)

Table 27 and Figure 11 illustrate that the costs of accidents is predicted to reduce without any further actions beyond those already required by the ITS Directive and other EU and national road safety policies and independent developments relating to increased safety of roads and vehicles. The effect is due to a reduction in the number of accidents, rather than a decrease in the value placed on an accident.

7.4.3. ACCIDENT TYPES BY ROAD TYPE

For the purpose of identifying the benefits to be derived from introducing SRTI, it is necessary to establish the type and number of accidents that have occurred on the different road types that fall within the scope of the IA Options.

Not all MS publish their accident data by road type. Therefore, for the purpose of this study, some figures have been derived from a review of those MS who publish their accident data at this level of granularity.

The data for fatal accidents on motorways were derived from a review of an extract from the CARE data base [97]. This contained a summary of the number of fatal accidents that took place on motorways for all MS.

Data for fatal accidents on main/national and other roads, and injury accidents for motorways, main/national roads and other roads is based upon an analysis of the French [98], German [99], and UK [100] national accident databases.

	Fatal	Injury
Motorways	7%	6%
Main/National Roads	64%	40%
Other roads	28%	55%

Table 28 Breakdown of accident type by road type

The figures in Table 28 have been applied to the total number of accidents for the different scenarios, to identify the proportion of accidents that occur on the networks.

7.4.4. COSTS OF DELAYS

The cost of delays caused by accidents utilised cost estimates from the eCall Impact Assessment. The eCall figures were derived from the average of the value cited by the HEATCO and CODIA studies. These studies were based on 2008 prices [75]. Therefore, the monetary values proposed by eCall were assumed to be:

Source	Cost of congestion relating to a fatal accident (€)	Cost of congestion relating to an injury accident (€)
HEATCO	15,000	4,500
CODIA	60,000	16,000
eCall IA	37,500	10,250

Table 29 Estimated cost of delays value for road accidents for 2008 (source: eCall 2011)

The information in Table 29 is based on 2008 prices (eCall, 2011). To enable these monetary valuations to be used to assess the cost of delays for future years it is necessary to apply a factor to account for inflation. Table 30 contains the monetary values for multiple years.

	Fatality	Injury accident
EU Value (€) 2002	35,813	9,789
EU Value (€) 2006	37,688	10,301
EU Value (€) 2008	37,500	10,250
EU Value (€) 2009	37,575	10,271
EU Value (€) 2012	38,262	10,458
EU Value (€) 2015	39,119	10,692
EU Value (€) 2020	40,103	10,961
EU Value (€) 2025	41,387	11,312
EU Value (€) 2030	42,671	11,663

Table 30 Monetary value of estimated cost of delays value for road accidents (based on eCall IA figure for 2008, other years adjusted for inflation)

Figures from Table 30 have been combined with the accident figures from the CARE database. The table below provides an overview of the total costs for the injury and fatal accidents by MS cumulative for the whole Europe and the period from 2006 to 2030.

Year	Status	Cost (€)
2006	Actual	14,221,900,474
2008	Actual	13,371,686,750
2009	Actual	12,543,922,019
2012	Prediction	12,030,393,830
2015	Prediction	11,351,857,623
2020	Prediction	10,255,484,810
2025	Prediction	9,406,899,581
2030	Prediction	8,558,314,352

Table 31 Total cost of delays caused by injury and fatal accidents for EU-27

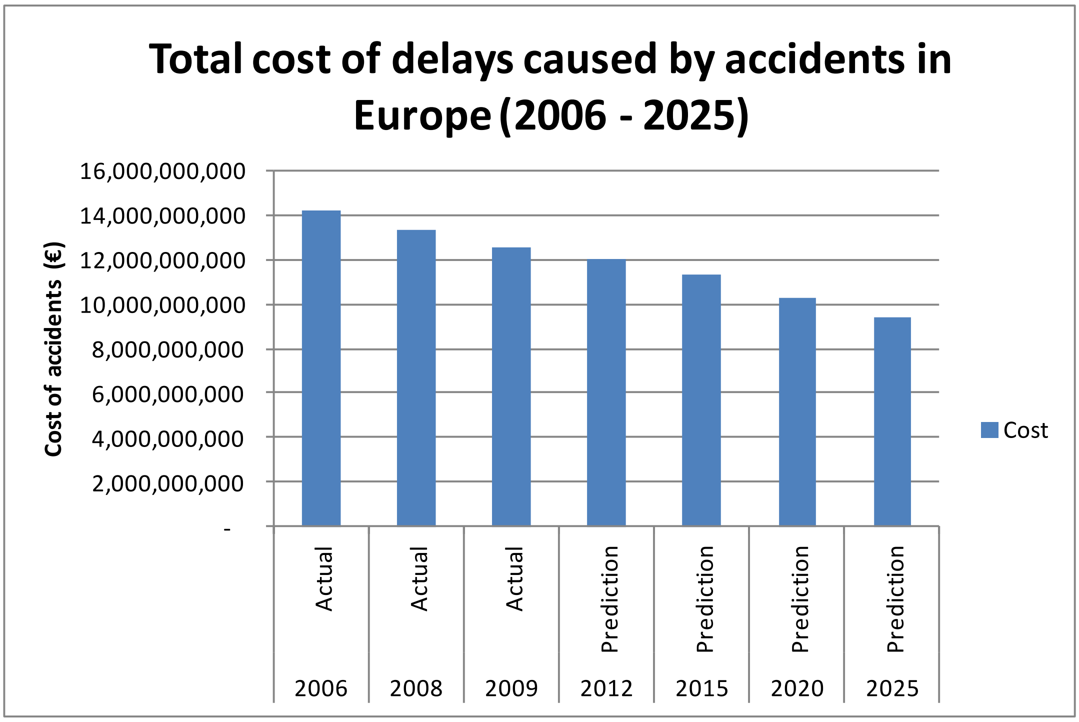

Figure 12 Total cost of delays caused by fatal and injury accidents in EU-27 (2006 - 2025)

Table 31 and Figure 12 illustrate that the costs of delays caused by accidents is predicted to reduce without any further actions beyond those already required by the ITS Directive and other EU or national policies. This is due to the reductions in the number of accidents, rather than a decrease in the value placed on a delay.

7.4.5. Deployment of traffic information services

There is already a significant market in place for the provision of traffic information services.

These services include:

- Roadside services (messages displayed to the user whilst on the road via outlets such as VMS signs)
- Free-to-air voice radio services (radio broadcasts either nationally or customised by a local station; range of public and private sources of information)
- RDS-TMC (across Europe this service is provided by a mix of public and private companies; utilises a range of source data; requires a receiver coupled with an end user device such as a satnav)
- TPEG-DAB
- Mobile phone services (such as a traffic information app)

7.4.5.1. Number of users capable of receiving SRTI

When considering the baseline scenario, it is important to consider how the market for traffic information services could develop in the absence of any other interventions. As well as taking account of the existing TMC/TPEG service provider market and coverage, it is also relevant to consider the extent to which the vehicle population is equipped.

The first step is to identify the vehicle population in Europe for the years covered by this Impact Assessment study (up to 2030). This information has been assembled using the actual vehicle population figures from the EUROSTAT database for 2007-2011 [94]. The average annual rate of change was then calculated for each MS, and a projection was therefore made for the years up to and including 2030 (the estimates are included in Table 33).

TISA has estimated that there are in excess of 100 million RDS-TMC receiver terminals in circulation in Europe [17]. This was used as a baseline for the estimates of users equipped with an RDS-TMC receiver in Europe and will support the identification of the market penetration rates. The figure of 100 million receivers as a base has been combined with the projections made by SBD [95] for annual sales of RDS-TMC receivers to 2015 in the Portable Navigation Device Market (PND).

	2009	2010	2011	2012	2013	2014	2015
RDS TMC receivers	2,958,400	4,204,200	5,489,300	7,586,100	10,252,100	14,838,500	19,503,100
TPEG receivers	-	1,900	20,900	49,900	110,300	287,400	566,000

Table 32 PND market: Annual Sales of DAB TPEG and RDS TMS receivers (2009-2015)

To create the projection of users equipped with RDS-TMC receivers, it was necessary to identify the average change in sales of RDS-TMC receivers. An average was taken from the SBD statistics from the years 2011-2015, and a projection was then made to 2030. The same process was followed for the TPEG receiver figures from the SBD data set.

This projected year on year increase was then added to the existing number of RDS-TMC receivers in circulation in Europe (assumed to be 100 million as per the TISA estimate). There is no assumed base for the number of existing TPEG receivers. Table 33 contains these projections against the total vehicle population in Europe.

In addition to the above, consideration has also been paid to the number of users who can be expected to receive TPEG IP. The focus of this estimate is the number of smartphone users in Europe. Comscore [101] has stated that 45% of mobile phone users use a smartphone at the present time. An assumption has been made that of those users, with the correct level of marketing/branding, you might expect up to 20% of smartphone users to have access to the SRTI app. The uptake of smartphones is expected to increase to nearly 100% in 2030. This has been reflected in Table 33.

Year	Vehicle population in Europe	Total number of users equipped with RDS-TMC receivers	Market Penetration (%)	Total number of users equipped with TPEG (DAB) receivers	Market penetration services (%)	Total users of an SR-TTI smartphone app	Market penetration of services (%)
2012	270.988.248	107.586.100	39,70	49.900	0,02	24.388.942	9
2013	272.471.630	117.838.200	43,25	160.200	0,06	25.067.390	9,2
2014	274.141.301	132.676.700	48,40	447.600	0,16	25.769.282	9,4
2015	276.002.539	152.179.800	55,14	1.013.600	0,37	26.496.244	9,6
2016	278.061.172	174.297.620	62,68	1.618.810	0,58	27.249.995	9,8
2017	280.323.592	199.943.440	71,33	2.356.790	0,84	28.032.359	10
2018	282.796.760	229.117.260	81,02	3.227.540	1,14	29.410.863	10,4
2019	285.488.219	261.819.080	91,71	4.231.060	1,48	31.974.681	11,2
2020	288.406.116	288.406.116	100,00	5.367.350	1,86	34.608.734	12
2021	291.559.213	291.559.213	100,00	6.636.410	2,28	36.736.461	12,6
2022	294.956.915	294.956.915	100,00	8.038.240	2,73	38.344.399	13
2023	298.609.293	298.609.293	100,00	9.572.840	3,21	41.805.301	14
2024	302.527.112	302.527.112	100,00	11.240.210	3,72	45.379.067	15
2025	306.721.861	306.721.861	100,00	13.040.350	4,25	49.075.498	16
2026	311.205.785	311.205.785	100,00	14.973.260	4,81	52.904.983	17
2027	315.991.922	315.991.922	100,00	17.038.940	5,39	56.878.546	18
2028	321.094.146	321.094.146	100,00	19.237.390	5,99	61.007.888	19
2029	326.527.200	326.527.200	100,00	21.568.610	6,61	65.305.440	20
2030	332.306.749	332.306.749	100,00	24.032.600	7,23	69.784.417	21

Table 33 Projected market penetration rates for RDS-TMC, TPEG DAB and SRTI smartphone app equipped users (2012-2030)

As can be seen from Table 33, it is predicted that without any other interventions beyond those already required by the ITS Directive, the market penetration rate is expected to be 100% for RDS-TMC receivers by 2020. During the same time period, it is predicted that the market penetration of TPEG DAB receivers would be at a level of 1.86% (and 7.23% by 2030). The number of users with access to a SRTI app could be expected to be at a level of 12% by 2020 and 21% by 2030.

7.4.5.2. Elements needed to support SRTI

It is assumed that to operate and support an SRTI service, certain elements would be required. Depending on the scenario being investigated, these can include:

- A DATEX II node (to exchange the underlying data)
- An unrestricted access TMC service
- An unrestricted access TPEG service

Section 3.4 of this report provides an overview of the countries that currently have an operational DATEX II node. Annex A provides an overview of the current situation regarding the availability of TMC and TPEG services in each MS.

The information included in Annex A indicates that there is at least some coverage for each MS, however it is not clear to what extent the network is covered in each MS.

For the purpose of the Impact Assessment, it is important to take account of the current network coverage of existing traffic information services, whether they are commercially provided or otherwise. The table below provides a summary of the coverage of the TMC & TPEG services in each country. A more detailed summary (including restricted access services) are included in the Annex G.

MS	TMC		TPEG	
	Motorways	Main/national roads	Motorways	Main/national roads
Austria	X	X	-	-
Belgium	X	X	-	-
Bulgaria	-	-	-	-
Cyprus	-	-	-	-
Czech Republic	X	X	-	-
Denmark	X	X	-	-
Estonia			-	-
Finland	X	X	-	-
France	X	X	-	-
Germany	X	X	-	-
Greece	-	-	-	-
Hungary	-	-	-	-
Ireland	-	-	-	-
Italy	X	X	-	-
Latvia	-	-	-	-
Lithuania	-	-	-	-
Luxemburg	-	-	-	-
Malta	-	-	-	-
Netherlands	X	X	-	-
Norway	-	-	-	-
Poland	-	-	-	-
Portugal	-	-	-	-
Romania	-	-	-	-
Slovak Rep.	X	X	-	-
Slovenia	-	-	-	-
Spain	X	X	-	-
Sweden	X	X	-	-
UK	-	-	-	-

Table 34 Network coverage of unrestricted access TMC and TPEG services

The responsibility for implementing SRTI would lie with the MS. Consequently, for certain scenarios where a broadcast channel has been identified, this study has assumed that the MS would either host their own unrestricted access TMC or TPEG service, or pay a third party to do so on their behalf. The cost of providing an unrestricted access service (TMC or TPEG) in the impact assessment reflects this assumption.

7.4.5.3. CONTENT AVAILABILITY

Section 3.3 includes a summary of the current levels of content availability for each MS. A detailed overview of the current level of data collection for each MS was not available for all MS. Consequently the study has made some broad assumptions about the current level of data collection. These figures are used to drive the cost estimates of how much investment might be required to support the provision of SRTI.

The following table provides a high-level overview of the assumptions made, based on the information available from section 3.3 and ANNEX A, as to the current level of data collection.

Current level of data collection	
Weather information	75%
Incident data	50%
Traffic observations (CCTV etc.)	100%
Overall	**75%**

Table 35 Current level of data collection in Europe

This study has also identified the possible costs of different sensors/probes. The list of these costs has been included in the Annex I.

7.4.6. NETWORK LENGTH

It is important to identify the network covered by the different scenarios. The network length drives the level of data collection required to meet certain quality levels.

The Impact Assessment scenarios have included two network coverage options:

- TERN + Motorways (not part of the TERN)
- TERN + Motorways (not part of the TERN) + main/national roads

The lengths of these networks were identified using data generated by the European Road Federation [102]. The following table includes the total network lengths for the above network coverage options. The full table including the breakdown by MS is available in the Annex H.

	TERN (TEN-T roads)	TERN* (TEN-T plus other motorways)	TERN* plus other main/national roads
Total (km)	99,889	107,371	249,943

Table 36 Network length for EU-27

7.5. Detailed Impact Assessment

This section provides a high level analysis of the overall costs and benefits for each of the scenarios. A more detailed breakdown of the costs and benefits, accompanied with an explanation of the assumptions used to generate the scenario, is included in Annex F.

7.5.1. Savings from SRTI

The savings that can be derived from implementing an SRTI service in Europe are presented in the table in section 7.5.2. The only savings taken into account are the costs of avoided accidents and the costs of avoided congestion directly related to accidents. The savings figure is cumulative based on the 27 MS and the time period covering 2015-2030.

The savings for SRTI are calculated using:

- The accident rates (by network type from the baseline)
- Applying the potential savings for SRTI (varied by the percentage of users capable of receiving SRTI)
- Calculating the monetised value of the savings for avoided accidents and reduced delays (varied by accident severity).

The larger variations between the scenarios are as a result of the network coverage for the individual scenario. For example, scenario 2 has a network coverage of the TERN + other motorways, whereas scenario 3 has a network coverage of the TERN + other motorways + main/national roads.

However, there are other/small differences between certain scenarios, in particular with respect to the different delivery channels used.

7.5.2. Savings against Data Sharing costs

The table below provides a summary of the total benefits of SRTI against the anticipated costs of sharing the SRTI data.

The Annex F contains a more detailed breakdown of the costs that are covered by each scenario, however, a brief summary of the costs that might be associated with sharing the SRTI data is included below[3]:

- Provision of a DATEX II node (either an addition to an existing node, or setting up a new node)
- Costs of operating a SRTI service (i.e. collating the data feeds, making any necessary checks, and preparing the service)
- Cost of setting up and maintaining a TMC service
- Cost of setting up and maintaining a TPEG service
- Cost of setting up an app
- Cost of VMS

[3] Please note that not all of these costs apply to all scenarios, neither do they apply to all MS (e.g. if a MS is already in possession of a suitable DATEX II interface then the costs will reflect that)

Scenario	Benefits of SRTI Total savings (cumulative 2015 - 2030) (€)	Data Sharing CAPEX/OPEX Costs for SRTI (cumulative 2015 - 2030) (€)	Benefit-Cost ratio	
			Based on Low cost estimate	Based on High cost estimate
1	1,477,339,505	459,585,947	3.21	3.21
1bis	1,581,739,688	459,585,947	3.44	3.44
2	1,278,739,474	459,585,947	2.78	2.78
3	8,083,354,972	459,585,947	17.59	17.59
4	8,700,585,172	459,585,947	18.93	18.93
5	1,278,131,474	633,870,612	2.02	2.02
6	1,753,207,470	3,057,860,028 - 5,594,514,960	0.57	0.31
7	1,641,735,477	460,414,091	3.57	3.57
8	1,581,739,688	633,870,612	2.50	2.50
9	8,718,193,695	746,025,464	11.69	11.69
10	9,044,787,536	746,853,608	12.11	12.11
11	1,581,739,688	459,585,947	3.44	3.44
12	9,044,787,536	571,740,799	15.82	15.82
13	10,807,945,548	746,853,608	14.47	14.47
14	10,416,953,233	459,585,947	22.67	22.67
15	8,718,193,695	633,870,612	13.75	13.75
16	1,581,257,820	571,740,799	2.77	2.77
17	5,180,267,743	633,870,612	8.17	8.17
18	1,640,024,959	746,853,608	2.20	2.20

Table 37 Total savings against costs of operating an SRTI service (cumulative costs 2015-2030)

The table illustrates the benefits that could be attained independently of data collection costs. As can be seen in the 'benefit - cost ratio' (BCR) column, it demonstrates that once the initial data collection investment has been made, most scenarios are able to generate benefits.

Scenario 6 is the only scenario to rely on VMS for information distribution. Data sharing costs for scenario 6 are indicated as a range because cost estimates for VMS deployment are ambiguous. Therefore both a low and high cost estimate was developed for distribution using VMS.

7.5.3. DATA COLLECTION COSTS

This study has assumed that to realise the maximum benefits of SRTI, data would need to be provided for the required level of network coverage at a particular level of quality. This data may come from existing sources, or additional data may be required for the given network to meet the necessary level of coverage/granularity. The costs associated with collecting this additional data are identified below.

The costs below include the initial investment for collecting the data (whether this is by investing in sensors etc. or accessing alternative sources), as well as the maintenance, operation and any replacement costs.

The level of additional data collection required for each scenario is based upon the following:

- the network length for the scenario
- the required level of data collection (based on the application of the QUANTIS methodology)
- an estimation as to the current level of data collection on the network (therefore providing us with an understanding of the proportion of the network that would need to be further equipped)

For the purposes of developing the impact assessment, it was necessary to identify the estimated cost of collecting the data needed to support SRTI. For each scenario, a set of low and high data collection cost estimates have been included. This is because there are a range of methods that could be used to collect the data needed to support the provision of SRTI, and there are different costs associated with each. For example, to identify the presence of ghost drivers you could use directional sensors, or CCTV, or a road user reporting system (e.g. by calling the emergency services to report a sighting). The table below provides examples of the data collection methods that have been used to help cost the different scenarios.

Data collection method	Mini SRTI (low cost estimate examples)	Mini SRTI (high cost estimate examples)	Full SRTI (low cost estimate examples)	Full SRTI (high cost estimate examples)
Weather stations	✓	✓	✓	✓
112 reports/eCall	✓	✓	✓	✓
Loop data		✓	✓	✓
Road User reports (e.g. jam buster reports)	✓		✓	
CCTV		✓		✓

Table 38 Examples of low and high cost data collection methods

If the operational lifetime for the data collection method is shorter than the period covered by the impact assessment (i.e. 2015-2030), then the cost of replacing the data collection method/equipment has been included in the model. For example, inductive loops installed in a motorway environment have an expected lifetime of 5 years; therefore, they would be replaced twice during the period 2015-2030.

It is acknowledged that in reality, each MS is likely to use a range of methods to access the data needed to support SRTI, ranging from probes/sensors to user reports, to floating vehicle data. For the purpose of developing a data collection cost for the impact assessment model, assumptions have had to be made as to the methods that could be used to collect the required data (see Table 38).

It should also be noted that although there is no distinction between the low and high data collection cost estimates for the coverage or granularity requirements, the study team does accept that there are likely to be quality differences between some of the low and high cost data collection methods. For example, relying on road users reports/observations to identify incidents such as ghost drivers, is unlikely to be as accurate as using CCTV to identify the same incident. The model cannot and does not currently take account of these quality variations.

The table below provides an overview of the potential costs required to ensure that data is available on the whole network at the appropriate level of quality and coverage.

	Data Collection CAPEX/OPEX costs (cumulative 2015 - 2030) (€)	
Scenario	Low estimate	High estimate
1	87,415,200	87,415,200
1bis	1,101,523,527	5,899,173,796
2	38,221,130	6,443,998,985
3	129,781,624	17,017,181,534
4	1,297,577,012	17,219,711,835
5	38,221,130	6,443,998,985
6	2,162,262,803	6,877,863,756
7	2,144,224,516	6,256,344,764
8	1,206,016,518	6,256,344,764
9	1,305,171,898	17,227,306,721
10	1,307,004,969	17,279,908,288
11	1,203,256,038	6,443,998,985
12	1,307,004,969	17,279,908,288
13	4,624,865,632	17,279,908,288
14	4,624,865,632	17,279,908,288
15	1,307,004,969	17,279,908,288
16	1,206,499,387	6,256,344,764
17	1,307,004,969	6,408,101,711
18	1,206,499,387	6,256,344,764

Table 39 Investment costs required for the collection of additional data needed to support SRTI (cumulative costs 2015- 2030)

The assumptions taken for each scenario are described in Annex F.

7.5.4. Analysis of Savings against overall costs

The table below provides an analysis of the anticipated savings from SRTI against the total costs of collecting data and sharing the data/supporting the service.

Scenario	Benefits (cumulative 2015 - 2030) (€)	Data collection and sharing costs (2015-2030) (€)		Benefit - cost ratio	
		Low estimate	High estimate	Based on low cost estimate	Based on high cost estimate
1	1,477,339,505	459,585,947	459,585,947	3.21	3.21
1bis	1,581,739,688	1,561,109,474	6,358,759,743	1.01	0.25
2	1,278,131,474	497,807,078	6,903,584,932	2.57	0.19
3	8,083,354,972	589,367,571	17,476,767,482	13.72	0.46
4	8,700,585,172	1,757,162,959	17,679,297,782	4.95	0.49
5	1,278,131,474	672,091,742	7,077,869,596	1.90	0.18
6	1,753,207,470	5,220,122,831	12,472,378,716	0.34	0.14
7	1,641,735,477	2,604,638,607	7,338,277,847	0.63	0.22
8	1,581,739,688	1,839,887,130	6,890,215,376	0.86	0.23
9	8,718,193,695	2,051,197,362	17,973,332,185	4.25	0.49
10	9,044,787,536	2,053,858,577	18,026,761,896	4.40	0.50
11	1,581,739,688	1,662,841,985	6,903,584,932	0.95	0.23
12	9,044,787,536	1,878,745,768	17,851,649,087	4.81	0.51
13	10,807,945,548	5,371,719,240	18,026,761,896	2.01	0.60
14	10,416,953,233	5,084,451,579	17,739,494,235	2.05	0.59
15	8,718,193,695	1,940,875,581	17,913,778,900	4.49	0.49
16	1,581,257,820	1,778,240,186	6,828,085,563	0.89	0.23
17	5,180,267,743	1,940,875,581	7,041,972,323	2.67	0.74
18	1,640,024,959	1,953,352,995	7,003,198,371	0.84	0.23

Table 40 Savings against total cost of introducing and operating SRTI (cumulative savings and costs 2015-2030)

As can be seen from Table 40, scenario 1 is able to generate a positive BCR for both the low and high costs estimates. This is because it does not require any additional data collection beyond that which already takes place (i.e. no mandatory deployment). Therefore the savings derived from introducing SRTI can be realised in theory with little additional investment.

Some of the scenarios, namely 1bis, 2-5, 9, 10, 12-15, and 17 have positive BCRs for the low cost estimates. However, some of these require a much higher level of initial data collection investment due to the SRTI content (i.e. including end-of-queue) and a wider network coverage (i.e. deployment on main/national roads). In practice, BCRs will be somewhere in between the minimum and maximum values (for low and high cost estimates). This will depend on the individual choices of each Member State.

It should be noted that the benefits to be derived from SRTI do not take into account the likelihood of drivers using SRTI influencing the drivers around them (e.g. if users with access to SRTI slow down as a result of the information they receive, it could encourage other vehicles around them to slow down).

7.5.5. Assessment of impact on existing markets

Table 41 provides an overview of the assessment of the overall impact of the different IA scenarios on the Stakeholders involved in the SRTI value chain:-

- Detection Equipment Suppliers
- Private Data Collectors
- Private Data Aggregators / Content Providers
- Private RTTI Broadcast Providers
- Private RTTI Service Providers
- End Users

The complete analysis is included in Annex K. This qualitative assessment shows that IA scenario 14 has the greatest overall benefit to the existing traffic information market, where it is expected to have a positive impact for all private sector actors in the value chain. Scenario 3 is the only scenario to have a positive impact on all actors.

Overall, equipment suppliers and the private data collectors will benefit from all scenarios, as they will benefit from the extra SRTI data collection effort. The scenarios with the higher road network and content coverage requirements, and the scenarios and with mandatory distribution channels deployment, have a negative impact on private data aggregators and private broadcasters. The end user benefits from all scenarios but in particular from the scenarios that achieve large road and content coverage, or that make distribution channels mandatory.

Nr	Scenario	Market Impact
1	Functional Specifications Only (i.e. no mandatory deployment)	4
1bis	Functional Specifications mandatory for existing services	5
2	Mini SRTI on TERN* (= TERN + other motorways)	5
3	Mini SRTI on TERN* & Main/National Roads	10
4	Full SRTI on TERN* & Mini SRTI on Main/National Roads	8
5	Mini SRTI on TERN* + mandatory broadcast via RDS-TMC	3
6	Full SRTI on TERN* + mandatory broadcast via VMS and existing channels	7
7	Full SRTI on TERN* + mandatory broadcast via SRTI smartphone app	4
8	Full SRTI on TERN* + mandatory broadcast via RDS-TMC	4
9	Full SRTI on TERN* & Mini SRTI on Main/National Roads + mandatory broadcast via RDS-TMC & TPEG-DAB	6
10	Full SRTI on TERN* & Mini SRTI on Main/National Roads + mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG-IP	8
11	Full SRTI on TERN*	7
12	Full SRTI on TERN* & Mini SRTI on Main/National Roads + mandatory broadcast via TPEG DAB	5
13	Full SRTI on TERN* + main/national roads + mandatory broadcast via RDS-TMC & TPEG DAB & TPEG IP	6
14	Full SRTI on TERN* and main/national roads	11
15	Full SRTI on TERN* + main/national roads + mandatory broadcast via RDS-TMC	8
16	Full SRTI on TERN* + mandatory broadcast via TPEG DAB	3
17	Full SRTI on TERN* and SRTI lite on national/main roads + mandatory broadcast via RDS-TMC	5
18	Full SRTI on TERN* + mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG SRTI app	2

Table 41 Qualitative Assessment of Market Impact

7.5.6. ASSESSMENT OF IMPACT ON FUNDAMENTAL RIGHTS

The potential impact of the adoption of SRTI specifications on the fundamental rights (as defined in Annex 8 of the Commission's Impact Assessment Guidelines) has been assessed. The results of the assessment are enclosed in Annex L and showed that no impact is expected other than a 'possible' impact on:

- The protection of personal data
- The freedom to conduct a business
- The right to property
- Environmental protection

The impact on potentially affected Fundamental Rights is elaborated in the next sections.

7.5.6.1. PROTECTION OF PERSONAL DATA

The data that is collected for providing SRTI can sometimes contain personal data, e.g. in case floating vehicle data or information from cooperative systems is collected, position data and travel patterns are collected from vehicles. *Privacy by design* principles need to be applied to safeguard that data is stored in such a way that it cannot be traced to an individual or group of individuals, e.g. regulation of maximum data retention time, anonymisation, etc.

Compliance with data protection regulations has been considered in the impact assessment with respect to data collection methods, in particular using CCTV, FCD and cooperative systems. Compliancy is achieved by applying the 'privacy by design' principles. It was assumed that 'privacy by design' incurs no additional costs for the implementation and operation of these technologies as these can be considered a standard part of the system design cycle.

Data protection regulations do not need to have an impact on the effectiveness of data collection methods. By applying the 'privacy by design' principles data collection system can be developed and implemented without compromising their effectiveness. As such, adherence to data protection regulations will not have an impact on the benefits in the impact assessment.

7.5.6.2. FREEDOM TO CONDUCT A BUSINESS

Adoption of specifications to harmonise SRTI deployment in the EU, can affect the existing market of RTTI services. Caution should be taken not to issue specifications that might undermine current business models and cooperation models in the various Member States. A more detailed assessment of the impact on existing markets is provided in section 7.5.5.

7.5.6.3. RIGHT TO PROPERTY

Both public and private organisations create road traffic data and information, and hold property rights to these. The specifications should respect these property rights.

7.5.6.4. ENVIRONMENTAL PROTECTION

The previous steps of the assessment have indicated that EU deployment of SRTI will reduce the number of accidents in the EU. A reduction in accidents will in turn

- Lower the risk of damages on air/soil/water resulting from fires or spillage after an accident.

- Reduce congestion and as such contribute in a positive way to a reduction of air pollution.

7.5.7. ASSESSMENT OF COMPLIANCE AGAINST PRINCIPLES OF THE ITS DIRECTIVE

Table 42 provides an overview of the results of the qualitative assessment of the different IA scenarios against the principles of the ITS Directive. Annex M presents the ITS Directive Principles and the assessment table with explanatory notes.

Nr	Scenario	Compliance rating
0	Functional Specification Only (i.e. no mandatory deployment)	-4
1	Mini SRTI on TERN* (= TERN + other motorways)	12
1bis	Specifications + DATEX II	13
2	Mini SRTI on TERN* & Main/National Roads	14
3	Full SRTI on TERN* & Mini SRTI on Main/National Roads	12
4	Mini SRTI on TERN* + mandatory broadcast via RDS-TMC	12
5	Full SRTI on TERN* + mandatory broadcast via VMS and existing channels	16
6	Full SRTI on TERN* + mandatory broadcast via SRTI smartphone app	9
7	Full SRTI on TERN* + mandatory broadcast via RDS-TMC	10
8	Full SRTI on TERN* & Mini SRTI on Main/National Roads + mandatory broadcast via RDS-TMC & TPEG-DAB	14
9	Full SRTI on TERN* & Mini SRTI on Main/National Roads + mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG-IP	14
10	Full SRTI on TERN*	14
11	Full SRTI on TERN* & Mini SRTI on Main/National Roads + mandatory broadcast via TPEG DAB	8
12	Full SRTI on TERN* + main/national roads + mandatory broadcast via RDS-TMC & TPEG DAB & TPEG IP	10
13	Full SRTI on TERN* and main/national roads	11
14	Full SRTI on TERN* + main/national roads + mandatory broadcast via RDS-TMC	16
15	Full SRTI on TERN* + mandatory broadcast via TPEG DAB	16
16	Full SRTI on TERN* and SRTI lite on national/main roads + mandatory broadcast via RDS-TMC	7
17	Full SRTI on TERN* + mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG SRTI app	17
18	Functional specification + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* + mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG-IP	9

Table 42 Qualitative assessment against the ITS Directive Principles

The analysis shows that IA scenarios 5, 14, 15 and 17 have the highest overall alignment with the ITS Directive principles, followed by IA scenarios 1, 2 and 8. But scenarios 2, 5, 14 & 17 perform 'best' because they do not have negative effects on any of the ITS Directive principles.

8. Preliminary Analysis

8.1. General findings

For the current set of assumptions, scenarios 6, 7, 8, 11, 16 and 18 produce benefit-cost ratio (BCR) of less than 1 for the low-cost estimate. All except scenario 1 produce BCRs of less than 1 for the high-cost estimate.

Scenario 6 results in a low BCR because of the high costs involved in the deployment and maintenance of VMS signs. The operational costs for the scenarios other than scenario 6 are quite similar. Indeed operational costs have a limited influence on the benefit-cost ratios of the scenarios. The scenarios exhibit significant differences in the implementation costs and expected safety impact. These are the key differentiators in the benefit-cost ratios.

This is partly due to the paradigm that SRTI can be collected most efficiently for motorways, but that the main safety benefits can be achieved on lower level roads, where data collection costs are significantly higher.

For the current set of assumptions, scenarios 1 to 5, 9, 10, 12 to 15, and 17 produce BCR higher than 1, i.e. savings are higher than costs, for the low-cost estimate. These are mainly scenarios where only minimum SRTI is provided for Main/National Roads. Although minimum SRTI produces a lower road safety impact than full SRTI, it produces a better BCR because minimum SRTI does not require the collection of end-of-queue warnings which is very costly in particular for main/national roads.

None of the evaluated scenarios has an impact on the Fundamental Rights of the European Union.

The following sections describe the general benefits and drawbacks of the scenarios that will serve as input for the comparison of key deployment options in chapter 9. The description of all 19 scenarios has been enclosed in Annex N.

8.2. Scenario 1bis – Functional Specifications mandatory for existing services

Scenario 1bis is the scenario whereby Member States are not obliged to collect new data. Making the existing data available through a DATEX II node however is mandatory. Also deployment of SRTI according to the specifications is mandatory only for Member States with some forms of SRTI systems already in place.

This scenario has a positive impact on content aggregators as it provides easy access to public road data but could affect service providers which core business rely on 'end of queue' warnings. Broadcasters are not penalised as no delivery channel is mandated. The impact on road safety is not very high since the deployment of services is limited.

Scenario 1bis shows relatively high alignment with the principles of the ITS Directive, scoring relatively high on proportionality, support for backward compatibility, respecting existing national arrangements and coherence.

8.3. Scenario 2 - Mini SRTI on TERN*

Scenario 2 is the scenario that identifies a set of functional specifications, with the addition of mandating that the minimum SRTI service should be deployed on the TERN + other motorways network.

Scenario 2 produces a low impact on road safety. This is mainly due to the limited road type coverage; motorways are already quite safe. As a result, despite the relatively low implementation and operational costs, the BCR is low.

Scenario 2 shows relatively high alignment with the principles of the ITS Directive, scoring relatively high on support for backward compatibility and respecting coherence. The functional nature of the specifications limits the effects on existing arrangements while contributing to harmonisation of cross border services.

8.4. Scenario 4 - Full SRTI on TERN*, Mini SRTI on Main/National Roads

Scenario 4 covers the same roads as scenario 3, but includes 'end-of-queue' information in the definition of SRTI.

The inclusion of 'end-of-queue' information enhances the impact on traffic safety, but also drives higher implementation costs. Still the resulting BCR is relatively high.

The qualitative assessment of market impacts shows that scenario 4 has a relatively high overall benefit. It could however have an adverse effect on private data aggregators and service providers, as it will touch on their key business proposition of providing traffic flow information.

Scenario 4 shows moderate compliance with the principles of the ITS Directive. Although scoring high on effectiveness, it scores relatively low on cost efficiency and proportionality. This is largely the result of the high investments for detecting 'end-of-queue' in particular on secondary roads.

8.5. Scenario 11 - Full SRTI on TERN*

Scenario 11 differs from scenario 2 by mandating the full SRTI service on the TERN + other motorways. This results in an increased reduction in the number of accidents experienced on the TERN + other motorways network.

Scenario 11 produces a relatively low impact on road safety because of the limited road type coverage. As a result, despite the moderate implementation and operational costs, the BCR is low.

Scenario 11 shows moderate alignment with the principles of the ITS Directive, despite scoring relatively high on effectiveness. This is related to the limited road type coverage, but also to the functional nature of the specifications. However this scenario 11 limits the effects on existing arrangements while contributing to harmonisation of cross border services.

8.6. Scenario 14 – Full SRTI on TERN* + Main/National Roads

Scenario 14 provides full SRTI on both TERN* as well as main/national roads.

This scenario 14 achieves a very high impact on road safety. The more extensive road type coverage with full coverage of the SRTI information categories, jointly produce this result.

Despite the high implementation costs, the resulting benefit-cost ratio is relatively high because of the road safety related savings that can be achieved on the main/national roads.

Although it has a negative impact on private data aggregators, the qualitative assessment of market impacts shows that scenario 14 has the highest overall benefit of all scenarios. This is mainly because it will make high-quality SRTI available across Europe and beyond the TERN.

Scenario 14 shows very high compliance with the principles of the ITS Directive, scoring positive on all criteria.

9. Comparison of key deployment options

9.1. Introduction

In the impact assessment, 19 different scenarios were evaluated. In this section the positive and negative impacts of the key deployment scenarios and the baseline scenario are mapped. Trade-offs and synergies between different stakeholders are identified per key deployment option, and specific drawbacks and benefits of each key deployment options described and substantiated.

9.2. Selection of Options

The impact assessment resulted in 19 different options with varying benefit-cost ratios. This section focuses on the 5 scenarios that were considered most suitable. These include scenarios with no mandated distribution channel, and were selected in concert with the European Commission.

These scenarios are:

a) Scenario 1^{bis} – Functional Specifications mandatory for existing services - 'status quo' + enhanced data sharing + obligation to Member States whom already have a SRTI service in place, to make it compliant with the specifications requirements (e.g. data sharing, data quality).
b) Scenario 11 - Full SRTI on TERN* - Functional Specifications + data collection to meet the needs of full SRTI on TERN*
c) Scenario 2 - Mini SRTI on TERN* - As above, but with data collection to meet mini SRTI
d) Scenario 14 - Full SRTI on TERN* + main/national roads - As above, with extension to main/national roads
e) Scenario 4 - Full SRTI on TERN* + Mini SRTI on main/national roads - As above, but varying the SRTI content for main/national roads

These will be referred to as scenarios A through E in this section. The impact assessment showed that road coverage, SRTI category coverage, and level of harmonisation are the key differentiators in the BCRs. Scenarios A to E combine these differentiators to cover the full spectrum of possible solutions.

9.3. Overview of impacts

The table below presents the various impacts as identified in the detailed impact assessment. These are further elaborated in the next sections but one general finding already stands out: the costs for data collection to a large extend determine the BCR. This means that quality criteria (which drive data collection costs) in specifications by the European Commission should be carefully considered. These criteria should not be too high as this would force Member States to deploy expensive data collection methods but still ambitious enough to foster enhancement of road safety.

	Baseline	A	B	C	D	E
Road type coverage	No requirements	No requirements	TERN*	TERN*	TERN*+main/national roads	TERN*+main/national roads
SRTI coverage	No requirements	No requirements	Full	Mini	Full	Full / Mini
Policy	No requirements (other than what is already required by the ITS Directive)	Functional requirements, mandated adaptation for MS where a service exist already	Functional specifications + Mandated deployment	Functional specifications + Mandated deployment	Functional specifications + Mandated deployment	Functional specifications + Mandated deployment
Costs cumulative 2015-2030 in M€						
Low estimate	0	1.102	1.663	498	5.084	1.757
High estimate	0	5.899	6.904	6.904	17.739	17.679
Savings cumulative 2015-2030 in M€	0	1.582	1.582	1.229	10.417	8.701
BCR (low cost)	1	1,0	1,0	2,5	2,0	5,0
BCR (high cost)	1	0,3	0,2	0,2	0,6	0,5
Market impact	-	+6	+7	+5	+11	+8
ITS Directive	-	+9	+8	+14	+16	+12

Table 43 Overview of the results of the impact assessment for scenarios A-E against Baseline

9.4. Savings and Costs

The graphs below present the costs and savings of the 5 scenarios using the same scale. These figures illustrate:

1) The large differences in costs of the scenarios. When main/national roads are included, the deployment and operational costs increase by a factor of about 3.
2) The large differences in savings of the scenarios. When main/national roads are included, the savings achieved through improved road safety increase by a factor of about 10. Expanding to main/national roads produces higher BCRs as a result. The question in the current economical context is however whether this justifies the high investments and operational costs required.
3) In all scenarios the high cost variant produces a negative net result, in some cases increasing in time, while the low cost variant produces a positive net result. This again confirms that the quality criteria for data collection need to be determined with great care as they determine the data collection costs and subsequently the BCRs in practice.

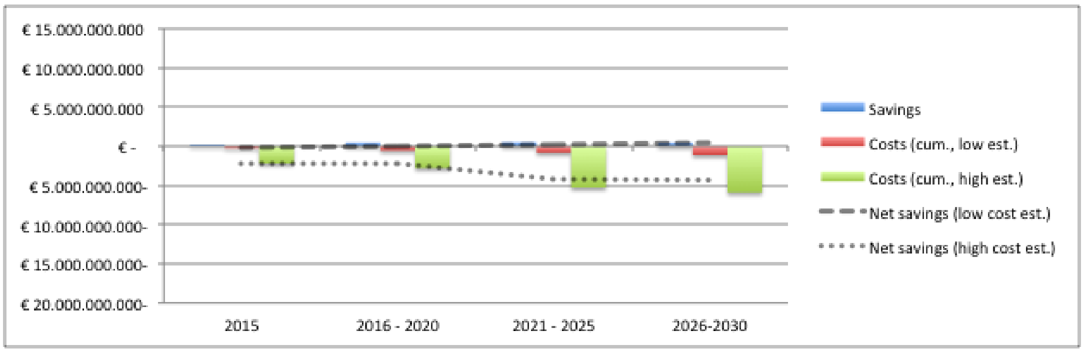

Table 44 Comparison of savings and costs for scenario A

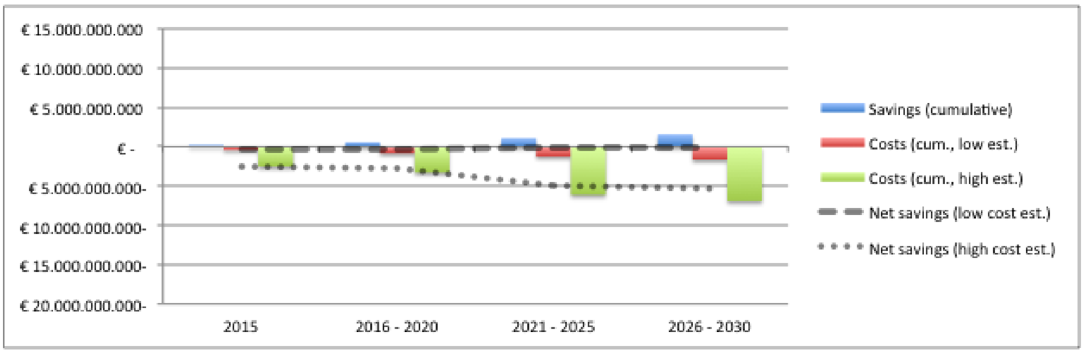

Table 45 Comparison of savings and costs for scenario B

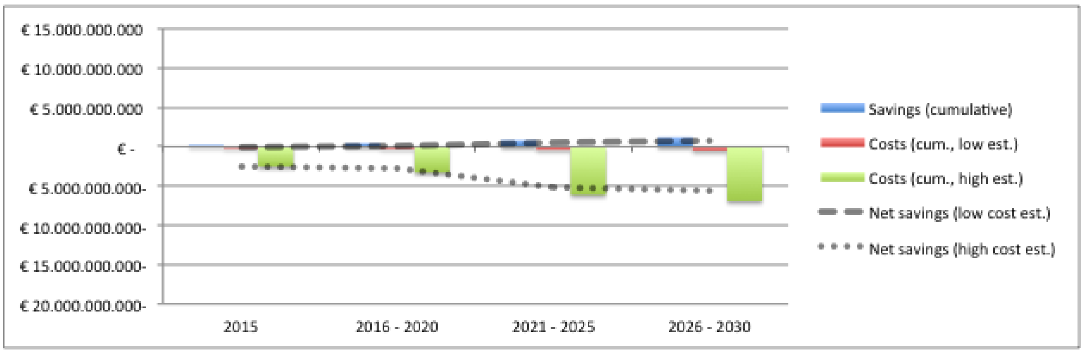

Table 46 Comparison of savings and costs for scenario C

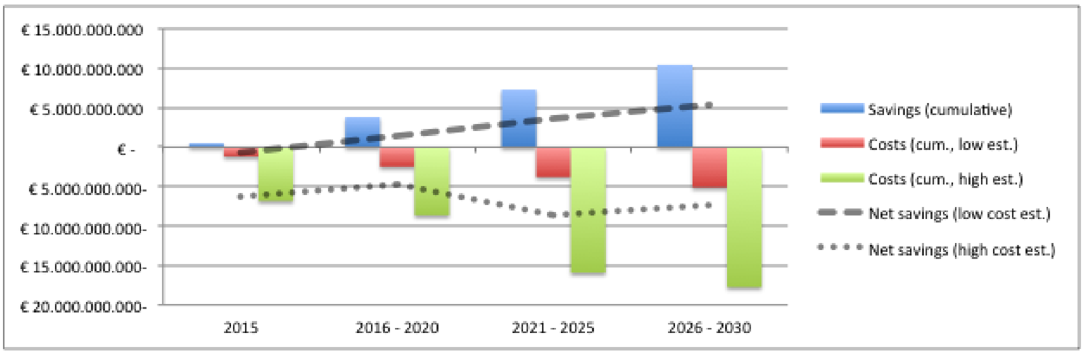

Table 47 Comparison of savings and costs for scenario D

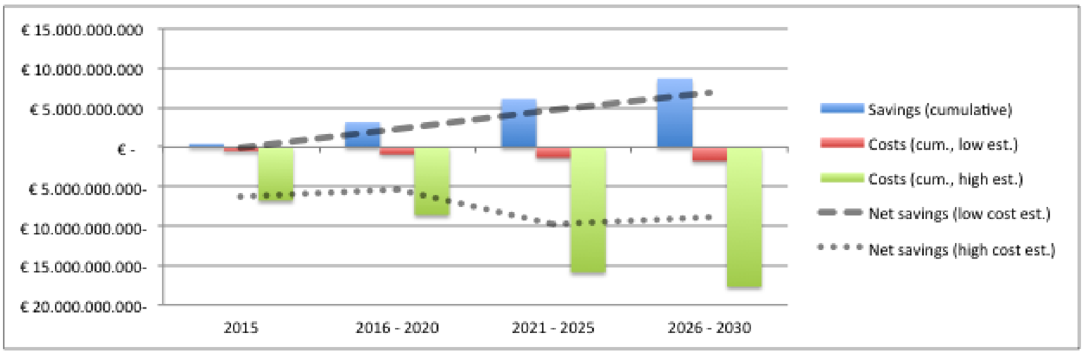

Figure 13 Comparison of savings and costs for scenario E

9.5. Level of regulation

All scenarios except 1bis rely on functional specifications and mandatory deployment. Mandatory deployment will obviously lead to a more harmonised SRTI service level in Europe. Specifications will however only bear fruit if supported by the Member States, as they will need to fund and operate deployment.

Scenario 1bis adheres closely to the ITS Directive and does not require Member States to collect new data or deploy new services, but only requires them to comply with ITS specifications when doing so at their own initiative and own pace. It however requires that Member States where some forms of SRTI services exist already, these are made compliant with the specifications.

Because ITS Directive Specifications also apply to existing systems, Member States with existing systems should be granted a transition period to enable adaptation and amortisation of their SRTI systems.

9.6. Proportionality and Subsidiarity

During the Expert Meetings Member States indicated that they consider TERN coverage as a minimum as the most appropriate level for regulation. This means that scenarios D and E will in practice lead to more resistance from Member States, which in turn might hamper or delay deployment of SRTI services on roads beyond the TERN only.

What is the right level of road coverage touches on the principles of proportionality and subsidiarity. From the impact assessment it is clear that:

1) Deployment costs for SRTI are much lower on TERN than on the national roads
2) The main safety benefits can be achieved on national roads

The national roads have limited relevance for cross-border traffic and as such the mandatory deployment of SRTI on national roads seems disproportionate. Motorists throughout Europe would however benefit from harmonised SRTI on European roads as it would make them feel more at ease when driving abroad because they can rely on the same SRTI as in their home country. Whether the increased safety benefits and the benefits of a more harmonised SRTI offering outweigh the high costs is however questionable.

For TERN the situations is clearer. The TERN was designed to carry traffic across borders. As such harmonisation of SRTI on TERN will make cross border traffic more comfortable and safe. Although the safety impact of SRTI on TERN is much lower than on national roads, it is still positive as long as the quality requirements for SRTI are not set too stringent. Because Member States already collect SRTI for large parts of TERN, the additional deployment and operational costs are relatively low.

The ITS Directive applies to both new and existing systems. Setting criteria for SRTI in terms of information categories that have to be covered, and data quality, will determine to what extent existing systems in Member States will be affected. Arguably, setting requirements that make existing systems obsolete should be considered disproportionate. The selected scenarios all will affect existing system if immediate deployment is required. All scenarios A through E require Member States to make systems compliant with requirements:

- In scenario A, existing central traffic information centres will need to be made compliant with the requirements, to allow for the 'enhanced data sharing'.
- Scenario B and C require Member States to collect either Mini or Full SRTI on TERN. Systems on only few sections of the TERN currently will be able to collect the data that is required for mini SRTI, and even less for full SRTI. These scenarios will therefore force many Member States to replace or update their

existing systems on the TERN. The same applies for scenarios D and E although the impact will be higher as it also applies to (the few) existing systems on the lower level roads.

A simple solution would be to allow Member States with existing systems to make these systems compliant when they have reached the end of their economic life. This means a two-step approach similar to the one taken by INSPIRE; new systems need to be compliant immediately, and existing systems need to be made compliant within a period that corresponds to their average depreciation period.

It therefore seems that deployment of SRTI on TERN is in line with the proportionality and subsidiarity principles of the ITS Directive, as long as the quality requirements for SRTI are not set too stringent (but still sufficient for mini SRTI quality), and as long as Member States with existing system are provided with the option to make existing systems compliant with the Specifications when they have reached the end of their economic lifespan, or after an ad hoc transition phase which shall be acceptable and common for all MS.

9.7. Definition of SRTI

The definitions of the SRTI categories that are to be included in the specifications will to a large extend determine costs, road safety benefits and the market impact.

Key issue is whether 'end-of-queue' warnings are to be included, i.e. the difference between ‘full SRTI’ and ‘mini SRTI’. End-of-queue collisions are an important cause of serious accidents, and occur in particular on motorways. As such the inclusion of 'end-of-queue' in SRTI would have a positive effect on road safety on TERN. Some private data collectors and aggregators consider 'end-of-queue' information to be part of traffic jam reports and therefore consider it their core business. As such some of these companies object to the inclusion of 'end-of-queue' information in the SRTI definition, claiming it will negatively affect their business.

The positional and temporal accuracy of 'end-of-queue' information is currently limited, and their value for short-term/real time 'end-of-queue' warnings is limited. To effectively warn motorists for an 'end-of-queue', very accurate data is required that is currently available only on very specific congestion prone links in densely populated areas. This explains why the deployment of full SRTI requires significantly higher investments than of mini SRTI.

It is expected that in future, new data collection methods (in particular cooperative systems) will allow for cost-efficient collection of more reliable 'end-of-queue' information. It is however unclear how fast cooperative systems will develop in the EU and what penetration rates they will achieve. It therefore seems appropriate not to discard 'end-of-queue' for SRTI, but to include it in a later stage of deployment.

9.8. Distribution Channels

None of the selected scenarios mandates Member States to distribute SRTI over a specific distribution channel. The SWOT of distribution channels showed that each has specific benefits and drawbacks. This seems a sensible approach as service providers will likely include SRTI in their services when made available (for free), so that SRTI will become available in all distribution channels. This also leaves room for public and private service providers to experiment and develop new forms of distribution using emerging technologies such as DAB-TPEG, LTE and DVB-S/T.

9.9. Quality Levels

As indicated in the previous sections, the quality criteria in the specifications will to a large extent determine costs and road safety benefits. Very few data aggregators and service providers have experience in measuring, monitoring and managing road traffic data, information and service quality. Measuring quality is complex and requires a concerted effort by all value chain players. However, the ITS Directive provides an excellent opportunity to adopt common methods for quality measurement and monitoring, and to set a benchmark for SRTI services in Europe. Considering the foregoing, a pragmatic approach to quality seems appropriate; starting with criteria and moderate targets that do not require high investments and that can be achieved and monitored relatively easily, while assuring a controlled regular re-assessment of the SRTI quality level for the future. One possible approach would be to set up a task force of technical experts to:

1. Make a selection of available methods for quality measuring for each of the SRTI categories, e.g. QUANTIS
2. Make a selection of available quality monitoring procedures, including self-assessment, certification and sampling.
3. Identify and remedy shortcomings of these methods and procedures
4. Test the methods and procedures through a programme of voluntary assessment during a limited period, e.g. one year
5. Propose a common set of methods and procedures for measuring, monitoring and managing SRTI quality in Europe
6. Liaise with standardisation bodies to attune work and have relevant extensions to the quality measuring method adopted as standards or certified.

10. Monitoring and Evaluation

To enable the effectiveness of the adoption of the specifications related to the provision of SRTI to be measured, it is necessary to propose and define a set of measurable indicators. These indicators will be used to identify the progress made in reaching the operational objectives.

10.1. Expected Impacts of SRTI

The impact assessment has been based on the assumption that the provision of SRTI will lead to the following high level impacts:-

- Reduction in the number and severity of accidents with SRTI related causation factors
- Reduction in secondary accidents
- Reduction in delays due to secondary accidents
- Decrease in the costs associated with the repair and maintenance of infrastructure.

The impact assessment is based upon the premise that to realise the above impacts (e.g. a reduction of accidents), it is necessary by a particular date for a certain proportion of the network to be covered by SRTI, with data collected at an appropriate level of granularity and made available to all road users through a combination of dissemination channels.

With the above in mind, the indicators to monitor the implementation and deployment of SRTI will focus on the steps needed to realise the operational objectives, rather than assessing whether or not the high level impacts have been realised. The reason for this is that a number of elements can have an influence on the high level impacts (such as developments in vehicle safety, road quality, driver behaviour etc.).

10.2. Operational Objectives

The following operational objectives have been defined to meet the overall policy objectives:-

- *SRTI compliant with the minimum requirements as defined by the Specification [4] is provided for 100%[5] of the TERN in 2030*
- *100% of road drivers in the EU are capable of receiving harmonised universal free of charge at the point of use SRTI by 2030*
- *All road safety related traffic data useful for generating SRTI are available in a harmonised format (e.g. DATEX II) for exchange and re-use in the 27 EU Member States through a single node/registry by 2015*

[4] "Data and procedures for the provision, where possible, of road safety related minimum universal traffic information free of charge to users"

[5] This is the long term objective, however in the short term it may be appropriate to prioritise the coverage to those sections where the provision of SRTI is expected to have the greatest impact e.g. sections with the highest traffic flows or those with a historically higher levels of incidents.

In order to fulfil the above operational objectives at EU level, these need to be translated into Operational Objectives that can be measured at the level of Member States as follows:-

- *SRTI compliant with the minimum requirements as defined by the Specification* [6] *is provided for 100% of the TERN within the Member State by 2030'*
- *100% of road drivers driving on the TERN in the Member State are capable of receiving harmonised universal free of charge at the point of use SRTI by 2030*
- *All road safety related traffic data useful for generating SRTI in the Member State are available in DATEX II for exchange and re-use through a central national node/registry by 2015.*

Each Member State will be required to contribute to these objectives by:

Operational Objective 1

Ensuring adherence to the Specifications, when providing SRTI including the definition of processes/procedures for conformity assessment within their territory (and the monitoring and management of the quality of the traffic information). The prioritisation for the network (TERN or otherwise) covered by SRTI within a Member State shall be based on traffic and safety assessments conducted at a national level where the provision of SRTI is expected to have the greatest impact.

Operational Objective 2

Ensuring that this 'service' is accessible, free of charge at the point of use, to all road users, through the use of a combination of the available delivery channels within their territory and/or end user devices available in the market, within the limit of their respective technical capabilities. The 'service' as a minimum should encompasses the extent of the TERN within their territory and the minimum requirements of the specifications.

Operational Objective 3

Ensuring that the data collected, by either public or private road operators and/or service providers, for generating the minimum information content of the 'service', should be available in DATEX II (CEN/TS 16157) compliant format. It should also be accessible for exchange and re-use by any public or private traffic information service provider and/or road operator via a 'central point of access'.

10.3. Identification of potential indicators

In order to monitor Member State's progression towards achieving the above operational objectives a number of potential indicators have been identified for each operational objective:

[6] "Data and procedures for the provision, where possible, of road safety related minimum universal traffic information free of charge to users"

	Indicator	Contribution to operational objective	Achievability
Operational Objective 1	• SRTI Categories Provided	High level indicator which provides information of which categories SRTI is available within a Member State	To meet the terms of the specifications, the MS should be in a position whereby they are aware of the SRTI categories that they are able to provide for the TERN in their region. Consequently, it should be possible to provide the evidence required by this indicator.
	• Proportion of TERN where one or more SRTI categories is available	High level indicator which provides information on the proportion of the TERN for which SRTI is provided for one or more categories	This is a potentially challenging indicator. However there would be a great deal of benefit to the Commission in understanding the current levels of data collection on the TERN. The MS should be in possession of this data to demonstrate their compliance with the specifications.
	• Coverage by SRTI category on the TERN	This would provide a detailed overview of the coverage by SRTI category available for the TERN within each region, and would subsequently enable the EC to have a view of the services available on the TERN as a whole. The information about SRTI categories should be broken down by road type (for example, whether SRTI on extreme weather conditions is available on a specific road section of the TERN).	To meet the terms of the specifications, the MS should be in a position whereby they are aware of the SRTI categories that they are able to provide for the TERN in their region. Consequently, it should be possible to provide the evidence required by this indicator.
	• Target Quality levels for SRTI Categories (Availability in time and/or location and/or content)	This indicator would identify the availability of SRTI data within the MS territory, based on the content type (e.g. which data type and sources?); the location based availability (e.g. which areas of the network can expect to be covered & shall be covered based on traffic and safety assessments); and the timeliness of data. This would help to establish the level of SRTI service that a road user	This is very detailed information, and at least initially could be difficult for a MS to provide (such information will be easier to provide once stability in the level of service provision is reached). Whilst the MS may be aware of the overall level of coverage that they possess for the TERN in their region, they may not be able to provide a breakdown of the quality criteria linked to this data.

	Indicator	Contribution to operational objective	Achievability
		could expect to receive in the MS (should all the data be made available to them by service providers).	
	• Proportion of published SRTI meeting the Quality thresholds	This provides indicative data on the proportion of SRTI that is published that meets the defined quality criteria.	This is a challenging indicator which would require Member States to continuously monitor the quality of SRTI that is provided within their territory, and imply an on-going operational cost for monitoring quality
	• Percentage of network coverage beyond the TERN (this is optional)	This would be complimentary data to identify the level of SRTI coverage beyond the TERN (i.e. beyond the network covered by the specifications). This could highlight the potential 'market' for service providers beyond the TERN.	This is useful information but is not critical for evaluating the adherence to the specifications.
Operational Objective 2	• Channels through which SRTI is freely available at the point of use	List of the channels through which SRTI is freely available at the point of use e.g. TMC, TPEG-DAB, TPEG-IP	This information should be easy for the Member State to compile
	• Number of Service Providers providing SRTI by dissemination Channel	This indicator would provide an indication of the number of Service Providers who are accessing SRTI data via the DATEX node to provide a service to end users via specific delivery channels.	Once the MS has a DATEX II node established it should be relatively straight forward to identify which service providers are using or providing the data. This can be established on the basis of the service providers that access to the SRTI feed from the DATEX II node. However it is recognised that if a data aggregator subscribes to the DATEX II node for the SRTI data, then the MS are unlikely to know who the final users of that data are.
	• Percentage of users receiving SRTI	This would establish the percentage of users who are able to receive the SRTI service.	This could be challenging to estimate. Even if a MS makes the service available to all users, there is no warranty that the user will access the

	Indicator	Contribution to operational objective	Achievability
			information (take note of it and act upon it).
Operational Objective 3	• Provision of a central point of access to DATEX II SRTI data feeds	This would enable the EC to have an overview of which MS had a central point of access to DATEX II SRTI data sources.	Provision of a central point of access to DATEX II SRTI data feeds
	• Extent of SRTI relevant messages published via DATEX II in the Member State	This would demonstrate the extent of SRTI data published via DATEX II nodes within a Member State.	It should be quite easy to get an overview of the extent of SRTI data exchanged & published via DATEX II nodes in MS
	• List of sources (public/private/service providers)	This would help to develop the picture of what data was available for the TERN in each MS.	List of sources (public/private/service providers)

Table 48 List of potential indicators to monitor and evaluate the introduction of SRTI

10.4. Recommended Indicators and Methods of Measurement / Assessment

The indicators below, taken from the potential indicators listed above, have been selected to assist Member States with their contribution to the EU's overall policy aim of implementing SRTI as per the specifications.

	Indicator	Rationale behind the including the indicator in the core list
Operational Objective 1	• Coverage by SRTI data type on the TERN	This would provide an overview of the SRTI services available for the TERN within each region, and would subsequently enable the EC to have a view of the services available on the TERN as a whole. This could enable the EC to target actions/initiatives on the back of an enhanced understanding of data availability for certain sections.
	• Proportion of TERN where one or more SRTI categories is available	Having an awareness of the overall coverage of SRTI on the TERN is important for the EC, as it allows the deployment to be monitored and enables any future interventions to be carefully targeted.
Operational Objective 2	• Channels through which SRTI is freely available at the point of use	List of the Channels through which SRTI is freely available at the point of use e.g. TMC, TPEG-DAB, TPEG-IP – this is usefully for a high level overview of the dissemination channels in use across Europe
	• Number of Service Providers providing SRTI by dissemination Channel	This indicator would provide an indication of the number of Service Providers who are receiving SRTI data via the DATEX feed to provide a service to Users via specific delivery channels.
Operational Objective 3	• Provision of a central point of access to DATEX II SRTI data feeds	This would enable the EC to have an overview of which MS had a central point of access to DATEX II SRTI data sources.
	• Extent of SRTI relevant messages published via DATEX II in the Member State	This would demonstrate the total number of SRTI data messages published by the DATEX II nodes within a Member State..
	• List of sources (public/private/service providers)	This would help to develop the picture of what data was available for the TERN in each MS.

Table 49: Indicators to be measured and monitored

By promoting the adoption of the above indicators, it would provide an overview of:

- The data types covered by each MS for the TERN
- The type/proportion of safety events identified by each MS for the TERN
- The network coverage of SRTI on the TERN
- The service providers involved in delivering the SRTI service to users
- The status of the DATEX II national nodes
- The extent to which SRTI data is exchanged via the DATEX II national nodes

In order to fulfil the requirements for the selected indicators, it is recommended that the Member States gather the required information by engaging the relevant parties potentially via a series of workshops or web surveys. Utilising this forum to both engage with and inform the relevant parties of the EU operational objectives; the indicators that the EU have put in place to monitor the progress of these operational objectives; how the relevant parties will be expected to assist the Member State in achieving these objectives and how the Member State will monitor their progress.

This forum could also be helpful for:

- MS in their reporting task to the EC under the ITS Directive;
- Assessing the level of progress within each MS
- To contribute to the conformity assessment task
- To guide future decision making regarding deployment

11. Conclusions

The overview of the existing situation indicates that in 3 Member States insufficient content is available to establish safety related traffic information services. In 7 more Member States, content is either limited or availability is unclear. This concerns in particular the smaller or less affluent Member States. In Member States with sufficient traffic information, DATEX is commonly used to code the information.

The broad availability and new deployments of TMC services, suggests that on short term TMC can deliver safety related traffic information to road users in all Member States of the EU. Limited DAB coverage hampers the deployment of TPEG over DAB as alternative to TMC. TPEG coded information is however available via mobile Internet in 16 EU Member States.

It seems that procedures and systems to monitor and manage quality in general are poorly developed in the Member States. The lack of commonly accepted methods of measuring and monitoring traffic information quality is considered to be an essential first step towards effective quality management of safety related traffic information, but this is costly.

In most Member States, both private and public organisations collect, aggregate and validate traffic data in parallel. The general consensus between both public and private stakeholders is that this dependency is likely to persist in the future.

In nearly all Member States, TMC services are free of charge at the point of use, meaning that once a device or vehicle is purchased, no additional payments by the end-user are required to receive real-time traffic updates. Subscription based traffic information services over mobile Internet are available in at least 19 Member States, with coverage expanding year by year.

The inventory and SWOT analyses of the data coding standards and distribution channels showed that TMC and TPEG (over DAB and IP) provide good solutions for delivering SRTI in respectively the short and medium term, and that DATEX is the preferred choice for the exchange of information between the different actors in the value chain.

DATEX is widely used and commonly accepted as standard for traffic information exchange between traffic management centres, traffic information centres and service providers throughout Europe. It provides a proven method for SRTI data exchange. Various companies offer DATEX encoding and decoding products in a competitive market, making it a cost efficient solution for both public and private organisations.

TMC services have been, or are being, deployed in most Member States. Compared to TPEG services, TMC has limited bandwidth, and low location granularity. The need for a location table in the receiver further limits the effectiveness of TMC in delivering SRTI, and restricts possible road coverage beyond motorways. DAB/TPEG data casting is a technically superior alternative to RDS-TMC yet it currently has a marginal market penetration. TPEG over IP (mobile internet) allows for short term deployment but suffers from high data roaming costs.

Cooperative systems (V2X, V2V) could provide an efficient channel, not only for the delivery, but also the collection of road safety related data. It is unclear how long wide-scale deployment of cooperative technology in all Member States will require.

Voice radio was considered unsuited as it does not support language independent use, has limited push capabilities and its bandwidth is suited for conveying only the most essential information. Further, VMS, TPEG over DVB-S, SMS/MMS were considered unsuited for various reasons.

Each of the assessed channels has specific advantages and disadvantages. Rather than selecting one specific channel for safety related traffic information it might be better to aim for maximum reach using multiple channels. Harmonisation could be achieved by recommending specific channels, while allowing for a controlled transition to new technologies.

The assessment of the impact of SRTI on road safety derived the theoretical maximum impact of: a reduction of all road traffic fatalities of 2.7% and a reduction of traffic injuries of 1.8%.

In the detailed impact assessment, the operational costs for the scenarios suggested limited variation, producing a limited influence on the BCRs of the scenarios. The scenarios exhibit significant differences in the implementation costs and expected safety impact. These are the key differentiators in the BCRs.

Of all assessed scenarios, scenarios 1 to 5, 9, 10, 12 to 15, and 17 produce BCRs higher than one. It should be noted that these are also the scenarios that require the most substantial level of investment to realise the benefits, and that all except scenarios 1, (1bis), 2 and 3 exert a negative impact on some of the stakeholders in the existing markets.

The scenarios with the highest BCR limit SRTI on the Main/National Roads to the minimum SRTI (i.e. without 'end of queue' warnings). Adopting full SRTI for Main/National roads leads to low BCRs as the costs increased more than the savings.

It should also be noted that cooperative systems were not included in the impact assessment because it is highly uncertain when the number of cooperative vehicles on the roads reach a critical mass. Data collection for SRTI is assumed to be entirely based on roadside infrastructure in all scenarios. Vehicle-based measurement of SRTI data was not considered. Such systems might in the future however provide a low-cost method for data collection and dissemination.

In terms of market impact none of the scenarios was assessed as overall negative. However, the scenarios that included 'end-of-queue' information were classified as having a negative impact on some stakeholders, e.g. data aggregators and private RTTI service providers and broadcasters, because of the free provision of this information to end users.

None of the evaluated options has an impact on the Fundamental Rights of the European Union, or was considered to be in contradiction with the ITS Directive Principles.

A set of monitoring indicators was drafted to allow for a pragmatic way of monitoring the policy objectives. It is recommended that the Member States gather the required information by engaging relevant parties in the value chain via a series of workshops or web surveys.

12. Management section

This section presents the contractor's view on the achievements of the study, and the execution of the project.

12.1. Achievement of Study Objectives

Nr	Objective	Achievement
1.	Providing quantitative and qualitative research and analysis to support and demonstrate the problem definition established by the Commission	The study team compiled an elaborate evidence base consisting of various types of documents containing relevant quantitative and qualitative information.
2.	Measuring the potential economic, social and environmental consequences of the various policy options	The impact assessment provides an assessment of the economic, social and environmental consequences of the various policy options.
3.	Consulting the various stakeholders on the envisaged options	Over 20 interviews were conducted. The interviewed organisations consisted of 11 national public authorities covering 10 different Member States, 3 companies operating on Member State level, 3 private companies with global focus, and 5 European associations. For the workshop 266 people were invited, of which 58 were admitted. In the end 53 people from 12 Member States attended the workshop.
4.	Proposing operational objectives supporting the implementation of the policy options and their long term evaluation	Section 10.2 of this final report describes the operational objectives, and section 10.4 provides a description of the recommended indicators and measurement and assessment methods.

12.2. Deliverables

Nr	Name	Planned	Final draft	Final	Approved
D1	Inception Report	11-05-12	17-04-12	02-05-12	11-05-12
D2	Stakeholder consultation	24-08-12	16-07-12	07-08-12	13-08-12
D3	Intermediate report	11-10-12	27-08-12	01-11-12	06-11-12
D4	Draft Final Report	16-11-12	14-11-12	22-01-13	23-01-13
D5	Final report	16-11-12	14-11-12	22-01-13	23-01-13

12.3. Differences between Work Expected and Work Actually Carried out

The impact assessment took considerable more work than expected, in particular the elaboration of additional scenarios. All other tasks were performed more or less in line with the original budget.

12.4. Use of Resources

The additional work on the impact assessment has meant the overall project budget was exceeded considerably.

12.5. Provisional Conclusions

Overall the study was managed well by the EC's officer. Collaboration between the team leader and the EC's officer was fruitful and productive.
The additional work on the impact assessment pushed back the final milestones of the study and caused study progress to slow down, because of the reduced availability of the team leader, but remained nonetheless within the contract timeframe.

List of Acronyms

BCR	Benefit Cost Ratio
CEN	European Committee for Standardization
DoT	Department of Transport
DRIP	Dynamic Route Information Panel
DSA	Dynamic Speed Adaptation
EC	European Commission
EEA	European Economic Area
EU	European Union
FVD	Floating Vehicle Data
I2V	Infrastructure-to-Vehicle Communication
ISA	Intelligent Speed Adaptation
ISO	International Organisation for Standardization
ITS	Intelligent Transport Systems
LDW	Local Danger Warnings
MS	Member State
PPP	Public Private Partnership
RTTI	Realtime Traffic and Travel Information
R&D	Research and Development
SRTI	(Road) Safety Related Traffic Information
SWOT	Strengths, Weaknesses, Opportunities, Threats
VSL	Variable Speed Limits
V2I	Vehicle-to-Infrastructure Communication
V2V	Vehicle-to-Vehicle Communication

Bibliography

Nr	Title	Author	Publ. date
[1]	Com (2008) 886 - ITS Action Plan	European Commission	2008
[2]	European Directive 2010/40/Ec On The Framework For The Deployment Of Intelligent Transport Systems In The Field Of Road Transport And For Interfaces With Other Modes Of Transport	European Commission	2010
[3]	PROSPER D4.3 Assessment Of Road Speed Management Methods V1.0	Oliver Carsten, Fergus Tate, Ronghiu Liu	2011
[4]	eIMPACT D4 Impact Assessment Of Intelligent Vehicle Safety Systems	Isabel Wilmink, Pirkko Rämä, Gunnar Lind, Thomas Benz, Heiko Peters e.a.	2008
[5]	Advanced Weather Information Services Increase The Safety Of Unprotected Road Users – Huge Potential For ITS?	Raine Hautala, Pekka Leviänkagas	2008
[6]	Road Safety Programme 2020	ASFINAG	2010
[7]	De Relatie Tussen Snelheid En Ongevallen – Factsheet	SWOV	2012
[8]	Spookrijden (Wrong-Way Driving) – Factsheet	SWOV	2009
[9]	The Use Of Efficiency Assessment Tools: Solutions To Barriers – Rosebud Project Wp3	Shalom Hakkert, Paul Wesemann	2005
[10]	Invloed Van Het Weer Op De Verkeersveiligheid - Factsheet	SWOV	2012
[11]	Proposal For A New Method For Wrong-Way Detection	Siniša Babič, Marko I. Valič	2010
[12]	Business Case And Benefit-Cost Assessment Of Easyway Priority Cooperative Services	EasyWay	2012
[13]	Effects Of Weather-Controlled Variable Message Signing On Driver Behaviour. (Vtt Publications 447, 2001).	Pirkko Rämä, VTT	2001
[14]	CODIA Final Study Report, Deliverable 5	Risto Kulmala, Pekka Leviäkangas e.a.	2008
[15]	Road Safety Guidelines. Code Project, Deliverable B5.2.	Draskóczy M, Carsten O.M. J. and Kulmala R.	1998
[16]	Task Specifications To Award A Specific Contract Under The Framework Contract Tren/G4/Fv-2008/475/01 Technical, Legal And Organisational	European Commission	02-2012

Nr	Title	Author	Publ. date
	Support For The Implementation Of The ITS Action Plan - Priority Action C: Free Road Safety Traffic Information Support To Impact Assessment And Specifications		
[17]	Position Paper - Provision Of Free Minimum Universal Traffic Information Service	TISA	05-2012
[18]	Directive 2010/40/Eu-Expert Meeting - Towards Specifications For Priority Action (C), Road Safety Related Minimum Universal Traffic Information Free Of Charge To Users. Minutes Of The Meeting On 25 May 2011.	European Commission	05-2011
[19]	ITS Action Plan - D8 –Final Report - Study Regarding Guaranteed Access To Traffic And Travel Data And Free Provision Of Universal Traffic Information	Tom van de Ven, Mark Wedlock	09-03-2011
[20]	Position Paper - Delivery Channels For Traffic And Travel Information (TTI) Services	TISA	13-12-2010
[21]	Report Of The eSafety Working Group On Real-Time Traffic And Travel Information (RTTI)	eSafety Forum	16-03-2007
[22]	Traveller Information Services Reference Document – TIS Deployment Guideline Annex - TIS-DG01	EasyWay	01-2012
[23]	Traveller Information Services - Traffic Condition And Travel Time Information Service - Deployment Guideline - TIS-DG03-05	EasyWay	01-2012
[24]	Easyway - Variable Message Signs Harmonisation. Principles Of VMS Design. Deployment Guideline. January 2012.	Alberto Arbaiza, Antonio Lucas-Alba	
[25]	Quantis Methodology Guidelines Document, Quality Assessment And Assurance Methodology For Traffic Data And Information Services. Final Version 1.0	Doug Newton, Risto Öörni, Astrid Kellermann, Thomas Scheider	09-2010
[26]	Cooperation Systems To Make The Road Traffic Safer And More Comfortable - Reducing Traffic Accidents		2011
[27]	CVIS– Final Activity Report	Paul Kompfner	30-08-2010
[28]	First Results Of Field Tests With The DAB Single Frequency Network In Bavaria	A. Lau, M. Pausch, W. Wütschner	1994
[29]	Global Broadcasting Update – DAB/DAB+/DMB	WorldDMB	01-2012
[30]	ITS Action Plan - D6 - Proposal For The Scope Of Free Minimum Universal Traffic Information - Study Regarding Guaranteed Access To Traffic And Travel Data And Free Provision Of Universal Traffic	Tom van de Ven, Mark Wedlock	6-12-2010

Nr	Title	Author	Publ. date
	Information		
[31]	Datex Ii –The Standard For ITS On European Roads	EasyWay	2011
[32]	Inception Report - Action 1.4. Free Road Safety Traffic Information - Support To Impact Assessment And Specifications. Final Approved Version, V3.0.	Tom van de Ven, Rapp Trans	11-05-2012
[33]	D2 – Stakeholder Consultation Report. Action 1.4 - Free Road Safety Traffic Information. Final Draft.	Tom van de Ven, Rapp Trans	16-07-2012
[34]	ITS Action Plan - D2 – State Of The Art - Study Regarding Guaranteed Access To Traffic And Travel Data And Free Provision Of Universal Traffic Information	Philippe Ballet, Gildas Baudez, Philipp Jordi, Tom van de Ven, Nabil Abou-Rahme	11-10-2010
[35]	ITS Action Plan - D8 –Final Report - Study Regarding Guaranteed Access To Traffic And Travel Data And Free Provision Of Universal Traffic Information	Tom van de Ven, Mark Wedlock	09-03-2011
[36]	Position Paper - TISA And International Standards	TISA	09-11-2010
[37]	Position Paper - Delivery Channels For Traffic And Travel Information (Tti) Services	TISA	13-12-2010
[38]	Report Of The Esafety Working Group On Real-Time Traffic And Travel Information (Rtti)	eSafety Forum	16-03-2007
[39]	Information And Communication Technologies - Deployment Guideline Ict-Dg01 Easyway Operating Environments	EasyWay	01-2012
[40]	Data Exchange Interfaces DATEX II - Deployment Guideline - Dtx-Dg01	EasyWay	01-2012
[41]	Traveller Information Services Reference Document - Tis Deployment Guideline Annex - TIS-DG01	EasyWay	01-2012
[42]	Traveller Information Services Weather Information Service - Deployment Guideline - TIS-DG06	EasyWay	01-2012
[43]	Traveller Information Services - Forecast And Real Time Event Information - Deployment Guideline - TIS-DG02	EasyWay	01-2012
[44]	Traveller Information Services - Traffic Condition And Travel Time Information Service - Deployment Guideline - TIS-DG03-05	EasyWay	01-2012
[45]	Quantis Methodology Guidelines Document, Quality Assessment And Assurance Methodology For Traffic Data And Information Services. Final Version 1.0	Doug Newton, Risto Öörni, Astrid Kellermann, Thomas Scheider	09-2010

Nr	Title	Author	Publ. date
[46]	First Report From Portugal Within The Scope Of Directive 2010/40/EUOn Their National Activities And Projects Regarding The Priority Areas Identified In This Directive On Intelligent Transport Systems (ITS).		08-2011
[47]	Status Und Rahmenbedingungen Für Intelligente Verkehrssysteme (IVS) In Deutschland.		2011
[48]	Report On Activities And Projects Related To Priority ITS Areas, As Implemented In The Czech Republic		2011
[49]	ITS Directive 2010/40/EUArticle 17(1) Report On Activities And Projects For The Deployment Of Intelligent Transport Systems In Road Traffic In The Republic Of Slovenia	MINISTRY OF TRANSPORT, Roads Directorate	08-2011
[50]	Rapport Sur Les Activités Et Projets Nationaux Français, Article 17-I De La Directive 2010/40/Ec, Systèmes De Transport Intelligents	Ministère de l'Écologie, de Développement Durable, Des Transports en du Logement	08-2011
[51]	Overview Of The Activities Carried Out By Estonian Administration In The Field Of Road Transport ITS And The Implementation Of The Directive 2010/40/Eu		2011
[52]	Dansk Strategi For ITS	ITS Udviklingsforum	03-2011
[53]	The Initial Report On National Activities And Projects Regarding To The Priority Areas Of Directive 2010/40/EUIn The Republic Of Latvia		2011
[54]	Finland's Strategy For Intelligent Transport	Ministry of Transport and Communication s	2010
[55]	ITS Initial Report - Overview Of National And Regional Activities And Projects In The Priority Areas. Belgium		2011
[56]	Intelligent Transport Systems In The United Kingdom: Initial Report As Required By European Union Directive 2010/40/Eu	Department for Transport	08-2011
[57]	Reporting By The Member States Referred To In Article 17 Of Directive 2010/40/EU– The ITS Directive Initial Report From Sweden	Swedish Transport Administration, Ministry of Enterprise, Energy and Communication s	26-08-2011

Nr	Title	Author	Publ. date
[58]	National Report For The State Of The ITS Deployment In Spain		24-08-2011
[59]	Directive 2010/40/EU- The ITS Directive. Initial Report From Norway	NPRA, Ministry of Transport and Communications	08-2011
[60]	Directive 2010/40/EUOf The European Parliament And Of The Council Of 7 July 2010. Report On National Activities And Projects Regarding The Priority Sectors, Italy's Contribution		09-2011
[61]	Article 17(1) Of Directive 2010/40/Eu, National Report For Ireland	Department of Transport, Tourism and Sport	26-08-2011
[62]	IVS Richtlinie 2010/40/EU- Statusbericht ÜBer AktivitäTen Und Projekte In ÖSterreich Gemäß Artikel 17 (1)	Austria Tech i.A. des BMVIT II/Infra 4	26-08-2011
[63]	ITS In The Netherlands	Connekt on behalf of the Ministry of Infrastructure and the Environment	2011
[64]	ITS Directive 2011. Reports On National Activities And Projects	European Commission, DG MOVE	15-12-2011
[66]	Global Broadcasting Update Dab/Dab+/Dmb	WorldDMB	01-2012
[67]	Traffic Safety Dimensions And The Power Model To Describe The Effect Of Speed And Safety.	Nilsson G.	2004
[68]	The Power Model Of The Relationship Between Speed And Road Safety: Update And New Analyses.	Elvik R.	2009
[69]	Annual Statistical Report 2010, Based On Data From CARE/EC From 1999 To 2008, Dacota Deliverable D3.1	DaCoTa project	2011
[71]	ITS Related Web Pages of service providers, ITS platforms	Various	07-2012
[72]	Annual Report 2011	Estonian Road Authority	2011
[73]	Inception Report - Action 1.4. Free Road Safety Traffic Information - Support To Impact Assessment And Specifications. Final Approved Version, V3.0.	Tom van de Ven, Rapp Trans	2012
[74]	D2 – Stakeholder Consultation Report. Action 1.4 - Free Road Safety Traffic Information. Final Draft.	Tom van de Ven	16-07-2011

Nr	Title	Author	Publ. date
[75]	eCall Impact Assessment; SEC(2011) 1019 final	European Commission	2011
[76]	TISA website	TISA	
[77]	TPEG – What is it all about?	European Broadcasting Union	2003
[78]	TPEG – What is it all about?	TISA	2012
[79]	DATEX II – The standard for ITS on European Roads	EasyWay	2012
[80]	Principles of RDS-TMC Location reference coding	Central European Data Agency a.s. (CEDA)	
[81]	OpenLR™ White Paper	TomTom International B.V.	2009
[82]	A Comprehensive Process for Linear Referencing	Kevin M. Curtin, Greta Nicoara, and Rumana Reaz Arifin	2007
[83]	AGORA-C: Technology and Licensing Overview	VIA LICENSING	2010
[84]	Annual Statistical Report 2011, Based On Data From CARE/EC From 2000 To 2010, Dacota Deliverable D3.1	DaCoTa project	2012
[85]	Accidents de la circulation (2009) - dossier	Belgium National statistics office	2009
[86]	Transport Accidents - time series	Czech National statistics office	2012
[87]	Traffic and Accident Data - Summary Statistics - Germany	Germany National statistics office	2011
[88]	News Release: Traffic accidents 2001	Malta National statistics office	2011
[89]	SWOV database	Netherlands National statistics office	2011
[90]	Statistics Portugal	Portugal National statistics office	2010
[91]	SI-STAT Data Portal: Road traffic accidents	Slovenia National statistics office	2010
[92]	Traffic accidents 2004-2009 series	Spain National statistics office	2010
[93]	RAS10013	Department for	2010

Nr	Title	Author	Publ. date
	Reported personal injury road accidents, by severity, Great Britain, annual from 1979	Transport, UK	
[94]	Eurostat database	European Commission	
[95]	Learn if, how and when to cash in on TPEG...	SBD Telematics and ITS research	
[96]	Global Broadcasting Update www.worlddab.org	World DMB Forum	2012
[97]	CARE accident data base http://www.nrso.ntua.gr/index.php/eu-data.html	European Commission	Accessed 2012
[98]	'Les accidents corporels de la circulation' http://www.securite-routiere.gouv.fr/	Observatoire national	Accessed 2012
[99]	Verkehr – Verkehrsunfalle	Statistisches Bundesamt	2012
[100]	Table RAS10001 http://www.dft.gov.uk/statistics/releases/reported-road-casualties-gb-main-results-2011	UK Department for Transport	Accessed 2012
[101]	'Press release: number of European Smartphone users…' http://www.comscore.com/Press_Events/Press_Releases/2012/	Comscore	Accessed 2012
[102]	2011 European Road Statistics http://www.erf.be/index.php?option=com_content&	European Road Federation	2011
[103]	http://ec.europa.eu/transport/infrastructure/ten-t-policy/transport-mode/doc/road_tab1.pdf	European Commission	2012
[104]	Consolidated Resolution on Road Signs and Signals	United Nations Economic Commission For Europe, Inland Transport Committee	09-2010
[105]	Les Accidents « Contresens » Sur Les Autoroutes Concedees, 2000 – 2010	ASFA	

Annex A - Overview Current Situation

Austria

Content Availability

Safety related information, congestion and weather information is available for motorways, inter-urban roads and city arteries. In particular weather information is advanced as it is safety relevant for Alpine traffic [34, 42].

DATEX

DATEX II is pre-operational [35].

Available Services

Voice radio:	Various radio stations
RDS-TMC:	In Austria, public broadcaster ORF is providing a free of charge national TMC service. Publicly owned motorway concessionaire ASFINAG is responsible for the location table. In total, around 8.000 location codes are present in this table [71].
TPEG over DAB or IP:	The MILE consortium and INRIX both provide a TPEG service over IP [71].
Proprietary coding over IP:	Google and TomTom provide RTTI over IP using proprietary coding protocols [71].

Organisation of the Value Chain

Traffic data is collected by ASFINAG (motorways), from road authorities and 30,000 volunteer traffic reporters. The traffic data is collected and validated by the traffic desk of Ö3, one of the radio station of public broadcaster ORF. The information is broadcasted for free on 3 national and 9 regional radio channels [62].

Business Models for Traffic Information

TMC is provided for free, private parties provide commercial services based on either a subscription or a sponsoring (free at the point of use) model [71].

Belgium

Content Availability
Safety related information, congestion and traffic conditions is available for motorways, and inter-urban roads [42, 55].

DATEX
DATEX operational, DATEX-II pre-operational [40, 55].

Available Services

Voice radio:	Various radio stations
RDS-TMC:	In Belgium there are 4 TMC services: TMOBILIS in Belgium, TIC-VL and 4FMTMC in Flanders and RTBF in Wallonia and Brussels. All of them (except for TMOBILIS) are currently open services [17, 71].
TPEG over DAB or IP:	The MILE consortium and INRIX both provide a TPEG service over IP [17]. Be-Mobile operates a DAB-TPEG service in Belgium [71].
Proprietary coding over IP:	Google and TomTom provide RTTI over IP using proprietary coding protocols [71, 71].

Organisation of the Value Chain
Data is collected, aggregated and validated by the regional authorities of Belgium (Flanders, Brussels, Walloon region). The information is broadcasted as TMC regionally, and aggregated and broadcasted on a national level by two private companies [17].

Business Models for Traffic Information
TMC is provided for free, private parties provide commercial services based on either a subscription or a sponsoring (free at the point of use) model.

Bulgaria

Content Availability
Detailed information is available for the city arteries of Sofia [71].

DATEX
No [40].

Available Services

Voice radio:	Unknown
RDS-TMC:	TrafficNav is testing a TMC service [71].
TPEG over DAB or IP:	No DAB infrastructure is currently available [34].
Proprietary coding over IP:	Since July 2012, TrafficNav provides a free app with information on Sofia only. Additional coverage can be purchased [71].

Organisation of the Value Chain
TMC Bulgaria is a cooperation between TrafficNav, Kvarta Soft, tix.bg, bTV Radio Group [71].

Business Models for Traffic Information
Privately operated services only [71]. Unclear if TMC will be free at the point of use.

Cyprus

Content Availability
Unknown, probably none.

DATEX
No [40].

Available Services

Voice radio:	Unknown
RDS-TMC:	No
TPEG over DAB or IP:	No
Proprietary coding over IP:	No

Organisation of the Value Chain
Not applicable.

Business Models for Traffic Information
Not applicable.

Czech Republic

Content Availability
Congestion, closures and other road restrictions, warning and advice on winter driving conditions, accident information from rescue services [42, 71].

DATEX
DATEX II, preoperational, regional [40].

Available Services

Voice radio:	Unknown
RDS-TMC:	In the Czech Republic, 3 services are available. 2 of them (DIC PRAGUE, TELEASIST) are in operation from January 2006 and one (JSDI) from 2008. A first service, called DIC PRAHA, is available in Prague. It is broadcast on Český Rozhlas – Regina (92.6 MHz). The service provider is TSK-Praha (Communication Technical Administration). A second service, TELEASIST provided by Teleasist together with Global Assistance is available countrywide, however is not as detailed as TIC Prague in specific areas. It is being broadcasted by CRo1 Radiožurnál. Last service, called JSDI, is provided by Czech Road Motorway Directorate (ŘSD ČR) and is broadcasted countrywide on ČRo3 Vltava. [71]
TPEG over DAB or IP:	DAB infrastructure is in place but bo TPEG service operational [34].
Proprietary coding over IP:	Google and TomTom provide RTTI over IP using proprietary coding protocols [71, 71].

Organisation of the Value Chain
Traffic data is collected by both public and private organisations. The Road and Motorway Directorate (RMD) operates the “Single system of transport information for the Czech Republic”, which provides road traffic information and ensures winter information service concerning the capacity of roads and motorways. Information systems of Fire and Rescue Brigade and the Police of the Czech Republic are linked. TMC developments are coordinated by CEDA. They are responsible for the location table (current version is 3.0, containing more than 16 000 records).

Business Models for Traffic Information
TMC is provided for free, private parties provide commercial services based on either a subscription or a sponsoring (free at the point of use) model [71].

Denmark

Content Availability

Detailed data is being collected on a continual basis on more than 200 km of motorway. Information on travel times and traffic incidents, speed control, traffic queues and lane control is available [52]. Weather data is available for the TERN, and most of the Danish road network.

DATEX

DATEX II, operational [40]

Available Services

Voice radio:	Yes [52]
RDS-TMC:	TMC service DK-TMC is operated by the Danish Road Directorate. It is broadcast on DR P1, P2, P3 and P4. DRD is also responsible for the location tables. The current version used is 9.0. It contains around 2.450 location codes [17].
TPEG over DAB or IP:	INRIX provides a TPEG service over IP [17].
Proprietary coding over IP:	Google and TomTom provide RTTI over IP using proprietary coding protocols [71]

Organisation of the Value Chain

The Danish Road Directorate's Traffic Information Centre, is responsible for traffic management and disseminating traffic information for road traffic. The Danish Metrological Institute (DMI) provides weather data. Various private companies collect traffic data and provide traffic information services [52].

Business Models for Traffic Information

TMC is provided for free, private parties provide commercial services based on either a subscription or a sponsoring (free at the point of use) model [71].

Estonia

Content Availability

Information is collected from roadside systems, construction companies, the police, the meteorological office, the Rescue Board, the Road Administration's employees, and volunteer road-users, and aggregated at the Road Information Centre [51, 72].

DATEX

No [40].

Available Services

Voice radio:	Unknown
RDS-TMC:	System is being tested [17].
TPEG over DAB or IP:	Estonia has been carrying out experimental DAB broadcasts, but no TPEG service [34].
Proprietary coding over IP:	Google provides travel time information for a few roads in and around Tallin [71].

Organisation of the Value Chain

The Road Information Centre of the the Estonian Road Administration supplies road users with information about road and traffic conditions. Offering information services is based on contracts with private entrepreneurs [72].

Business Models for Traffic Information

Unknown.

Finland

Content Availability

Finland has an elaborate system to collect information on weather relevant to road users and road conditions. It also collects information on roadworks, and congestion at the south-east border. MediaMobile collects traffic data from induction loops, traffic cameras, radio stations, volunteer road users and partner companies [54].

DATEX

DATEX II is pre-operational [40].

Available Services

Voice radio:	Unknown
RDS-TMC:	MediaMobile provides an encrypted paid TMC service [17] on national radio (YLE Radio Suomi), covering the main metropolitan areas and national roads. The location table is provided by FINNRA, the Finnish Road Administration. The newest location table is version number 1.42 and it is used by Destia's TMC service. This version of the table contains around 8.100 problem locations [71].
TPEG over DAB or IP:	No DAB infrastructure is currently available [34].
Proprietary coding over IP:	Google and TomTom provide RTTI over IP using proprietary coding protocols [71].

Organisation of the Value Chain

The Finnish Transport Authority works in co-operation with the police, regional emergency centres, border guard detachment, voluntary road services and radio stations to collect traffic information [66]. Private companies also collect traffic data [54].

Business Models for Traffic Information

Paid services only [71].

France

Content Availability
Elaborate information on incidents and traffic flow for motorways, many secondary roads and city arteries. Road related weather information is also available [42].

DATEX
The French Ministry of Ecology uses and recommends DATEX, DATEX 2 for exchanging data with other parties [34].

Available Services

Voice radio:	Yes, various stations [34].
RDS-TMC:	The motorway operators provide a free TMC service on their toll-roads, on the 107.7 traffic channel. MediaMobile provides a national commercial TMC service named V-Trafic on the frequencies of France Inter, with information on both the motorways and the Parisien metropolitan area. ViaMichelin also operates a commercial TMC service, broadcasted on the Towercast network. Location tables are released by the government agency SETRA and includes about 20000 locations. The latest certified version is 8.0 for France [17, 34].
TPEG over DAB or IP:	The MILE consortium and INRIX both provide a TPEG service over IP [17]. TPEG over DAB is being trialled [34].
Proprietary coding over IP:	Google and TomTom provide RTTI over IP using proprietary coding protocols [71].

Organisation of the Value Chain
Data is collected by both private and public organisations. Information is aggregated by various private organisations as well as Bison Futé which combines information from motorway concessionaires, public road operators, regional and urban traffic information and management centres (CRICR) [50].

Business Models for Traffic Information
Only commercial services are available, but many of them are free at the point of use [71].

Germany

Content Availability
Incident and congetsion information is available for all motorways, as well as many secondary roads and city arteries [40]. Road conditions and weather information is available for TERN and other motorway and secondary roads.

DATEX
DATEX II is operational in regional traffic information centres, and serves as interface for the mobility data market place. RDS-TMC is used as location referencing method [40].

Available Services

Voice radio:	Yes, various stations.
RDS-TMC:	Both a free public service and a commercial service are available in Germany [17]. The free service is provided by public broadcasters. NOKIA provides a commercial TMC service. BASt manages the TMC location tables. The current version is 10.1, which contains 44.233 location codes.
TPEG over DAB or IP:	The MILE consortium and INRIX provide commercial TPEG services over IP. The public broadcasters are testing an unrestricted TPEG service (testing) [17].
Proprietary coding over IP:	Google and TomTom provide RTTI over IP using proprietary coding protocols [71].

Organisation of the Value Chain
Public traffic data collection and distribution is carried out by the German States. The public broadcasters play an important role in delvering the information to the end-user via TMC and voice radio. The Federal Ministry has a coordinating role. Various private parties collect aggregate and disseminate traffic information [34, 40].

Business Models for Traffic Information
TMC is provided for free, private parties provide commercial services based on either a subscription or a sponsoring (free at the point of use) model [71].

Greece

Content Availability
Travel times for Athens and major motorways, regional (generic) weather reports [71].

DATEX
DATEX II, preoperational, regional [40].

Available Services

Voice radio:	Unknown
RDS-TMC:	TrafficNav provides a TMC-service in the Attica region on Galaxy Radio and Radio DeeJay [71].
TPEG over DAB or IP:	No DAB infrastructure is currently available [34].
Proprietary coding over IP:	No [71].

Organisation of the Value Chain
Motorway concessionaires collect travel time data. Unclear what information is aggregated from other sources. Service offering is limited to a regional TMC service and a voice response service providing driving conditions for some motorways [71].

Business Models for Traffic Information
The TMC service is commercial but free at the point of use for a selected number of receiver brands [17, 71].

Hungary

Content Availability
Information on congestion, roadworks, diversions and incidents is available for motorways and city arteries [71]. Weather and road condition data is collected for Hungarian main national roads (~200 stations), including forecasts and warnings [42].

DATEX
DATEX II, preoperational, regional [40].

Available Services

Voice radio:	Yes [71].
RDS-TMC:	TrafficNav provides a TMC service on Petőfi Radio (National Public Radio Station) and NEO FM (a national commercial station) [17, 66].
TPEG over DAB or IP:	DAB infrastructure is currently available only locally [34]. INRIX provides a TPEG service over IP [71].
Proprietary coding over IP:	Google provides travel time information for a motorways and city arteries [71].

Organisation of the Value Chain
Data is collected by motorway concessionaires, other road authorities and the meteorological agency. Services are provided by private companies [17].

Business Models for Traffic Information
The TMC service is commercial but free at the point of use for a selected number of receiver brands [17, 71].

Ireland

Content Availability
Incident and congestion information is available for some motorways [61, 66]. Weather data is collected for the national road network [42].

DATEX
DATEX II is operational, TPEG LOC as location referencing standard [40].

Available Services

Voice radio:	Yes.
RDS-TMC:	TrafficNav provides a TMC service on RTE Radio 1 (public national radio) [17, 71].
TPEG over DAB or IP:	INRIX provides a TPEG service over IP [17].
Proprietary coding over IP:	Both Google and TomTom provide congestion information [71].

Organisation of the Value Chain
Public road authorities collect and aggregate incident information, private companies collect congestion data. Private companies provide the end-user services [61].

Business Models for Traffic Information
All services are commercial but free at the point of use [71].

Italy

Content Availability
The Road Safety Information Coordination Centre brings together information from various sources on accidents, delays, static events (road works) and dynamic events (congestion, meteorological events, etc.). Congestion information is further collected by private organisations [60].

DATEX
DATEX is in operational use. DATEX II is preoperational, RDS-TMC is used as location referencing method [40].

Available Services

Voice radio:	Yes [60].
RDS-TMC:	Both a free public service and a commercial service are available in Italy The free service is provided by the CCISS on RAI (public national station). InfoBlu provides an encrypted commercial TMC service on national commercial radio station RTL 102.5 [60, 66]. The Italian location table is administered by RAI-CCISS, the current version is 3.1 with around 41.000 location codes [71].
TPEG over DAB or IP:	InfoBlu provides a TPEG service over DAB. The MILE consortium and INRIX both provide a TPEG service over IP [17].
Proprietary coding over IP:	Both Google and TomTom provide congestion information [71].

Organisation of the Value Chain
The Road Safety Information Coordination Centre (CCISS) receives information from the traffic police, Carabinieri, ANAS and motorway operator companies in addition to the RAI and ACI. CCISS also operates the national public TMC service. The CCISS is coordinated and managed by the Ministry of Infrastructure and Transport. Private companies collect congestion information, and provide services to the end-user combining information from public sources [60].

Business Models for Traffic Information
Both a free and a restricted TMC service is available to end-users. Private parties further provide subscription based and sponsored services, some of which are free at the point-of-use [17, 71].

Latvia

Content Availability
Road authorities operate road sensors (traffic counters, road weather stations, cameras etc.), and traffic centers (information, management) on national road network and municipal roads of Riga and Jelgava [53].

DATEX
No [40].

Available Services

Voice radio:	Yes
RDS-TMC:	No [17, 71].
TPEG over DAB or IP:	No DAB infrastructure is currently available [34].
Proprietary coding over IP:	Google provides congestion information for the city arteries of Riga [71].

Organisation of the Value Chain
Public authorities collect and aggregate traffic data and make it available to media. Google collects flow data using probes [53].

Business Models for Traffic Information
Not applicable [71].

Lithuania

Content Availability
Information on road and weather conditions, road works, obstacles on the road are available at the national traffic information centre [71].

DATEX
DATEX II, preoperational, regional [40].

Available Services

Voice radio:	Unknown
RDS-TMC:	No, test for a TMC service with conditional access are being tested [17].
TPEG over DAB or IP:	No DAB infrastructure is currently available [34].
Proprietary coding over IP:	No [71].

Organisation of the Value Chain
The Lithuanian traffic information centre collects traffic and road weather data using sensors. This information is published on the web site trafficinfo.lv [71].

Business Models for Traffic Information
Not applicable [71].

Luxembourg

Content Availability

Traffic flow data are collected automatically by the public road authority. Information on road works and road weather and road conditions are also available [71].

DATEX

No [40].

Available Services

Voice radio:	Unknown
RDS-TMC:	Be-Mobile operates an RDS-TMC service in Luxembourg [17].
TPEG over DAB or IP:	Be-Mobile operates a DAB-TPEG service in Luxembourg [71]. INRIX operates a IP-TPEG service [17].
Proprietary coding over IP:	Google and TomTom provide RTTI over IP using proprietary coding protocols [71].

Organisation of the Value Chain

Traffic flow data is collected by both the road authority and private companies. Services are provided by private companies [71].

Business Models for Traffic Information

Only commercial services are available, some of them are free at the point of use [71].

Malta

Content Availability
Unknown, probably none

DATEX
No [40].

Available Services

Voice radio:	Unknown
RDS-TMC:	No
TPEG over DAB or IP:	No
Proprietary coding over IP:	No

Organisation of the Value Chain
Not applicable.

Business Models for Traffic Information
Not applicable.

Poland

Content Availability
Information is available on traffic flow, traffic incidents, roadworks, closures, weather and road conditions [71].

DATEX
No [40].

Available Services

Voice radio:	Unknown
RDS-TMC:	MediaMobile provides an encrypted paid TMC service [17] on commercial radio station RMF FM [17, 71].
TPEG over DAB or IP:	No DAB infrastructure is currently available [34]. INRIX provides a TPEG-service over IP [71].
Proprietary coding over IP:	Google and TomTom provide RTTI over IP using proprietary coding protocols [71].

Organisation of the Value Chain
Public road authorities collect road traffic data and incident reports. These are provided to private service providers [17, 71].

Business Models for Traffic Information
Only commercial services are available, some of them are free at the point of use [17, 71].

Portugal

Content Availability
Traffic flow, traffic incident, and weather information is available on toll roads. Traffic flow data is also available on city arteries [40, 46].

DATEX
The INIR centre is based on DATEX II, motorway concessionaires use DATEX I [40, 71].

Available Services

Voice radio:	Yes [46].
RDS-TMC:	Be-Mobile provides a commercial TMC service on RFM radio. Be-Mobile made the Portuguese TMC table version 1.1. [17].
TPEG over DAB or IP:	No DAB infrastructure is currently available [34].
Proprietary coding over IP:	Google and TomTom provide RTTI over IP using proprietary coding protocols [71].

Organisation of the Value Chain
Traffic data is collected by toll road concessionaires and public road authorities. The information is aggregated by the INIR centre and made available to service providers [40, 46].

Business Models for Traffic Information
Only commercial services are available, some of them are free at the point of use [17, 71].

Romania

Content Availability
Travel times are measured by floating vehicle probes. Weather alarms are available from the meteorological institute. Incident reports and road conditions are available for the motorways [71].

DATEX
DATEX II, preoperational, regional [40].

Available Services

Voice radio:	Unknown
RDS-TMC:	TrafficNav is providing a TMC service on private radio station ProFM [17, 71]. The National Police operate the InfoTrafic Center, gathering weather warnings and incident reports [71].The National Motorway Company collects information on their roads [71].
TPEG over DAB or IP:	No DAB infrastructure is currently available [34].
Proprietary coding over IP:	Google provides travel time information for a few motorways [71].

Organisation of the Value Chain
Data for the TMC service is collected and aggregated by private companies [71].

Business Models for Traffic Information
Only commercial services are available, some of them are free at the point of use [17].

Slovakia

Content Availability
Unknown.

DATEX
DATEX II, preoperational, regional [40].

Available Services

Voice radio:	Unknown
RDS-TMC:	GeoMatika provide a free TMC service [17].
TPEG over DAB or IP:	No DAB infrastructure is currently available [34].
Proprietary coding over IP:	Google provides travel time information for a few motorways [71].

Organisation of the Value Chain
Unknown.

Business Models for Traffic Information
Free services only [17, 71].

Slovenia

Content Availability
Travel times, incident reports, road conditions and weather warnings, and road closures are available for the national roads [49].

DATEX
DATEX II, preoperational [40].

Available Services

Voice radio:	Yes [49].
RDS-TMC:	TrafficNav is providing a commercial TMC service on two national FM networks of Radiotelevizija Slovenija, Slovenia's State Radio [17, 66]. The National Police operate the InfoTrafic Center, gathering weather warnings and incident reports [71].The National Motorway Company collects information on their roads [71].
TPEG over DAB or IP:	Limited DAB coverage, no TPEG services [34]. INRIX provides a TPEG service over IP [17].
Proprietary coding over IP:	No.

Organisation of the Value Chain
Both public and private organisations collect and aggregate traffic information in Slovenia. The traffic information centre for national roads collects road and traffic information for all national roads managed by the National Roads Directorate and the motorway concessionaire DARS. The information is provided to private service providers free of charge [49].

Business Models for Traffic Information
Only commercial services are available, some of them are free at the point of use [17].

Spain

Content Availability
The following road traffic information is available: traffic events and incidents, traffic flow (levels of service) and travel time, dynamic speed limits, driving restrictions, and weather information [58].

DATEX
DATEX II, preoperational, RDS-TMC as location referencing method [40].

Available Services

Voice radio:	Yes
RDS-TMC:	A public RDS-TMC service is provided by DGT over RNE, for the interurban network [17, 53, 66]. Location tables are managed by the DGT. The current version is 2.1 and contains about 7.750 locations.
TPEG over DAB or IP:	Limited DAB coverage, no TPEG services [34]. INRIX provides a TPEG service over IP [17].
Proprietary coding over IP:	Both Google and TomTom provide congestion information [71].

Organisation of the Value Chain
Both public and private organisations collect traffic information. The General Directorate of Traffic (DGT) is responsible of traffic control and management on interurban roads of Spain (except in the Basque country -DT- and Catalonia -SCT-). Traffic information is exchanged between DGT, SCT and DT by means of DATEX [40, 58].

Business Models for Traffic Information
A free TMC service is available to end-users. Private parties further provide subscription based and sponsored services, some of which are free at the point-of-use [17, 71].

Sweden

Content Availability
Information is available on road condition, road works, obstacles, accidents, congestion, closures, etc. [57], for motorways, inter-urban roads, and main city arteries [34].

DATEX
All information from the Transport Administration is available in DATEX II, using TMC location referencing [57, 40].

Available Services

Voice radio:	Private and public radio stations broadcast traffic safety information throughout the country [57].
RDS-TMC:	Both a free public service and a commercial service are available [57]. The Swedish Transport Administration, or Trafikverket is responsible for the free service. The service is broadcast on Sveriges Radio P3 radio station and covers 98 percent of Sweden. Trafikverket manages the location tables. The current version is v2.2.2009, which contains about 22587 location codes [57, 71].
TPEG over DAB or IP:	TPEG over DAB is trialled, although DAB coverage is only 35% [34]. INRIX provides a TPEG service over IP [17].
Proprietary coding over IP:	Both Google and TomTom provide congestion information [71]. An estimated 2.5 million Smartphones with apps using GPRS/3G with traffic information are currently in use in Sweden [57].

Organisation of the Value Chain
Both public and private organisations collect, aggregate and validate traffic data. Trafiken.nu is a collaboration between the Swedish Transport Administration, the local public transport companies and the municipalities. The data used is collected through the Administration’s own channels (CCTV-cameras, loops and rapporteurs) or through contracts or arrangements such as SOS, taxi and the police. The public real-time information is provided for free to service providers. Private companies that collect and aggregate data are Info24, MediaMobile, Nokia, Google and TomTom [57, 71].

Business Models for Traffic Information
The public TMC service is completely free of charge. Other services rely on a subscription, sponsoring, or advertisement model [17, 71].

The Netherlands

Content Availability
Information on congestion, incidents, roadworks, closures, road conditions and weather warnings, are available for all motorways, most inter-urban, and some city arteries.

DATEX
DATEX II is operational, TMC and lat/lon are used as location referencing methods [40].

Available Services

Voice radio:	Yes [34].
RDS-TMC:	Only commercial services are available, but most are free. VIDExtra is a premium TMC service providing not only congestion and incident information, but also information on roadworks and speedcams [17, 71]
TPEG over DAB or IP:	No TPEG-service is provided over DAB [34]. INRIX provides a TPEG-service over IP.
Proprietary coding over IP:	Both Google and TomTom provide congestion information [71].

Organisation of the Value Chain
Both public and private organisations collect, aggregate and validate traffic data. The national, regional and local road authorities provide traffic data to the public traffic information centre NDW. This is information is made available to service providers for a small fee.

Business Models for Traffic Information
Road users can obtain traffic information for free from commercial providers (using a sponsoring or advertising business model), or can subscribe to paid premium services.

UK

Content Availability
Information on congestion, incidents, road conditions and weather warnings, road works and closures, is available for all motorways, inter-urban and main urban roads [34, 40].

DATEX
DATEX II is operational in multiple traffic information centres, TPEG-LOC is used as location referencing standard [40].

Available Services

Voice radio:	Yes [34].
RDS-TMC:	Only commercial TMC services are available with conditional access, from INRIX and TrafficMaster, free at the point-of-use. INRIX broadcasts nationally on Classic FM and commercial radio stations. TrafficMaster broadcasts nationwide on Global Radio, a network of local and regional radio stations. Both providers are manage their own location table.
TPEG over DAB or IP:	INRIX provides a TPEG service over DAB. The MILE Consortium provides a TPEG service over IP [17, 71].
Proprietary coding over IP:	Both Google and TomTom provide congestion information [71].

Organisation of the Value Chain
Both public and provide organisations collect, aggregate and validate traffic data. In the public sector the task is delegated to Highways Agency and Traffic Scotland. TrafficMaster operates its own network of sensors. Highways Agency Weather Central Service (HAWCS) collects, stores and distributes weather information.

Business Models for Traffic Information
All services are commercial and rely on a subscription, advertising or sponsoring based business model. Most services are free at the point-of-use.

Annex B – Results SWOT Data and Location Standards

1) Location Coding Standards

Traffic Information Coding				
	Strengths	**Weaknesses**	**Opportunities**	**Threats**
Traffic Message Channel (TMC)	Proven technology, wide coverage, moderately large installed base, relatively low cost of operation	Information is simple, it is essentially designed for inter-urban road events. Pre-defined and coded location tables are required. Very limited bandwidth, which also constrains deployment on roads other than motorways and secondary roads.	TMC has been largely deployed in many Member States and be familiar with by current road users. It can be introduced on radio networks in less developed Member States with relatively low infrastructure investment.	TMC can be considered as an 'old' technology and it is expected to be replaced gradually by other technologies.
Transport Protocol Experts Group (TPEG)	Proven technology, large bandwidth, doesn't need for a pre-defined location database in client devices, high language independence, applications cover all modes of transport, filter function	Various applications are under development.	TPEG based services will be developed and will deliver more details and wider services in coming years. It is likely to replace TMC in some of the more developed Member States.	Costs of change of the current deployed standards, wide range implementation can be expensive.
DATEX / DATEX II	Proven technology, wide coverage, moderately large installed base, good compatibility and interoperability in information exchanges	Some more parts of specifications are still under development.	With the improvement of the coverage of contents, it might establish a logical model and become the leading reference model for information exchange in road transport all over Europe.	Costs of change of the current deployed standards, implementation can be expensive.

2) Location Referencing Standards

Location Referencing Coding				
	Strengths	**Weaknesses**	**Opportunities**	**Threats**
TMC location	A mature method to support RDS-TMC, wide coverage	Location tables need to be created, maintained and renewed. The pre-code tables constrain the range of applications.	More rich and frequent location information can be updated by some countries which have mature procedures to manage and develop their location tables.	TMC (with TMC location tables) can be considered as an 'old' technology and it is expected to be replaced gradually by other technologies.
TPEG-Loc	Proven technology, doesn't need for a pre-defined location database in client devices, high language independence, applications cover all modes of transport, filter function	Small installed base. Various applications are under development.	It is likely to support more TPEG based services and replaced the role of TMC location tables.	Costs of change the current deployed standards.
Open LR™	Non pre-defined location, open and royalty-free standard, dynamic location referencing, suitable for all type of road, compact data	It is under development. Operational experience is limited.	The open standard might attract wide-scale interest and adoption by the industry.	It is current lead and developed by TomTom. The prospect of this standard is not clear.
Linear referencing	Proven technology, wide coverage	It is limited in defining the locations relative to linear objects.	It is mature technology and preferable method for some applications such as GIS.	Limitation in application ranges
AGORA-C	Dynamic encoding and decoding method, good compatibility and interoperability	It is costly operation and operational experience is limited.	As an open international standard (ISO 17572-3), AGORA-C could gain broad support and development, as well as ensure its relevance and applicability to new applications and markets in future.	Costs of change the current deployed standards.

Annex C - Assessment Results Distribution Channels

1) Overview of assessment criteria

Nr	Name	Description	Reference
1	Bandwidth	Is bandwidth sufficient to transmit all relevant information?	[17], [19], [30], [21] Consortium expert
2	Push	Channel preferably allows the road operator to timely deliver real-time information to the driver	[17], [19], [30], [21] Consortium expert
3	Cross-border	Can the channel provide seamless cross-border services	[17], [19], [30], [21] Consortium expert
4	Delivery on-trip	Can the channel deliver information on-trip, i.e. in the vehicle	[17], [19], [30], [21] Consortium expert
5	Information conveyance	Capabilities or restrictions of the channel to convey information to the driver. E.g. textual, audio, graphical, map-based display of information to the driver	[17], [19], [30], [21] Consortium expert
6	Multilingual	Does the channel support the presentation of information to the driver in a language he/she understands	[17], [19], [30], [21] Consortium expert
7	Suitability for users groups	Is the channel suitable for different road users (Car drivers, truck drivers, Motor cyclists, as well as for Elderly or Youngsters drivers)	[17], [19], [30], [21] Consortium expert
8	Locational awareness	Does the channel allow for filtering of relevant information based on the position, road section and/or planned route of the vehicle	[17], [19], [30], [21] Consortium expert
9	Safety of use	Does the channel require interaction by the driver that might lead to driver distraction or other safety compromising behaviour	[17], [19], [30], [21] Consortium expert
10	Geographic availability	In how many Member States Is the infrastructure available	[25]
11	Road type coverage	Is the channel suited for the dissemination of information on TERN, motorways, secondary roads, and urban roads?	[25]
12	Installed base	How many drivers already have equipment to receive information through the channel	[25]
13	Reliability	The chance that information that is pushed into the channel is timely delivered to the end-user.	[25]
14	Topographic restrictions	Does the channel allow a good reception in every topographic situation (mountainous areas, terrestrial position (latitudes),…) ?	[28], Consortium expert
15	Technological maturity	How mature is the distribution channel; is it under development, tested in pilots, deployed in operational environments, foreseen evolution	[17], [19], [30], [21] Consortium expert

2) Overview of Channels

Nr	Channel Name	Description	Ownership Specifications	Infrastructure	Services	Refer.
1	Road side VMS	Roadside panels that can display safety related information, based on graph and text information	No general specifications are in place although EasyWay has developed common deployment guidelines for VMS Harmonisation, and the Consolidated Resolution on Road Signs and Signals provides elements of specifications [104].	In general owned and operated by public road authorities	In general owned and operated by public road authorities	[19], [30], [17]
2	SMS/MMS services	Services that send information to drivers by SMS or MMS messages. 2 possibilities are available: 1°) Profiling/registration is required first through a web interface. Then information is sent to all subscribers. 2°) by pushing information through cell broadcasting to all mobile phones in a cell of the cellular network	3GPP	Mobile telecom operators	Various services operated by public/private organisations	[19], [30], [17]
3	RDS-TMC data casting via FM	Services that broadcast digitally encoded information over the radio data system. The in-vehicle device decodes and presents the information to the driver.	TISA, CEN, ISO	In general public broadcasting organisations	In general public and private radio stations and TMC service providers	[19], [30], [17]
4	Radio VHF/FM or DAB	Spoken radio bulletins with safety related information.	Radio communication protocols owned by various organisations	In general public broadcasting organisations	In general public and private radio stations	[19], [30], [17]

Nr	Channel Name	Description	Ownership Specifications	Infrastructure	Services	Refer.
5	DAB/DAB+/DMB with TPEG data casting	Services that distribute digitally encoded information via terrestrial digital audio broadcasting. The in-vehicle device decodes and presents the information to the driver.	TISA, CEN, ISO	In general public broadcasting organisations	Currently in development, in general public and private radio stations and TPEG service providers	[19], [29] [30], [17]
6	DVB-S(H) with TPEG data casting	Services that distribute digitally encoded information via satellite broadcasting. The in-vehicle device decodes and presents the information to the driver.	ETSI	Private satellite operators	No known services	[19], [29] [30], [17]
7	Mobile internet	Services that exchange information with in-car or handheld devices through terrestrial mobile internet connections such as GPRS, UMTS, WiMAX and LTE-A.	3GPP	Mobile telecom operators	Various services operated by public/private organisations	[19], [30], [17]
8	V2I protocols	Services that exchange information from the infrastructure to the vehicles and vice versa. The in-vehicle device decodes and presents the information to the driver.	ETSI (on-going)	Will probably in general be owned and operated by road authorities	No known services	[17]
9	V2V protocols	Services that exchange information between vehicles. The in-vehicle device decodes and presents the information to the driver	ETSI (on-going)	No infrastructure required	Currently in development. Experimental services.	[17] [26], [27]

3) Assessment of Distribution Channels

Nr	Criteria	Road side VMS	SMS/MMS services	RDS/TMC data casting	Radio VHF/FM or DAB	DAB/DAB+ with TPEG data casting	DVB-S(H) with TPEG data casting	Mobile internet	C2x protocols	C2C protocols
1	**Bandwidth**	Very limited	Limited	Limited	Limited	Adequate	Adequate	Adequate	Adequate	Adequate
2	**Push**	Yes	Yes, but only after registration	Yes	Yes, highly captive but delivery can be slow	Yes	Yes	Yes, although in general not very fast	Yes	Yes
3	**Cross-border**	No	Yes, but perception is 'none/limited' because of roaming costs.	Yes, but requires knowledge of TMC frequencies abroad	No, since channel is not language independent	Yes, but requires knowledge of DAB frequencies abroad	Yes	Yes, but perception is 'none/limited' because of roaming costs.	Yes	Yes
4	**Delivery on-trip**	Yes	Poor because of HMI restrictions	Yes, but reception can be poor if no external antenna is used	Yes	Yes	Yes	Yes	Yes	Yes
5	**Information conveyance**	Poor because of short attention timespan	Poor because of HMI restrictions	Satisfactory	Poor because of limited bandwidth, required topological knowledge of the driver, single delivery opportunity	Good, but depends on HMI design	Good, but depends on HMI design	Good, but depends on HMI design	Good, but depends on HMI design	Good, but depends on HMI design
6	**Multilingual**	Limited possibilities	Yes, but only after registration of preferred language	Yes	No	Yes	Yes	Yes	Yes	Yes

7	**Suitability for users groups**	Limited for the elderly because of the limited attention timespan	Poor because of high level of driver distraction. In particular poor for motorcyclist.	Limited for motorcyclist. Appropriate for others	Optimal for elderly road users. Appropriate for others.	Limited for motorcyclist. Appropriate for others.	Limited for motorcyclist. Appropriate for others.	Limited for motorcyclist. Appropriate for others.	Limited for motorcyclist. Appropriate for others.	Limited for motorcyclist. Appropriate for others.
8	**Locational awareness**	Yes, by definition	Only through manual input	Possible, depends on receiver	No	Possible, depends on receiver	Possible, depends on receiver	Possible, depends on end-user device	Yes, by definition	Yes, by definition
9	**Safety of use**	Limited, might lead to driver distraction	Limited, might encourage mobile phone use while driving	Good, if HMI of device is properly designed	Good	Good, if HMI of device is properly designed	Good, if HMI of device is properly designed	Good, if HMI of device is properly designed	Good, if HMI of device is properly designed	Good, if HMI of device is properly designed
10	**Geographic availability**	Limited due to cost of operation	Everywhere	Most Member States	Everywhere	Only in a few of the more developed Member States	Most Member States	Everywhere	Only on pilot sites	Only on pilot sites
11	**Road type coverage**	In principle all road types, but cost of operation severely constrains deployment on roads other than motorways	All road types	In principle all road types, but limited bandwidth constrains deployment on roads other than motorways and secondary roads	In principle all road types, but limited bandwidth constrains deployment on roads other than motorways and secondary roads	All road types	All road types	All road types	In principle all road types, but high costs severely constrains deployment on roads other than motorways	All road types
12	**Installed base**	Limited due to cost of operation	Very large	Moderate, varies between Member States	Very large	Very small	Very small	Large	Almost none	Almost none

13	**Reliability**	Limited because of the short information conveyance window	Moderate	High, although topography might block reception	High for urgent safety related info. Moderate for other because of the limited bandwidth	High, although topography might impede timely reception	High, although topography might impede timely reception	High, although a sudden burst of information can overload the network locally	High	High
14	**Topographic restriction**	None	None	Difficult in mountainous areas	Difficult in mountainous areas	None	Poor reception at higher latitudes, in particular in urban areas.	None	None	None
15	**Technological maturity**	High	High	High	High	High	Moderate	High	Low	Low

Annex D – Literature Review on Road Safety Impact

Impact assessment methodology

The risk of an injury or fatality in traffic can be regarded as the product of three factors, see e.g. [4] and [14]:

- Exposure (relative time spent in traffic where an accident may occur)
- Risk that a collision takes place while participating in traffic
- Risk that – given a collision – it will result in an injury or fatality.

Measures to improve traffic safety will target one or more of these three factors. Draskóczy e.a. [15] developed a framework of nine behavioural mechanisms that can be distinguished and which is often used in safety impact assessments. See e.g CODIA [14], eIMPACT [4] and EasyWay [12].

The first five mechanisms are connected to the accident risk:

1. Direct in-car modification of the driving task
2. Direct influence by roadside systems
3. Indirect modification of user behaviour
4. Indirect modification of non-user behaviour
5. Modification of interaction between users and non-users

The second group affects exposure:

6. Modification of road user exposure
7. Modification of modal choice
8. Modification of route choice

Finally one mechanism is defined for changing the damage resulting from an accident:

9. Modification of accident consequences

For each of the mechanisms the *coefficients of efficiency* are calculated (i.e. a reduction of injuries/fatalities of 25% leads to a coefficient of efficiency of 0,75). The overall efficiency coefficient is the product of the coefficients for the individual mechanisms. Note that a coefficient can also be > 1, in case there is a mechanism involved that has a negative impact on traffic safety. An example is that certain in-vehicle systems, by assisting in the driving task, might encourage drivers to use their car under difficult conditions where they would have refrained from making the trip without these systems (mechanism 6). See [14] for a more detailed explanation.

Relation between speed and accident risk

From assessments done on related applications, it can be concluded that a reduction in vehicle speed as a result of information on specific hazards likely stands out as the most important mechanism of safety impact for SRTI. This is covered by mechanism 1 above.

Extensive research has been done on the relation between speed and risk of injuries/fatalities. A mathematical relation was first suggested by Nilsson [16] and has been refined and verified in later research, see [7] for an overview. The following formula is generally applied:

$$P_2(\text{damage})/P_1(\text{damage}) = (v_2/v_1)^n ;$$

Where P_2 represents the probability of a certain type of damage at speed v_2, and P_1 represents the probability of a certain type of damage at speed v_1. The exponent n depends on the type of damage considered (casualty, accident with casualties, severe injury, accident with severe injuries etc.) as well as the road type (inside urban area / outside urban area). Best fit exponent values range from 4.6 for fatalities outside the urban area to 1.0 for light injuries inside the urban area, see Elvik [17].

Using these values, a 1% reduction in average speed on a particular road leads to a reduction of 4.5% for fatalities, 3.5% for severe injuries and 1.4% for light injuries.

Safety impact assessment studies for similar applications

Finland – impact of real-time weather and road information

In this study real-time information on slipperiness and other road/weather related problems using Variable Message Signs, was estimated to reduce the risk of injury accidents in adverse conditions by 8 % on main roads and 5 % on minor roads in a Nordic environment, see [13]. This effect is largely due to a reduction of average speed and a longer headway as a result of the warning. The presentation of the message was also found to be a factor of influence.

Considering that in Finland approximately 20% of all accidents occur under adverse weather conditions (this is quite close to the European average), the overall reduction of injury accidents would be 1.6% and 1% on main and minor roads respectively.

Applying Nilsson's formula, and the coefficients determined by Elvik [68], the corresponding figures for fatalities would be 2.6% and 2.0% on main and minor roads respectively; and 1.8% and 1.3% for severe injuries.

eIMPACT - Wireless Local Danger

The project eIMPACT included a safety impact assessment on a wireless local danger application, see [14]. It includes two safety functions: a) a warning concerning a stopped vehicle ahead, and b) a warning concerning reduced visibility and friction.

Mechanisms 1 (direct influence on the driving task, in particular reducing speed in reaction to a warning), 3 (small indirect influence, here regarded as a detrimental effect when users learn to rely on the system) and 5 (modification of interaction between users and non-users, in this case other vehicle drivers reacting to the equipped vehicle that reduces speed) are considered relevant.

The combined result of the three mechanisms in a scenario of 100% penetration – all vehicles and all roads covered – yields a 4.5% reduction of fatalities and a 2.8% reduction of injuries.

EasyWay – Hazardous Location Notification and Traffic Jam Ahead Warning

EasyWay assessed a number of cooperative safety services, including a Vehicle-to-Vehicle based cooperative application for hazardous location notification and traffic jam ahead warning, see [12].

The services assessed do not interfere in the operation of the vehicle or the driving task; they only provide warnings to the driver. These warnings are assumed to be provided 10 seconds before arriving at the hazardous location, after a more generic pre-warning some minutes before. The main purpose is to increase driving safety of following cars by making drivers aware of the situation and preparing them for the hazard condition. As a result, drivers are expected to lower their speed in time before the actual problem location and/or to react quicker to the actual problem when reaching it, due to the warning. The driver's attention is expected to be focused on the road (surface) ahead, to have better situation awareness, and to keep longer headway. Some drivers will likely also avoid overtaking whereas some might still wish to utilise the problem-free section to overtake and maintain the same speed as before so long as possible. It is emphasized that the major part of the effect results from a direct reaction on the information by the driver, i.e. mechanism 1. It is estimated – based on other research – that a low friction warning will lead to an average speed reduction of 2 km/h and a low visibility warning will lead to an average speed reduction of 5 km/h. This leads to a significant crash risk reduction.

Other mechanisms deemed of influence are indirect modification of user behaviour (3), modification of exposure (6) and modification of route choice (8). The overall effectiveness is estimated to be in the order of 20-30%.

The estimated effectiveness is consequently multiplied with the fraction of crashes where the service/information would be applicable, by filtering European accident figures from the CARE database as to vehicle type, road type, weather & lighting conditions and location (intersection or non-intersection). This leads to the estimates for the overall safety effect of the two safety functions as summarized in the table below. It is noted that a 100% penetration is assumed and a 100% availability (time, location).

Type of information/warning	Reduction of fatal accidents and fatalities				Reduction of injury accidents and injuries			
	Overall	Motor-way	Inter-urban	Urban	Overall	Motor-way	Interurban	Urban
Hazardous location notification	-4.1%	-5.2%	-5.3%	-1.7%	-3.1%	-5.3%	-5.3%	-1.9%
Traffic jam ahead and decentralized FCD	-2.4%	-3.3%	-2.8%	-1.6%	-2.8%	-4.9%	-4.1%	-2.0%
Overall effect	-6.4%	-8.0%	-8.0%	-3.0%	-5.8%	-10%	-9.0%	-4.0%

Table - Overview of estimated effect on traffic safety of priority cooperative services, assuming 100% penetration, V2V bundle, source: EasyWay [12]

In addition it is estimated that centralized (i.e. delivered to the vehicle from a central system) information provisioning would add another 0.5% to the effectiveness, both in terms of injuries and fatalities. The combined effect would therefore be estimated as 6.9% and 6.3% (of all road traffic fatalities/injuries).

Prosper - Safety impact of Intelligent speed adaptation

In the PROSPER project the impact of different types of ISA (Intelligent Speed Adaptation) was assessed as to their potential to reduce traffic fatalities and injuries, see [3]. PROSPER made use of micro-simulations to model the behaviour of equipped and non-equipped vehicles in traffic. The simulated behaviour was validated by field trial data (Lund).

ISA has a reduction of speed as main mechanism to increase safety. The impact of ISA is greater the more the adopted maximum speeds are tuned to specific local (dynamic) conditions. More invasive/mandatory forms of ISA (the most drastic form is when the advised maximum speed is maintained automatically without any possibility to override) have more impact than types that only give a warning signal to the driver in case of speeding. The 'lightest' type is most relevant for this study, as SRTI will only have an informative character.

For 'advisory ISA' the following results were obtained:

- A fatality reduction from 7% to 8% on rural roads and motorways.
- A fatality reduction from 17% to 21% in urban areas, assuming 100% penetration and availability.

It is emphasised that ISA has an effect on the average speed (and variance) for all road and weather conditions, whereas the scope of SRTI is limited to occasional hazards and adverse conditions.

CODIA – dynamic speed adaptation

The CODIA project assessed the potential safety impact of a number of cooperative safety applications, including dynamic speed adaptation. The system uses V2I and I2V interaction, assumes processing by a traffic management centre and provides local speed 'advice' adapted to weather/road conditions, obstacles and congestion (end-of-queue).

The assessment distinguishes between dynamic speed adaptation concerning a) local speed limits, b) adverse weather and c) obstacles or congestion ahead.

The following results are reported for a 100% penetration scenario, and use on 55% of travelled kilometres.

Type of information / warning	Number of fatalities				Number of injuries			
	Overall	Motor-way	Inter-urban	Urban	Overall	Motor-way	Interurban	Urban
Local Speed Limit	-4.2%			Large	-2.7%			Large
Adverse weather/road conditions	-1.9%			Negligible	-1.5%			Negligible
Obstacle/congestion	-0.7%			Negligible	-0.3%			Negligible
Combined effect	-7.2%				-4.8%			

Table - Results of a safety impact assessment on advised dynamic speed adaptation performed by the CODIA project, [14].

The study also estimates the effect for different horizons and penetration rates. For 2020, the low scenario yields a 0.3% reduction of fatalities; the high scenario a 1.0% reduction. For 2030, the corresponding figures are 3.2% and 4.2%.

Wrong-way driving

No studies were found that report on the estimated effect of traffic information on reducing wrong-way driving accidents. We therefore provide our own (crude) estimate.

Wrong-way driving is a specific cause of accidents where SRTI may be effective. In general, wrong-way driving accidents are rare, but when they occur, the consequences are almost always very serious. Whereas wrong-way driving constitutes a negligible fraction of traffic injuries, it is responsible for a significant portion of traffic fatalities. The occurrence of wrong-way driving accidents is concentrated on motorways, and varies from country to country. For most European countries, no reliable figures are available.

For the Austrian motorway network some 3 fatalities per year are reported, out of approximately 70 fatalities on motorways and 700 traffic fatalities in total, see ASFINAG's safety report [6]; roughly 4% resp. 0.4%. In Slovenia 4 fatalities out of a total of approximately 200 traffic fatalities relate to wrong-way driving, i.e. around 2% of all traffic fatalities, see [11], and some 30% of all motorway fatalities[7]. SWOV reports an average of 2 such fatalities per year for the Netherlands: this would approximately be 0.25% of all road traffic fatalities and 2% of motorway traffic fatalities, see [8]. For the French concessionaire motorways some 10 to 12 fatalities per year are reported caused by wrong-way driving. This accounts for 3.7% of all fatalities. Per year about 8 fatal accidents are caused by wrong-way driving, accounting for 0.2% of all accidents [105].

As noted above, figures differ largely between countries. It is assumed that in the next 5-10 years countries will take conventional measures to reduce wrong-way driving fatalities to a level of 4% of motorway fatalities (the Austrian figure). We further assume that a reduction of 25% of wrong-way driving fatalities is a realistic target if adequate, timely and accurate information is available for a vast majority of car drivers.

This would lead to a reduction of 1% of fatalities on motorways. In terms of all traffic fatalities the fraction would be app. 0.05%, using the CARE database figures [69] on the fraction of fatalities on motorways in the EU-23. We assume that the reduction of injuries would be negligible, as well as the reduction of fatalities on other roads than motorways.

Synthesis

The studies summarized in this ANNEX have in common that they estimate the potential safety effect of providing information on local road/weather/traffic conditions with increased safety risks. By informing the driver adequately, he will reduce speed and take more caution. This results in less accidents, casualties and injuries. As to the estimated quantitative impact, the differences between the studies are considerable. This is partly due to differences in characteristics of the safety applications/services involved. Remaining

[7] It is not known if reported wrong-way driving accidents in Slovenia also take place on roads not labeled motorways.

differences may be explained by the fact that in all cases the assessment methods involve multiple assumptions that are difficult to validate and lead to significant uncertainty in the outcome.

When looking at the potential impact of *weather related road safety warnings* the results of the Finnish study lead to an estimated reduction of fatalities of 2.6% on ‘main roads’. The incremental effect of adverse road/weather conditions and dynamic speed adaptation as assessed in the CODIA project is 2.4% on motorways (applying a 1.33 factor, derived from the table above, to convert from ‘all roads’ to ‘motorways only’). The hazardous location warning as assessed by EasyWay, has an estimated effect of 5.2% less fatalities on motorways. eIMPACT even predicts an effect of 6.0% on motorways (again applying a 1.33 factor to the overall figure to convert to motorways only), yet for a combined service of traffic jam ahead and reduced vision/friction warnings. PROSPER estimates an effect in the order of 7-8% for a dynamic form of ISA (advice), including adapted speeds for deteriorated road/weather conditions. The results are comparable to the CODIA results as the major part of the effect is due to basic ISA: reminding the driver of local speed limits on all roads.

The fact that the effects estimated by EasyWay and eIMPACT are much higher than the other studies can possibly be explained by the fact that the cooperative approach elaborated in EasyWay and eIMPACT is capable of a higher granularity, completeness, reliability and accuracy of warning messages compared to a conventional approach of collection, centralised processing and distribution of traffic information, as assumed in the other studies. As the scope of SRTI is to improve the distribution of (mostly) already available traffic information, it is better reflected by the conventional approach. We therefore deem the lower figures better applicable to SRTI.

As to traffic jam / obstacle ahead warnings, similar observations and considerations apply. This service was not in the scope of the Finnish study. Taking the estimate from CODIA, and multiplying – as above – by 1.33 to convert from all roads to motorways, the jam / obstacle ahead warning would be 1.0% for the incremental reduction of fatalities on motorways, (0.7% concerning fatalities on all roads). The corresponding figure from the EasyWay Traffic Jam ahead warning is 3.3% (2.4% for all roads). As above the lower CODIA figure is deemed better applicable to SRTI.

For injuries, the (derived) CODIA figures are 2.6% / 1.5% for road/weather warnings and 0.5% / 0.3% for jam / obstacle ahead warnings, for motorways / all roads respectively (applying a factor to convert from motorways injuries to all roads derived from EasyWay results).

Annex E – Possible Combinations Impact Assessment

		C1	C2	C3	C4	C5	C6	
		None	TERN	TERN*	TERN* National/Primary Roads	TERN* National/Primary Roads City Arteries	TERN* National/Primary Roads City Arteries Secondary Roads	Total Combinations
DC1	None	P1,P2a FS1,FS2,FS3 TS1 O1,O2	N/A	N/A	N/A	N/A	N/A	12
DC2	DATEX II Node	P2a FS4,FS5,FS6,FS10 TS2 O3,O4	P3a FS4,FS5,FS6,FS10 TS2 O3,O4					48
DC3	DATEX II Node RDS-TMC	P2b FS7,FS8,FS9,FS10 TS3 O5,O6	P3b FS7,FS8,FS9,FS10 TS3 O5,O6					48
DC4	DATEX II Node RDS-TMC VMS	P2b FS7,FS8,FS9,FS10 TS2 O5,O6	P3b FS7,FS8,FS9,FS10 TS2 O5,O6					48
DC5	DATEX II Node RDS-TMC Smartphone App	P2b FS7,FS8,FS9,FS10 TS4 O5,O6	P3b FS7,FS8,FS9,FS10 TS4 O5,O6					48
DC6	DATEX II Node RDS-TMC TPEG-DAB	P2b FS7,FS8,FS9,FS10 TS5 O5,O6	P3b FS7,FS8,FS9,FS10 TS5 O5,O6					48
DC7	DATEX II Node RDS-TMC Smartphone App TPEG-DAB	P2b FS7,FS8,FS9,FS10 TS6 O5,O6	P3b FS7,FS8,FS9,FS10 TS6 O5,O6					48
DC8	DATEX II Node RDS-TMC VMS Smartphone App TPEG-DAB	P2b FS7,FS8,FS9,FS10 TS6 O5,O6	P3b FS7,FS8,FS9,FS10 TS6 O5,O6					48
Total Combinations		68	56	56	56	56	56	**348**

Annex F - Detailed IA results

This section of the annex will present the assumptions used to generate the results for the Impact Assessment scenarios. A number of assumptions are relevant to all the scenarios – these are documented below. The assumptions particular to the individual scenarios will be described in the sections that follow. In addition to the assumptions, a summary table has been included that indicates the costs and benefits for that particular scenario.

Assumptions relevant to all scenarios

- Data collection requirements are based on the levels adopted in the QUANTIS methodology. All data collection requirements are set at level 2 (i.e. data collection at 3.5km intervals) for incident and traffic observation data, and at 25km intervals for weather information data (on the basis that forecasting information is carried out at a lower level of granularity and combined with local observations etc to inform drivers).
- The investment in additional data collection methods are based on an initial investment in 2015, with maintenance costs being applied for the years 2016-2030. If the lifecycle of the equipment required for data collection is less than 10 years, a cost for the replacement of equipment has been included
- There are a number of possible approaches to gathering incident data. These have a range of costs. The calculations have included an upper and lower estimate for the additional cost of data collection. The upper costs reflect the investment in and installation of inductive loops and CCTV. The lower costs are based on 'cooperative data sharing' from eCall devices (this assumes that the eCall devices are able to accurately identify the location of an incident that triggers eCall) or using other incident notification methods (e.g. records from PSAPs). Additional software would likely be needed to decode the data from eCall/PSAPs.
- The savings that can be derived from SRTI have been calculated based on a mix of CODIA/EasyWay figures (section 6 describes this in more detail). The savings from SRTI are also combined with the number of users who could potentially access the SRTI service (e.g. total potential savings * affected users).
- The IA assumes that there is 100% coverage of data collection for the network in question. Therefore, IA scenarios 2-18 consider the costs involved in reaching that level of coverage.
- IA scenario 1 (functional specification and DATEX II node only) works on the basis of the current level of data collection (the anticipated savings from SRTI are therefore scaled down accordingly).
- The SRTI savings cannot be broken down by road type beyond motorway/outside urban area/inside urban area. Therefore, the values for 'motorways' have been applied to both TERN + other motorways and main/national roads.
- The accident rates (injuries/fatalities) for the road types covered by this scenario were taken from the national databases for France, Germany, Switzerland and the UK

Scenario 1 – Functional spec only

Assumptions:

- MS provide whatever relevant data they have via a DATEX II feed
- Assumes that if the SRTI data was made available by MS, then private service providers would provide an SRTI service to their users
- Based on the current level of data collection for each MS (therefore, the costs of getting the network to 100% data coverage are not relevant)
- This scenario considers the current level of data collection on the TERN + motorways network
- Cost assumptions:
    - For those MS with a DATEX II feed: a cost has been identified for extending the existing DATEX II feed to support SRTI (it is assumed that those MS with an existing DATEX II feed already have operations in place to maintain it and collate the data that it supports)
    - Provision of DATEX II feed (for those MS that do not already have one = £8m/yr (cost of operating an SRTI service, e.g. collating/processing data) + CAPEX cost of setting up a DATEX II feed)

	2015	2016 - 2020	2021 - 2025	2026-2030
Savings	€ 69,316,818	€ 462,582,202	€ 499,760,932	€ 445,679,554
Cumulative savings (2015-2030)				€ 1,477,339,505
CAPEX Costs (low estimate)	€ 87,415,200	€ -	€ -	€ -
Cumulative CAPEX costs (low estimate)				€ 87,415,200
CAPEX Costs (high estimate)	€ 87,415,200	€ -	€ -	€ -
Cumulative CAPEX costs (high estimate)				€ 87,415,200
OPEX costs	€ 23,260,672	€ 116,303,359	€ 116,303,359	€ 116,303,359
Cumulative OPEX costs				€ 372,170,747
Cumulative costs (low estimate) 2015-2030				€ 459,585,947
Cumulative costs (high estimate) 2015-2030				€ 459,585,947
Scenario 1 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				-€ 1,017,753,558
Scenario 1 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				-€ 1,017,753,558

Table 50: Detailed IA for scenario 1

*Scenario 2 – Mini-SRTI on TERN**

- If SRTI data is made available by MS, then service providers will provide the service to their customers
- All existing RDS-TMC equipped users are capable of receiving SRTI from the commercial users
- Mini-SRTI is assumed to only include the 'Weather/road warning' data
- The number of users deemed able to access SRTI for this scenario is the number of users equipped with RDS-TMC
- Cost assumptions:
    - Cost of additional data collection
    - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)
    - Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	**€ 59,818,694**	**€ 399,643,766**	**€ 432,423,276**	**€ 386,245,737**
Cumulative savings (2015-2025)				**€ 1,278,131,474**
CAPEX + OPEX Costs (data collection) (low estimate)	**€ 30,978,098**	**€ 2,414,344**	**€ 2,414,344**	**€ 2,414,344**
Cumulative CAPEX + OPEX data collection costs (low estimate)				**€ 38,221,130**
CAPEX + OPEX (data collection) Costs (high estimate)	**€ 2,412,945,146**	**€ 628,672,306**	**€ 2,744,309,927**	**€ 658,071,606**
Cumulative CAPEX + OPEX data collection costs (high estimate)				**€ 6,443,998,985**
CAPEX costs of sharing SR-TTI data	**€ 87,415,200**	**€ -**	**€ -**	**€ -**

OPEX costs of sharing SR-TTI data	**€ 23,260,672**	**€ 116,303,359**	**€ 116,303,359**	**€ 116,303,359**
Cumulative OPEX costs for the sharing of SR-TTI data				**€ 372,170,747**
Cumulative costs (low estimate) 2015-2025				**€ 497,807,078**
Cumulative costs (high estimate) 2015-2025				**€ 6,903,584,932**
Scenario 2 Total cumulative costs of delivering SR-TTI (low estimate) 2015 - 2025				**-€ 780,324,396**
Scenario 2 Total cumulative costs of delivering SR-TTI (high estimate) 2015 - 2025				**€ 5,625,453,458**

Table 51: Detailed IA for scenario 2

Scenario 3 - Mini-SRTI on TERN (coverage at 80%) + Main/National roads (coverage at 60%)*

- A TMC service covering all roads is not available for Bulgaria, Cyprus, Estonia, Latvia, Lithuania or Malta at the time of writing. Therefore, the road lengths for these MS have been removed from the overall total for this scenario.
- All existing RDS-TMC equipped users are capable of receiving SRTI from the commercial users
- Mini-SRTI is assumed to only include the 'Weather/road warning' data
- The accident rates (injuries/fatalities) for the road types covered by this scenario were taken from the national databases for France, Germany, Switzerland and the UK
- The number of users deemed able to access SRTI for this scenario is the number of users equipped with RDS-TMC
- Cost assumptions:
  - Cost of additional data collection
  - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)
  - Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)

	2015	**2016 - 2020**	**2021 - 2025**	**2026 - 2030**
Savings	**€ 382,692,323**	**€ 2,544,449,757**	**€ 2,735,041,600**	**€ 2,421,171,293**
Cumulative savings				**€**

	2015	2016 - 2020	2021 - 2025	2026 - 2030
(2015-2030)				8,083,354,972
CAPEX + OPEX Costs (data collection) (low estimate)	€ 109,880,448	€ 6,633,725	€ 6,633,725	€ 6,633,725
Cumulative CAPEX + OPEX data collection costs (low estimate)				€ 129,781,624
CAPEX + OPEX (data collection) Costs (high estimate)	€ 6,659,469,968	€ 1,699,900,188	€ 6,957,911,189	€ 1,699,900,188
Cumulative CAPEX + OPEX data collection costs (high estimate)				€ 17,017,181,534
CAPEX costs of sharing SRTI data	€ 87,415,200	€ -	€ -	€ -
OPEX costs of sharing SRTI data	€ 23,260,672	€ 116,303,359	€ 116,303,359	€ 116,303,359
Cumulative OPEX costs for the sharing of SRTI data				€ 372,170,747
Cumulative costs (low estimate) 2015-2030				€ 589,367,571
Cumulative costs (high estimate) 2015-2030				€ 17,476,767,482
Scenario 4 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				-€ 7,493,987,401
Scenario 4 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				€ 9,393,412,509

Table 52: Detailed IA for scenario 3

Scenario 4 – Full SRTI on TERN (coverage at 80%) + Mini-SRTI on Main/National roads (coverage at 60%)*

- A TMC service covering all roads is not available for Bulgaria, Cyprus, Estonia, Latvia, Lithuania or Malta at the time of writing. Therefore, the road lengths for these MS have been removed from the overall total for this scenario.
- All existing RDS-TMC equipped users are capable of receiving SRTI from the commercial users
- Mini-SRTI is assumed to only include the 'Weather/road warning' data. It is assumed that this data can be collected using a combination of CCTV, RWIS and eCall incident data
- Full-SRTI is assumed to include the 'Weather/road warning' and 'Traffic jam/obstacle ahead' data (this therefore includes end of queue data). It is assumed that this data could be collected using a combination of CCTV, RWIS, eCall incident data, plus vehicle detection data
- Cost assumptions:
    - Cost of additional data collection

- Cost of operating an SRTI service (for those MS without an existing DATEX II feed)
- Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	€ 411,766,241	€ 2,738,137,947	€ 2,943,802,470	€ 2,606,878,514
Cumulative savings (2015-2030)				€ 8,700,585,172
CAPEX + OPEX Costs (data collection) (low estimate)	€ 381,910,956	€ 305,222,019	€ 305,222,019	€ 305,222,019
Cumulative CAPEX + OPEX data collection costs (low estimate)				€ 1,297,577,012
CAPEX + OPEX (data collection) Costs (high estimate)	€ 6,659,469,968	€ 1,699,900,188	€ 7,160,441,490	€ 1,699,900,188
Cumulative CAPEX + OPEX data collection costs (high estimate)				€ 17,219,711,835
CAPEX costs of sharing SRTI data	€ 87,415,200	€ -	€ -	€ -
OPEX costs of sharing SRTI data	€ 23,260,672	€ 116,303,359	€ 116,303,359	€ 116,303,359
Cumulative OPEX costs for the sharing of SRTI data				€ 372,170,747
Cumulative costs (low estimate) 2015-2030				€ 1,757,162,959
Cumulative costs (high estimate) 2015-2030				€ 17,679,297,782
Scenario 4 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				-€ 6,943,422,213
Scenario 4 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				€ 8,978,712,610

Table 53: Detailed IA for scenario 4

Scenario 5 – Mini-SRTI on TERN (coverage at 80%) + mandatory broadcast via RDS-TMC*

- Equipped user population is expected to be the same (users already equipped with RDS-TMC compatible devices should be able to receive unrestricted TMC services)
- Cost assumptions:
  - Cost of additional data collection
  - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)

- Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)
- Cost of broadcasting RDS-TMC for those MS without an existing Unrestricted Access TMC service (set up of service and annual operating costs)

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	€ 59,818,694	€ 399,643,766	€ 432,423,276	€ 386,245,737
Cumulative savings (2015-2030)				€ 1,278,131,474
CAPEX + OPEX Costs (data collection) (low estimate)	€ 30,978,098	€ 2,414,344	€ 2,414,344	€ 2,414,344
Cumulative CAPEX + OPEX data collection costs (low estimate)				€ 38,221,130
CAPEX + OPEX (data collection) Costs (high estimate)	€ 2,412,945,146	€ 628,672,306	€ 2,744,309,927	€ 658,071,606
Cumulative CAPEX + OPEX data collection costs (high estimate)				€ 6,443,998,985
CAPEX costs of sharing SRTI data	€ 87,415,200	€ -	€ -	€ -
OPEX costs of sharing SRTI data	€ 33,566,464	€ 169,128,272	€ 170,819,990	€ 172,940,687
Cumulative OPEX costs for the sharing of SRTI data				€ 546,455,412
Cumulative costs (low estimate) 2015-2030				€ 672,091,742
Cumulative costs (high estimate) 2015-2030				€ 7,077,869,596
Scenario 5 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				-€ 606,039,732
Scenario 5 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				€ 5,799,738,123

Table 54: Detailed IA for scenario 5

Scenario 6 – Full-SRTI on TERN (coverage at 80%) + mandatory broadcast via VMS*
- If SRTI data is made available by MS, then service providers will provide the service to their customers
- All existing RDS-TMC equipped users are capable of receiving SRTI from the commercial users
- If VMS was provided at for the whole network, then the majority of users (approx 90%) would be reached by SRTI (VMS are assumed to be set in the native language so not necessarily accessible to foreign drivers)

- The number of users deemed able to access SRTI for this scenario is the number of users equipped with RDS-TMC, plus those that see VMS on the network
- Assumed that the provision of SRTI via VMS would reach approx 90% of users (native language only)
- Cost assumptions:
    - Cost of additional data collection
    - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)
    - Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)
    - Cost of broadcasting RDS-TMC for those MS without an existing Unrestricted Access TMC service (set up of service and annual operating costs)
    - Cost of providing additional VMS on the affected network

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	**€ 134,098,341**	**€ 610,639,277**	**€ 533,078,327**	**€ 475,391,524**
Cumulative savings (2015-2030)				**€ 1,753,207,470**
CAPEX + OPEX Costs (data collection) (low estimate)	**€ 456,995,585**	**€ 553,321,514**	**€ 567,245,478**	**€ 584,700,226**
Cumulative CAPEX + OPEX data collection costs (low estimate)				**€ 2,162,262,803**
CAPEX + OPEX (data collection) Costs (high estimate)	**€ 2,575,405,118**	**€ 670,999,867**	**€ 2,929,080,192**	**€ 702,378,579**
Cumulative CAPEX + OPEX data collection costs (high estimate)				**€ 6,877,863,756**
CAPEX costs of sharing SRTI data (low estimate)	**€ 1,325,197,909**	**€ -**	**€ -**	**€ 1,360,491,372**
CAPEX costs of sharing SRTI data (high estimate)	**€ 2,533,626,087**	**€ -**	**€ -**	**€ 2,688,718,126**
OPEX costs of sharing SRTI data	**€ 23,260,672**	**€ 116,303,359**	**€ 116,303,359**	**€ 116,303,359**
Cumulative OPEX costs for the sharing of SRTI data				**€ 372,170,747**
Cumulative costs (low estimate) 2015-2030				**€5,220,122,831**
Cumulative costs (high estimate) 2015-2030				**€12,472,378,716**
Scenario 6 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				**€ 3,466,915,361**
Scenario 6 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				**€10,719,171,246**

Table 55: Detailed IA for scenario 6

Scenario 7 – Full-SRTI on TERN (coverage at 80%) + mandatory broadcast via TPEG-IP (SRTI smartphone app)*

- If SRTI data is made available by MS, then service providers will provide the service to their customers
- All existing RDS-TMC equipped users are capable of receiving SRTI from the commercial users
- The SRTI app would be developed by each MS, and that there would be a market penetration rate of around 20% for smartphone users (based on between 45%-80% of all users having access to a smartphone, meaning between 9.5% and 16% of users would have access to an SRTI app)
- The number of users deemed able to access SRTI for this scenario is the number of users equipped with RDS-TMC, plus those who access an SRTI app via a smartphone
- Cost to MS includes:
    - Cost of additional data collection
    - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)
    - Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)
    - Cost of setting up an SRTI app (1 app per MS)

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	€ 87,303,846	€ 544,251,262	€ 533,078,327	€ 477,102,041
Cumulative savings (2015-2030)				€ 1,641,735,477
CAPEX + OPEX Costs (data collection) (low estimate)	€ 456,995,585	€ 547,308,752	€ 561,232,716	€ 578,687,463
Cumulative CAPEX + OPEX data collection costs (low estimate)				€ 2,144,224,516
CAPEX + OPEX Costs (data collection) (high estimate)	€ 2,575,405,118	€ 670,999,867	€ 2,929,080,192	€ 702,378,579
Cumulative CAPEX + OPEX data collection costs (high estimate)				€ 6,877,863,756
CAPEX costs of sharing SRTI data	€ 88,243,344	€ -	€ -	€ -
OPEX costs of sharing SRTI data	€ 23,260,672	€ 116,303,359	€ 116,303,359	€ 116,303,359
Cumulative OPEX costs for the sharing of SRTI data				€ 372,170,747
Cumulative costs (low estimate) 2015-2030				€ 2,604,638,607
Cumulative costs (high estimate) 2015-2030				€ 7,338,277,847
Scenario 7 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				€ 962,903,130
Scenario 7 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				€ 5,696,542,370

Table 56: Detailed IA for scenario 7

Scenario 8 – Full SRTI on TERN (coverage at 80%) + mandatory broadcast via RDS-TMC*

- Equipped user population is expected to be the same (users already equipped with RDS-TMC compatible devices should be able to receive unrestricted TMC services)
- Full-SRTI is assumed to include the 'Weather/road warning' and 'Traffic jam/obstacle ahead' data (this therefore includes end of queue data). It is assumed that this data could be collected using a combination of CCTV, RWIS, eCall incident data, plus vehicle detection data
- Cost assumptions:
    - Cost of additional data collection
    - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)

- Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)
- Cost of broadcasting RDS-TMC for those MS without an existing Unrestricted Access TMC service (set up of service and annual operating costs)

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	€ 73,937,939	€ 493,421,015	€ 533,078,327	€ 481,302,407
Cumulative savings (2015-2030)				€ 1,581,739,688
CAPEX + OPEX Costs (data collection) (low estimate)	€ 303,008,606	€ 301,002,637	€ 301,002,637	€ 301,002,637
Cumulative CAPEX + OPEX data collection costs (low estimate)				€ 1,206,016,518
CAPEX + OPEX (data collection) Costs (high estimate)	€ 2,412,945,146	€ 618,678,608	#############	€ 618,678,608
Cumulative CAPEX + OPEX data collection costs (high estimate)				€ 6,256,344,764
CAPEX costs of sharing SRTI data	€ 87,415,200	€ -	€ -	€ -
OPEX costs of sharing SRTI data	€ 33,566,464	€ 169,128,272	€ 170,819,990	€ 172,940,687
Cumulative OPEX costs for the sharing of SRTI data				€ 546,455,412
Cumulative costs (low estimate) 2015-2030				€ 1,839,887,130
Cumulative costs (high estimate) 2015-2030				€ 6,890,215,376
Scenario 8 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				€ 258,147,442
Scenario 8 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				€ 5,308,475,687

Table 57: Detailed IA for scenario 8

Scenario 9 – Full SRTI on TERN (coverage at 80%) + mini-SRTI on main/national roads (coverage at 60%) + mandatory broadcast via RDS-TMC & TPEG-DAB*

- Equipped user population is expected to be the same (users already equipped with RDS-TMC compatible devices should be able to receive unrestricted TMC services)
- Full-SRTI is assumed to include the 'Weather/road warning' and 'Traffic jam/obstacle ahead' data (this therefore includes end of queue data). It is assumed

that this data could be collected using a combination of CCTV, RWIS, eCall incident data, plus vehicle detection data

- Cost assumptions:
    - Cost of additional data collection
    - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)
    - Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)
    - Cost of broadcasting RDS-TMC for those MS without an existing Unrestricted Access TMC service (set up of service and annual operating costs)
    - Cost of broadcasting TPEG is assumed to be based the value of the licence paid to DAB radio stations to host the service (the generation of SRTI and the underlying information is assumed to be part of the annual operating cost for the SRTI service).

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	€ 414,508,827	€ 2,765,542,166	€ 2,931,264,188	€ 2,606,878,514
Cumulative savings (2015-2030)				€ 8,718,193,695
CAPEX + OPEX Costs (data collection) (low estimate)	€ 381,910,956	€ 307,753,647	€ 307,753,647	€ 307,753,647
Cumulative CAPEX + OPEX data collection costs (low estimate)				€ 1,305,171,898
CAPEX + OPEX (data collection) Costs (high estimate)	€ 6,659,469,968	€ 1,702,431,817	€ 7,162,973,118	€ 1,702,431,817
Cumulative CAPEX + OPEX data collection costs (high estimate)				€ 17,227,306,721
CAPEX costs of sharing SRTI data	€ 87,415,200	€ -	€ -	€ -
OPEX costs of sharing SRTI data	€ 40,467,664	€ 203,634,272	€ 206,193,816	€ 208,314,513
Cumulative OPEX costs for the sharing of SRTI data				€ 658,610,264
Cumulative costs (low estimate) 2015-2030				€ 2,051,197,362
Cumulative costs (high estimate) 2015-2030				€ 17,973,332,185
Scenario 9 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				-€ 6,666,996,333
Scenario 9 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				€ 9,255,138,489

Table 58: Detailed IA for scenario 9

Scenario 10 – Full SRTI on TERN (coverage at 80%) + mini-SRTI on main/national roads (coverage at 60%) + mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG-IP (SRTI smartphone app)*

- Equipped user population is expected to be the same (users already equipped with RDS-TMC compatible devices should be able to receive unrestricted TMC services)
- Full-SRTI is assumed to include the 'Weather/road warning' and 'Traffic jam/obstacle ahead' data (this therefore includes end of queue data). It is assumed that this data could be collected using a combination of CCTV, RWIS, eCall incident data, plus vehicle detection data
- The SRTI app would be developed by each MS, and that there would be a market penetration rate of around 20% for smartphone users (based on between 45%-80% of all users having access to a smartphone, meaning between 9.5% and 16% of users would have access to an SRTI app)
- Cost assumptions:
    - Cost of additional data collection
    - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)
    - Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)
    - Cost of broadcasting RDS-TMC for those MS without an existing Unrestricted Access TMC service (set up of service and annual operating costs)
    - Cost of broadcasting TPEG is assumed to be based the value of the licence paid to DAB radio stations to host the service (the generation of SRTI and the underlying information is assumed to be part of the annual operating cost for the SRTI service).
    - Cost of setting up an SRTI app (1 app per MS)

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	**€ 486,202,039**	**€ 3,020,442,795**	**€ 2,931,264,188**	**€ 2,606,878,514**
Cumulative savings (2015-2030)				**€ 9,044,787,536**
CAPEX + OPEX Costs (data collection) (low estimate)	**€ 383,744,027**	**€ 307,753,647**	**€ 307,753,647**	**€ 307,753,647**
Cumulative CAPEX + OPEX data collection costs (low estimate)				**€ 1,307,004,969**
CAPEX + OPEX (data collection) Costs (high estimate)	**€ 6,712,071,535**	**€ 1,702,431,817**	**€ 7,162,973,118**	**€ 1,702,431,817**
Cumulative CAPEX + OPEX data collection costs (high estimate)				**€ 17,279,908,288**
CAPEX costs of sharing SRTI data	**€ 88,243,344**	**€ -**	**€ -**	**€ -**
OPEX costs of sharing SRTI data	**€ 40,467,664**	**€ 203,634,272**	**€ 206,193,816**	**€ 208,314,513**
Cumulative OPEX costs for the sharing of				**€ 658,610,264**

	2015	2016 - 2020	2021 - 2025	2026 - 2030
SRTI data				
Cumulative costs (low estimate) 2015-2030				**€ 2,053,858,577**
Cumulative costs (high estimate) 2015-2030				**€ 18,026,761,896**
Scenario 10 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				**-€ 6,990,928,959**
Scenario 10 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				**€ 8,981,974,359**

Table 59: Detailed IA for scenario 10

Scenario 11 - Full SRTI on TERN (coverage at 80%)*

- Equipped user population is expected to be the same (users already equipped with RDS-TMC compatible devices should be able to receive TMC services, users already equipped with TPEG-DAB compatible devices should be able to receive TPEG DAB services)
- Full-SRTI is assumed to include the 'Weather/road warning' and 'Traffic jam/obstacle ahead' data (this therefore includes end of queue data). It is assumed that this data could be collected using a combination of CCTV, RWIS, eCall incident data, plus vehicle detection data
- Cost assumptions:
  - Cost of additional data collection
  - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)
  - Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	**€ 73,937,939**	**€ 493,421,015**	**€ 533,078,327**	**€ 481,302,407**
Cumulative savings (2015-2030)				**€ 1,581,739,688**
CAPEX + OPEX Costs (data collection) (low estimate)	**€ 300,248,126**	**€ 301,002,637**	**€ 301,002,637**	**€ 301,002,637**
Cumulative CAPEX + OPEX data collection costs (low estimate)				**€ 1,203,256,038**
CAPEX + OPEX (data collection) Costs (high estimate)	**€ 2,412,945,146**	**€ 628,672,306**	**€ 2,744,309,927**	**€ 658,071,606**
Cumulative CAPEX + OPEX data collection costs (high estimate)				**€ 6,443,998,985**
CAPEX costs of sharing SRTI data	**€ 87,415,200**	**€ -**	**€ -**	**€ -**
OPEX costs of sharing	**€ 23,260,672**	**€**	**€**	**€**

	2015	2016 - 2020	2021 - 2025	2026 - 2030
SRTI data		**116,303,359**	**116,303,359**	**116,303,359**
Cumulative OPEX costs for the sharing of SRTI data				**€ 372,170,747**
Cumulative costs (low estimate) 2015-2030				**€ 1,662,841,985**
Cumulative costs (high estimate) 2015-2030				**€ 6,903,584,932**
Scenario 8 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				**€ 81,102,297**
Scenario 8 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				**€ 5,321,845,243**

Table 60: Detailed IA for scenario 11

Scenario 12 - Full SRTI on TERN (coverage at 80%) and Mini SRTI on national/main roads (coverage at 60%) + mandatory broadcast via TPEG-DAB*

- All existing RDS-TMC equipped users are capable of receiving SRTI from the commercial providers
- Existing users equipped with a device capable of receiving TPEG DAB are assumed to be capable of receiving SRTI via TPEG DAB
- Mini-SRTI is assumed to only include the 'Weather/road warning' data. It is assumed that this data can be collected using a combination of CCTV, RWIS and eCall incident data
- Full-SRTI is assumed to include the 'Weather/road warning' and 'Traffic jam/obstacle ahead' data (this therefore includes end of queue data). It is assumed that this data could be collected using a combination of CCTV, RWIS, eCall incident data, plus vehicle detection data
  - Cost assumptions:
  - Cost of additional data collection
  - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)
  - Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)
  - Cost of broadcasting an unrestricted TPEG DAB service for each Member State

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	**€ 486,202,039**	**€ 3,020,442,795**	**€ 2,931,264,188**	**€ 2,606,878,514**
Cumulative savings (2015-2025)				**€ 9,044,787,536**
CAPEX + OPEX Costs (data collection) (low estimate)	**€ 383,744,027**	**€ 307,753,647**	**€ 307,753,647**	**€ 307,753,647**
Cumulative CAPEX + OPEX data collection costs (low estimate)				**€ 1,307,004,969**

	2015	2016 - 2020	2021 - 2025	2026 - 2030
CAPEX + OPEX (data collection) Costs (high estimate)	€ 6,712,071,535	€ 1,702,431,817	€ 7,162,973,118	€ 1,702,431,817
Cumulative CAPEX + OPEX data collection costs (high estimate)				€ 17,279,908,288
CAPEX costs of sharing SRTI data	€ 87,415,200	€ -	€ -	€ -
OPEX costs of sharing SRTI data	€ 30,161,872	€ 150,809,359	€ 151,677,184	€ 151,677,184
Cumulative OPEX costs for the sharing of SRTI data				€ 484,325,599
Cumulative costs (low estimate) 2015-2030				€ 1,878,745,768
Cumulative costs (high estimate) 2015-2030				€ 17,851,649,087
Scenario 12 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				-€ 7,166,041,768
Scenario 12 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				€ 8,806,861,551

Table 61: Detailed IA for scenario 12

Scenario 13 - Full SRTI on TERN (coverage at 80%) + main/national roads (coverage at 60%) + mandatory broadcast via RDS-TMC/TPEG DAB/TPEG IP*

- Equipped user population is expected to be the same (users already equipped with RDS-TMC compatible devices should be able to receive unrestricted TMC services)
- Full-SRTI is assumed to include the 'Weather/road warning' and 'Traffic jam/obstacle ahead' data (this therefore includes end of queue data). It is assumed that this data could be collected using a combination of CCTV, RWIS, eCall incident data, plus vehicle detection data
- The SRTI app would be developed by each MS, and that there would be a market penetration rate of around 20% for smartphone users (based on between 45%-80% of all users having access to a smartphone, meaning between 9.5% and 16% of users would have access to an SRTI app)
- Cost assumptions:
    - Cost of additional data collection
    - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)
    - Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)
    - Cost of broadcasting RDS-TMC for those MS without an existing Unrestricted Access TMC service (set up of service and annual operating costs)
    - Cost of broadcasting TPEG is assumed to be based the value of the licence paid to DAB radio stations to host the service (the generation of

SRTI and the underlying information is assumed to be part of the annual operating cost for the SRTI service)

- Cost of setting up an SRTI app (1 app per MS)

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	€ 582,457,587	€ 3,614,433,653	€ 3,501,621,612	€ 3,109,432,697
Cumulative savings (2015-2030)				€ 10,807,945,548
CAPEX + OPEX Costs (data collection) (low estimate)	€ 1,078,188,993	€ 1,182,225,546	€ 1,182,225,546	€ 1,182,225,546
Cumulative CAPEX + OPEX data collection costs (low estimate)				€ 4,624,865,632
CAPEX + OPEX (data collection) Costs (high estimate)	€ 6,712,071,535	€ 1,702,431,817	€ 7,162,973,118	€ 1,702,431,817
Cumulative CAPEX + OPEX data collection costs (high estimate)				€ 17,279,908,288
CAPEX costs of sharing SRTI data	€ 88,243,344	€ -	€ -	€ -
OPEX costs of sharing SRTI data	€ 40,467,664	€ 203,634,272	€ 206,193,816	€ 208,314,513
Cumulative OPEX costs for the sharing of SRTI data				€ 658,610,264
Cumulative costs (low estimate) 2015-2030				€ 5,371,719,240
Cumulative costs (high estimate) 2015-2030				€ 18,026,761,896
Scenario 13 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				-€ 5,436,226,309
Scenario 13 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				€ 7,218,816,348

Table 62: Detailed IA for scenario 13

Scenario 14 - Full SRTI on TERN (coverage at 80%) and main/national roads (coverage at 60%)*

- A TMC service covering all roads is not available for Bulgaria, Cyprus, Estonia, Latvia, Lithuania or Malta at the time of writing. Therefore, the road lengths for these MS have been removed from the overall total for this scenario.
- All existing RDS-TMC equipped users are capable of receiving SRTI from the commercial users
- Full-SRTI is assumed to include the 'Weather/road warning' and 'Traffic jam/obstacle ahead' data (this therefore includes end of queue data). It is assumed

that this data could be collected using a combination of CCTV, RWIS, eCall incident data, plus vehicle detection data

- The accident rates (injuries/fatalities) for the road types covered by this scenario were taken from the national databases for France, Germany, Switzerland and the UK
- The number of users deemed able to access SRTI for this scenario is the number of users equipped with RDS-TMC
- Cost assumptions:
    - Cost of additional data collection
    - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)
    - Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	€ 496,570,956	€ 3,309,327,969	€ 3,501,621,612	€ 3,109,432,697
Cumulative savings (2015-2030)				€ 10,416,953,233
CAPEX + OPEX Costs (data collection) (low estimate)	€ 1,078,188,993	€ 1,182,225,546	€ 1,182,225,546	€ 1,182,225,546
Cumulative CAPEX + OPEX data collection costs (low estimate)				€ 4,624,865,632
CAPEX + OPEX (data collection) Costs (high estimate)	€ 6,712,071,535	€ 1,702,431,817	€ 7,162,973,118	€ 1,702,431,817
Cumulative CAPEX + OPEX data collection costs (high estimate)				€ 17,279,908,288
CAPEX costs of sharing SRTI data	€ 87,415,200	€ -	€ -	€ -
OPEX costs of sharing SRTI data	€ 23,260,672	€ 116,303,359	€ 116,303,359	€ 116,303,359
Cumulative OPEX costs for the sharing of SRTI data				€ 372,170,747
Cumulative costs (low estimate) 2015-2030				€ 5,084,451,579
Cumulative costs (high estimate) 2015-2030				€ 17,739,494,235
Scenario 14 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				-€ 5,332,501,654
Scenario 14 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				€ 7,322,541,002

Table 63: Detailed IA for scenario 14

Scenario 15 - Full SRTI on TERN (coverage at 80%) + Mini SRTI on main/national roads (coverage at 60%) + mandatory broadcast via RDS-TMC*

- Equipped user population is expected to be the same (users already equipped with RDS-TMC compatible devices should be able to receive unrestricted TMC services)
- Full-SRTI is assumed to include the 'Weather/road warning' and 'Traffic jam/obstacle ahead' data (this therefore includes end of queue data). It is assumed that this data could be collected using a combination of CCTV, RWIS, eCall incident data, plus vehicle detection data
- The SRTI app would be developed by each MS, and that there would be a market penetration rate of around 20% for smartphone users (based on between 45%-80% of all users having access to a smartphone, meaning between 9.5% and 16% of users would have access to an SRTI app)
- Cost assumptions:
    - Cost of additional data collection
    - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)
    - Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)
    - Cost of broadcasting RDS-TMC for those MS without an existing Unrestricted Access TMC service (set up of service and annual operating costs)

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	**€ 414,508,827**	**€ 2,765,542,166**	**€ 2,931,264,188**	**€ 2,606,878,514**
Cumulative savings (2015-2030)				**€ 8,718,193,695**
CAPEX + OPEX Costs (data collection) (low estimate)	**€ 383,744,027**	**€ 307,753,647**	**€ 307,753,647**	**€ 307,753,647**
Cumulative CAPEX + OPEX data collection costs (low estimate)				**€ 1,307,004,969**
CAPEX + OPEX (data collection) Costs (high estimate)	**€ 6,712,071,535**	**€ 1,702,431,817**	**€ 7,162,973,118**	**€ 1,702,431,817**
Cumulative CAPEX + OPEX data collection costs (high estimate)				**€ 17,279,908,288**
CAPEX costs of sharing SRTI data	**€ 87,415,200**	**€ -**	**€ -**	**€ -**
OPEX costs of sharing SRTI data	**€ 33,566,464**	**€ 169,128,272**	**€ 170,819,990**	**€ 172,940,687**
Cumulative OPEX costs for the sharing of SRTI data				**€ 546,455,412**
Cumulative costs (low estimate) 2015-2030				**€ 1,940,875,581**
Cumulative costs (high estimate) 2015-2030				**€ 17,913,778,900**
Scenario 15 Total cumulative costs of delivering SRTI (low				**-€ 6,777,318,114**

	2015	2016 - 2020	2021 - 2025	2026 - 2030
estimate) 2015 - 2030				
Scenario 15 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				€ 9,195,585,204

Table 64: Detailed IA for scenario 15

Scenario 16 - Full SRTI on TERN (coverage at 80%) + mandatory broadcast via TPEG-DAB*

- Equipped user population is expected to be the same (users already equipped with RDS-TMC compatible devices should be able to receive unrestricted TMC services)
- Full-SRTI is assumed to include the 'Weather/road warning' and 'Traffic jam/obstacle ahead' data (this therefore includes end of queue data). It is assumed that this data could be collected using a combination of CCTV, RWIS, eCall incident data, plus vehicle detection data
- Cost assumptions:
    - Cost of additional data collection
    - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)
    - Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)
    - Cost of broadcasting TPEG is assumed to be based the value of the licence paid to DAB radio stations to host the service (the generation of SRTI and the underlying information is assumed to be part of the annual operating cost for the SRTI service).

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	€ 74,430,405	€ 498,357,563	€ 533,078,327	€ 475,391,524
Cumulative savings (2015-2030)				€ 1,581,257,820
CAPEX + OPEX Costs (data collection) (low estimate)	€ 303,491,475	€ 301,002,637	€ 301,002,637	€ 301,002,637
Cumulative CAPEX + OPEX data collection costs (low estimate)				€ 1,206,499,387
CAPEX + OPEX (data collection) Costs (high estimate)	€ 2,412,945,146	€ 618,678,608	€ 2,606,042,402	€ 618,678,608
Cumulative CAPEX + OPEX data collection costs (high estimate)				€ 6,256,344,764
CAPEX costs of sharing SRTI data	€ 87,415,200	€ -	€ -	€ -
OPEX costs of sharing SRTI data	€ 30,161,872	€ 150,809,359	€ 151,677,184	€ 151,677,184
Cumulative OPEX costs for the sharing of SRTI data				€ 484,325,599
Cumulative costs (low				€ 1,778,240,186

	2015	2016 - 2020	2021 - 2025	2026 - 2030
estimate) 2015-2030				
Cumulative costs (high estimate) 2015-2030				€ 6,828,085,563
Scenario 12 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				€ 196,982,366
Scenario 12 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				€ 5,246,827,743

Table 65: Detailed IA for scenario 16

Scenario 17 - Full SRTI on TERN (coverage at 80%) and SRTI lite on national/main roads (coverage at 60%) + mandatory broadcast via RDS-TMC*

- All existing RDS-TMC equipped users are capable of receiving SRTI from the commercial providers
- Existing users equipped with a device capable of receiving TPEG DAB are assumed to be capable of receiving SRTI via TPEG DAB
- SRTI lite is assumed to be limited to accident notifications and weather warnings. It is assumed that this data can be collected using a combination of eCall incident data, emergency service 112 reports and weather station data
- Full-SRTI is assumed to include the 'Weather/road warning' and 'Traffic jam/obstacle ahead' data (this therefore includes end of queue data). It is assumed that this data could be collected using a combination of CCTV, RWIS, eCall incident data, plus vehicle detection data
- Cost assumptions:
    - Cost of additional data collection
    - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)
    - Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)
    - Cost of broadcasting RDS-TMC for those MS without an existing Unrestricted Access TMC service (set up of service and annual operating costs)

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	€ 246,078,974	€ 1,642,224,073	€ 1,742,369,558	€ 1,549,595,138
Cumulative savings (2015-2030)				€ 5,180,267,743
CAPEX + OPEX Costs (data collection) (low estimate)	€ 383,744,027	€ 307,753,647	€ 307,753,647	€ 307,753,647
Cumulative CAPEX + OPEX data collection costs (low estimate)				€ 1,307,004,969
CAPEX + OPEX (data collection) Costs (high estimate)	€ 2,544,449,063	€ 625,429,618	€ 2,612,793,412	€ 625,429,618

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Cumulative CAPEX + OPEX data collection costs (high estimate)				**€ 6,408,101,711**
CAPEX costs of sharing SRTI data	**€ 87,415,200**	**€ -**	**€ -**	**€ -**
OPEX costs of sharing SRTI data	**€ 33,566,464**	**€ 169,128,272**	**€ 170,819,990**	**€ 172,940,687**
Cumulative OPEX costs for the sharing of SRTI data				**€ 546,455,412**
Cumulative costs (low estimate) 2015-2030				**€ 1,940,875,581**
Cumulative costs (high estimate) 2015-2030				**€ 7,041,972,323**
Scenario 17 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				**-€ 3,239,392,162**
Scenario 17 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				**€ 1,861,704,580**

Table 66: Detailed IA for scenario 17

Scenario 18 - Full SRTI on TERN (coverage at 80%) + mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG SRTI app*

- Equipped user population is expected to be the same (users already equipped with RDS-TMC compatible devices should be able to receive unrestricted TMC services)
- Full-SRTI is assumed to include the 'Weather/road warning' and 'Traffic jam/obstacle ahead' data (this therefore includes end of queue data). It is assumed that this data could be collected using a combination of CCTV, RWIS, eCall incident data, plus vehicle detection data
- Cost assumptions:
  - Cost of additional data collection
  - Cost of operating an SRTI service (for those MS without an existing DATEX II feed)
  - Cost of a DATEX II feed (extension for those MS with an existing feed, and a new feed for those MS without)
  - Cost of broadcasting RDS-TMC for those MS without an existing Unrestricted Access TMC service (set up of service and annual operating costs)
  - Cost of broadcasting TPEG is assumed to be based the value of the licence paid to DAB radio stations to host the service (the generation of SRTI and the underlying information is assumed to be part of the annual operating cost for the SRTI service)
  - Cost of setting up an SRTI app (1 app per MS)

	2015	2016 - 2020	2021 - 2025	2026 - 2030
Savings	€ 87,303,846	€ 544,251,262	€ 533,078,327	€ 475,391,524
Cumulative savings (2015-2030)				€ 1,640,024,959
CAPEX + OPEX Costs (data collection) (low estimate)	€ 303,491,475	€ 301,002,637	€ 301,002,637	€ 301,002,637
Cumulative CAPEX + OPEX data collection costs (low estimate)				€ 1,206,499,387
CAPEX + OPEX (data collection) Costs (high estimate)	€ 2,412,945,146	€ 618,678,608	€ 2,606,042,402	€ 618,678,608
Cumulative CAPEX + OPEX data collection costs (high estimate)				€ 6,256,344,764
CAPEX costs of sharing SRTI data	€ 88,243,344	€ -	€ -	€ -
OPEX costs of sharing SRTI data	€ 40,467,664	€ 203,634,272	€ 206,193,816	€ 208,314,513
Cumulative OPEX costs for the sharing of SRTI data				€ 658,610,264
Cumulative costs (low estimate) 2015-2030				€ 1,953,352,995
Cumulative costs (high estimate) 2015-2030				€ 7,003,198,371
Scenario 18 Total cumulative costs of delivering SRTI (low estimate) 2015 - 2030				€ 313,328,035
Scenario 18 Total cumulative costs of delivering SRTI (high estimate) 2015 - 2030				€ 5,363,173,412

Table 67: Detailed IA for scenario 18

Annex G - TMC service coverage in Europe

MS	Broadcast coverage
Austria	ORF – free public TMC service broadcast nationwide (8000 location codes present). ASFINAG is responsible for the location table. It covers content of high-level road network (2200km A roads).
Belgium	4 TMC services: TMOBILIS, TIC-VL and 4FMTMC in Flanders and RTBF in Wallonia and Brussels. With the exception of TMOBILIS, these are all open services. The TMOBILIS services covers all A roads (1,747 km/1,086 mi) and small part of R roads. The TIC-VL service is limited to the Flanders region. The 4FMTMC service is provided by Vialis. It is broadcast by 4FM in Flanders, containing both the content from the Vlaams Verkeerscentrum and PEREX and so covers Belgium in total. The RTBF service is limited to Wallonia and Brussels. Free TMC information is available for motorways and major roads.
Bulgaria	TrafficNav is testing a national TMC service from December 2010. The data source is presently only for the city of Sofia.
Cyprus	No information
Czech Republic	Coverage in Prague and surrounding major roads, plus some cross border cooperation with Austria. A DIC PRAHA service is available in Prague. A TELEASIST service is available countrywide, however is not as detailed as DIC Prague in specific areas. The JSDI service is provided by Czech Road Motorway Directorate (ŘSD ČR) and is broadcast countrywide on ČRo3 Vltava.
Denmark	Danish Road Directorate provides free public TMC traffic information nationwide. It is also responsible for the location tables, which contains around 2.450 location codes at present.
Estonia	Conditional access: testing phase
Finland	TMC is operated as a commercial paid service. Offers national coverage. The commercial service in Finland is provided by Destia. The service covers biggest cities and roads 1-999. These areas cover the whole country. MediaMobile Nodic provides an encrypted paid TMC service on national radio (YLE Radio Suomi), covering the main metropolitan areas and national roads. The location table is provided by the Finnish Road Administration (FINNRA). The newest location table is version number 1.42 and it is used by Destia's TMC service. This version of the table contains around 8.100 locations.
France	Both a free public service and a commercial service are available in France. Services from autoroute companies free to users of the network. The commercial service, V-Traffic, covers 95% of France (the service

MS	Broadcast coverage
	covers Paris, main cities and over 50,000km of motorways and the national network). ViaMichelin cover all metropolitan areas in France. Location tables are released by the government agency SETRA and the latest includes around 13.500 locations).
Germany	Public free TMC services are offered by a regionalised network of 10 public broadcasters with 100% coverage. Commercial providers Navteq offer a private service TMCpro covering at least 90% of the country and motorways. BASt manages the TMC location tables. The current version is 10.1, which contains 44.233 location codes.
Greece	TrafficNav provides nationwide coverage.
Hungary	A national TMC-service has been provided by TrafficNav since 2008.
Ireland	TrafficNav provides national coverage TMC services. The TMC location table has national coverage.
Italy	National traffic information centre broadcasts a free public TMC service covering major routes in northern Italy. Infoblu (a commercial provider) provide traffic information on motorways, ring roads and all major roads in Italy. They act as an integrator for information sources from Gruppo Autostrde, Autostrada del Brennero, OCTO Telematics and Infomobility. Their coverage extends to all major roads on the Italian network – approximately 50,000km (7000km of motorways, 43,000km or state and regional roads). The current version of location table, provided by RAI-CCISS, contains around 41.000 location codes. It has all highways, state roads, county roads and urban roads for main towns.
Latvia	Under testing
Lituania	Under testing
Luxemburg	TMC service provided by commercial provider Be-mobile, covers all motorways, E roads and routes nationals 15.
Malta	No information
Netherlands	TMC services cover all highways and major roads. Vialis provides a national public TMC service. VIDextra provide a commercial solution. VIDextra has a coverage of all A and N roads in the Netherlands.
Norway	The TMC service is focused on the major cities and some major roads. Mediamobile Nordic provides TMC service in all E roads and small parts of national roads.
Poland	MediaMobile Nordic offers commercial TMC service on private radio station RMF FM. They have coverage of National roads.
Portugal	Be-Mobile provides TMC premium service and operates TMC tables.
Romania	TrafficNav provides TMC service in Romania, on private radio station (ProFM).
Slovak Rep.	Free TMC services are provided by GeoMatika
Slovenia	A national TMC-service is provided by TrafficNav.
Spain	TMC services are available in the whole Spanish road network. DGT gathers information from different regional, non-urban traffic public administrators into the Traffic Information Concentrator (CIT). Messages are then sent to the Spanish National Radio (RNE) to be

MS	Broadcast coverage
	broadcast to different geographical regions. The free public service is available to anyone with a RDS-TMC receiver at any national or first-level conventional road/motorway.
Sweden	The Swedish Roads Administration provides a national free public service that reaches 98% of Sweden. The message covers all European level highways, national highways and trunk roads. Swedish Transport Administration (STA) has announced a major upgrade of their TMC service in Sweden that is now being fed by DATEX2 node. TMC-events are now broadcast with precise location on the TERN+ road network.
UK	There are 2 private companies that provide commercially available TMC services in the UK – INRIX and Trafficmaster. All motorways and trunk roads are covered by the services (approximately 8000km).

Table 68: TMC services coverage for selected MS (source: adapted from eSafety RTTI Working Group final report (2007))

Annex H – Network lengths (in km)

Country	TERN* (TERN+Motorways)	Main/National roads (not including those on the TEN-T)	Total
Austria	1,941	10,326	110,205
Belgium	2,636	11,752	153,595
Bulgaria	2,203	2,967	N/A
Cyprus	262	2,126	8,718
Czech Republic	1,514	6,167	130,573
Denmark	1,191	2,706	73,331
Estonia	1,066	2,927	58,034
Finland	3,960	9,372	78,142
France	15,028	9,472	1,027,791
Germany	12,941	40,129	644,288
Greece	3,092	9,766	117,756
Hungary	2,254	6,609	198,344
Ireland	1,607	4,677	96,525
Italy	8,636	18,368	495,804
Latvia	1,819	750	69,686
Lithuania	1,415	6,587	81,479
Luxembourg	149	835	2,875
Malta	9	175	2,228
Netherlands	2,725	2,325	136,135
Poland	3,522	15,431	261,233
Portugal	3,069	5,512	76,890
Romania	3,711	12,980	81,693
Slovakia	714	3,354	43,858
Slovenia	754	935	39,035
Spain	17,572	9,189	666,064
Sweden	5,749	9,580	215,597
United Kingdom	7,834	44,928	419,483
Total	**107,371**	**249,943**	**5,289,362**
Source for Motorways, Main/national roads, other and total: http://www.erf.be/index.php?option=com_content&view=article&id=261&Itemid=61			
Source for TEN-T: http://ec.europa.eu/transport/infrastructure/ten-t-policy/transport-mode/doc/road_tab1.pdf			

Source: [102], [103]

Annex I – Other supporting information

An excel spreadsheet is provided that contains the following tables:

- Overall savings
- Savings vs OPEX
- Implementation costs
- Total costs vs savings
- SRTI savings
- Market penetration rates
- Accident rates
- Accident type by road type
- Data collection costs
- Network length
- Inflation rate data

Annex J – Additional considerations

During the preparation of the Impact Assessment, consideration was paid to the possibility of changing the scope of the SRTI service for certain network types.

The only difference between the scenarios described in the IA from section 7 of this report, and the scenarios briefly outlined below, is the scope of the SRTI service for main/national roads. The scope of the SRTI for main/national roads is limited to accident notifications and weather warnings – this set of SRTI data is referred to as SRTI 'lite'. All the assumptions described in Annex C still apply.

The benefits to be derived from SRTI lite were deemed to be:

	Motorways	Inter-urban roads	Other
Fatalities	2.41%	1.23%	0.00%
Injury accidents	2.56%	1.28%	0.00%

Figure 14: SRTI lite savings

The benefits of limiting the scope of adopting SRTI lite on the main/national roads is that it can build upon existing data to provide benefits without incurring too much additional investment costs.

The results from the IA are listed below.

Safety benefits

Based on the deployment of full SRTI on the TERN plus motorway network, and SRTI lite on the main/national roads network, the following benefits could be realised:

Scenario	Total savings (cumulative 2015 - 2030) (€)
1	1,477,339,505
2	1,229,044,473
3	8,083,354,972
4	8,700,585,172
5	1,278,131,474
6	1,753,207,470
7	1,641,735,477
8	1,581,739,688
9	8,718,193,695
10	9,044,787,536
11	1,581,739,688
12	9,044,787,536
13	10,807,945,548
14	10,416,953,233

Scenario	Total savings (cumulative 2015 - 2030) (€)
15	8,718,193,695
16	1,581,257,820
17	5,180,267,743
18	1,640,024,959

Table 69: Savings from introducing a combination of full SRTI and SRTI lite

Savings vs. Data Sharing costs

The table below compares the savings for these scenarios with the costs of sharing the data.

Scenario	Benefits of SRTI Total savings (cumulative 2015 - 2030) (€)	Data Sharing CAPEX/OPEX Costs for SRTI (cumulative 2015 - 2030) (€)	Benefit:Cost ratio	
			Based on Low cost estimate	Based on High cost estimate
1	1,477,339,505	459,585,947	3.21	3.21
2	1,229,044,473	459,585,947	2.67	2.67
3	8,083,354,972	459,585,947	17.59	17.59
4	8,700,585,172	459,585,947	18.93	18.93
5	1,278,131,474	633,870,612	2.02	2.02
6	1,753,207,470	3,057,860,028 - 5,594,514,960	0.57	0.31
7	1,641,735,477	460,414,091	3.57	3.57
8	1,581,739,688	633,870,612	2.50	2.50
9	8,718,193,695	746,025,464	11.69	11.69
10	9,044,787,536	746,853,608	12.11	12.11
11	1,581,739,688	459,585,947	3.44	3.44
12	9,044,787,536	571,740,799	15.82	15.82
13	10,807,945,548	746,853,608	14.47	14.47
14	10,416,953,233	459,585,947	22.67	22.67
15	8,718,193,695	633,870,612	13.75	13.75
16	1,581,257,820	571,740,799	2.77	2.77
17	5,180,267,743	633,870,612	8.17	8.17
18	1,640,024,959	746,853,608	2.20	2.20

Table 70: Savings vs costs of sharing a combination of full SRTI and SRTI lite data

Data collection costs

The table below illustrates the costs of collecting data needed to support full SRTI on the TERN plus motorway network, and SRTI lite on the main/national roads network.

Scenario	Data Collection CAPEX/OPEX costs (cumulative 2015 - 2030) (€)	
	Low estimate	High estimate
1	87.415.200	87.415.200
2	38.221.130	6.443.998.985
3	129.781.624	17.017.181.534
4	1.297.577.012	17.219.711.835
5	38.221.130	6.443.998.985
6	2.162.262.803	6.877.863.756
7	2.144.224.516	6.256.344.764
8	1.206.016.518	6.256.344.764
9	1.305.171.898	17.227.306.721
10	1.307.004.969	17.279.908.288
11	1.203.256.038	6.443.998.985
12	1.307.004.969	17.279.908.288
13	4.624.865.632	17.279.908.288
14	4.624.865.632	17.279.908.288
15	1.307.004.969	17.279.908.288
16	1.206.499.387	6.256.344.764
17	1.307.004.969	6.408.101.711
18	1.206.499.387	6.256.344.764

Table 71: Data collection costs to support a combination of full SRTI and SRTI lite

Comparison of savings vs. costs

The table below provides a comparison of the savings against the costs of providing full SRTI on the TERN and motorways, and SRTI lite on the main/national roads network.

Scenario	Benefits (cumulative 2015 - 2030) (€)	Data collection and sharing costs (2015-2030) (€)		Benefit : cost ratio	
		Low estimate	High estimate	Based on low cost estimate	Based on high cost estimate
1	1.477.339.505	459.585.947	459.585.947	3,21	3,21
2	1.229.044.473	497.807.078	6.903.584.932	2,47	0,18
3	8.083.354.972	589.367.571	17.476.767.482	13,72	0,46
4	8.700.585.172	1.757.162.959	17.679.297.782	4,95	0,49
5	1.278.131.474	672.091.742	7.077.869.596	1,90	0,18
6	1.753.207.470	5.220.122.831	12.472.378.716	0,34	0,14
7	1.641.735.477	2.604.638.607	7.338.277.847	0,63	0,22
8	1.581.739.688	1.839.887.130	6.890.215.376	0,86	0,23
9	8.718.193.695	2.051.197.362	17.973.332.185	4,25	0,49

10	9.044.787.536	2.053.858.577	18.026.761.896	4,40	0,50
11	1.581.739.688	1.662.841.985	6.903.584.932	0,95	0,23
12	9.044.787.536	1.878.745.768	17.851.649.087	4,81	0,51
13	10.807.945.548	5.371.719.240	18.026.761.896	2,01	0,60
14	10.416.953.233	5.084.451.579	17.739.494.235	2,05	0,59
15	8.718.193.695	1.940.875.581	17.913.778.900	4,49	0,49
16	1.581.257.820	1.778.240.186	6.828.085.563	0,89	0,23
17	5.180.267.743	1.940.875.581	7.041.972.323	2,67	0,74
18	1.640.024.959	1.953.352.995	7.003.198.371	0,84	0,23

Table 72: Savings vs. costs of providing a combination of full SRTI and SRTI lite

Annex K – Impact on Existing Markets

			Stakeholder Groups						
			Detection Equipment Suppliers	Private Data Collectors	Private Data Aggregators	Private RTTI Broadcasters	Private RTTI Service Providers	End User	Overall
1	Functional Specification Only (i.e. no mandatory deployment)	Functional description of SRTI Types (TISA + Extreme Weather) Definition of a minimum quality level for each SRTI Type (not including definition of coverage) Functional requirement to make SRTI information available for publication and dissemination via DATEXII on a non-discriminatory basis.	0	0	+	+	+	+	4
1bis	Specifications + DATEX II	The 'status quo' plus enhanced data sharing, with the obligation to Member States whom already have a SR-TTI service in place, to make it compliant with the data quality requirements.	0	0	++	+	+	+	5
2	Mini SRTI on TERN* (= TERN + other motorways)	Functional specification + Mandated deployment of mini SRTI (i.e. excluding end of queue) on TERN* Shared via all existing channels	+	0	0	+	++	+	5
3	Mini SRTI on TERN* & Main/National Roads	Functional specification + Mandated deployment of mini SRTI (i.e. not including end-of-queue) on TERN* + Main/National Roads Shared via all existing channels	++	+	+	+	+++	++	10
4	Full SRTI on TERN* & Mini SRTI on Main/National Roads	Functional specification + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* + mandated deployment of mini SRTI (i.e. not including end-of-queue) in Main/National Roads Shared via all existing channels	+++	++	-	+	+	++	8
5	Mini SRTI on TERN* + mandatory broadcast via RDS-TMC	Functional specification + Mandated deployment of mini SRTI (i.e. excluding end of queue) on TERN* + mandatory broadcast via RDS-TMC	+	0	0	-	++	+	3

			Stakeholder Groups						
			Detection Equipment Suppliers	Private Data Collectors	Private Data Aggregators	Private RTTI Broadcasters	Private RTTI Service Providers	End User	Overall
6	Full SRTI on TERN* + mandatory broadcast via VMS and existing channels	Functional specification + Mandated deployment of full SRTI Types (i.e. including end-of-queue) on TERN* + mandatory broadcast via VMS on the road + shared via all existing channels	+	++	0	0	++	++	7
7	Full SRTI on TERN* + mandatory broadcast via SRTI smartphone app	Functional specification + Mandated deployment of full SRTI Types (i.e. including end-of-queue) on TERN* + mandatory broadcast via an SRTI app for smartphone users + shared via all existing channels	+	++	0	0	0	+	4
8	Full SRTI on TERN* + mandatory broadcast via RDS-TMC	Functional specification + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* + mandatory broadcast via RDS-TMC	++	++	-	-	+	+	4
9	Full SRTI on TERN* & Mini SRTI on Main/National Roads + mandatory broadcast via RDS-TMC & TPEG-DAB	Functional specification + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* + mandated deployment of mini SRTI (i.e. not including end-of-queue) on Main/National Roads + mandatory broadcast via RDS-TMC & TPEG-DAB	+++	++	-	--	++	++	6
10	Full SRTI on TERN* & Mini SRTI on Main/National Roads + mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG-IP	Functional specification + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* + mandated deployment of mini SRTI (i.e. not including end-of-queue) on Main/National Roads + mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG-IP Service	+++	++	-	--	+++	+++	8
11	Full SRTI on TERN*	Functional specification + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* + Shared via all existing channels	+	++	0	+	++	+	7

			Stakeholder Groups						
			Detection Equipment Suppliers	Private Data Collectors	Private Data Aggregators	Private RTTI Broadcasters	Private RTTI Service Providers	End User	Overall
12	Full SRTI on TERN* & Mini SRTI on Main/National Roads + mandatory broadcast via TPEG DAB	Functional specification + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* + mandated deployment of mini SRTI (i.e. not including end-of-queue) in Main/National Roads + mandatory Broadcast via TPEG DAB	++	++	0	-	+	+	5
13	Full SRTI on TERN* + main/national roads + mandatory broadcast via RDS-TMC & TPEG DAB & TPEG IP	Functional specification + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* & Main/National Roads + mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG-IP	+++	+++	--	--	+	+++	6
14	Full SRTI on TERN* and main/national roads	Functional specification + Mandated deployment of Full SRTI (i.e. including end-of-queue) on TERN* & Main/National Roads Shared via all existing channels	+++	+++	--	+	+++	+++	11
15	Full SRTI on TERN* + main/national roads + mandatory broadcast via RDS-TMC	Functional specification + Mandated deployment of Full SRTI (i.e. including end-of-queue) on TERN* & Main/National Roads + mandatory broadcast via RDS-TMC	+++	+++	--	-	++	+++	8
16	Full SRTI on TERN* + mandatory broadcast via TPEG DAB	Functional specification + Mandated deployment of Full SRTI (i.e. including end-of-queue) on TERN* + mandatory broadcast via TPEG DAB	+	+	-	-	++	+	3
17	Full SRTI on TERN* and SRTI lite on national/main roads + mandatory broadcast via RDS-TMC	Functional specification + Mandated deployment of all SRTI types (i.e. including end-of-queue) on TERN* + mandated deployment of SRTI lite (i.e. weather warnings and accident notifications only) on Main/National Roads + mandatory broadcast via RDS-TMC	++	++	-	-	+	++	5
18	Full SRTI on TERN* + mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG SRTI app	Functional specification + Mandated deployment of full SRTI (i.e. including end-of-queue) on TERN* + mandatory broadcast via RDS-TMC & TPEG-DAB & TPEG-IP	+	+	-	--	+	++	2

Explanatory Notes:-

Detection Equipment Suppliers

- All IA scenarios which mandate the provision of SRTI on the road network will increase the market demand for Detection Equipment required for the provision of SRTI.

Private Data Collectors

- IA scenarios which mandate the provision of mini SRTI on the TERN* are deemed to have little or no impact
- IA scenarios which mandate the provision of mini SRTI on Primary / National roads will increase the market demand for their information
- IA scenarios which mandate the provision of full SRTI on TERN* will increase the market demand for ‘end of queue’ detection

Private Data Aggregators

- IA scenarios which mandate minimum SRTI on the TERN* are expected to have a neutral effect
- IA scenario 3 which mandates minimum SRTI on TERN* and National/Primary roads is deemed to have a positive impact as there will be better quality information available to the Data aggregators for a larger part of the network
- IA scenarios which mandate provision of full SRTI are expected to have a negative effect as Public Authorities will be publishing ‘end of queue’ information free (at the point of use) to users

Private RTTI Broadcasters

- IA scenarios 1-4 & 6-7 which do not mandate the broadcasting via a particular channel, but ensure that SRTI is available via DATEX II feeds are expected to have positive impact as they will enable RTTI Broadcasters to have access to higher quality SRTI.
- IA scenarios 5, 8-10 are expected to have a negative impact on the markets for private RTTI Broadcasters as potentially these will introduce competing public sector services.

Private RTTI Service Providers

- All IA scenarios which result in an improved level for SRTI on the network enable RTTI Service Providers to deliver higher quality of information to their users.
- IA scenarios which mandate one or more of RDS-TMC, TPEG-DAB or TPEG-IP are likely to reduce the costs of broadcasted SRTI.
- IA scenarios which mandate the provision of SRTI may have an adverse effect on their business as it introduces a direct alternative to their service for users who only require the SRTI.
- IA scenarios which mandate the provision of SRTI may provide a stimulus to their market it might enable them to cross-sell pro-services in combination with free SRTI.

End Users

All IA scenarios have a benefit to the End User, as they will lead to increased availability and higher quality of SRTI and the number of channels over which it is available, leading to greater consumer choice and competition between providers.

Annex L – Assessment of the Fundamental Rights

Fundamental Right	Potential impact SRTI
DIGNITY	
1. Human dignity	None
2. Right to life	None
3. Right to the integrity of the person	None
4. Prohibition of torture and inhuman or degrading treatment or punishment	None
5. Prohibition of slavery and forced labour	None
FREEDOMS	
6. Right to liberty and security	None
7. Respect for private and family life	None
8. Protection of personal data	Possible
9. Right to marry and right to found a family	None
10. Freedom of thought, conscience and religion	None
11. Freedom of expression and information	None
12. Freedom of assembly and of association	None
13. Freedom of the arts and sciences	None
14. Right to education	None
15. Freedom to choose an occupation and right to engage in work	None
16. Freedom to conduct a business	Possible
17. Right to property	Possible
18. Right to asylum	None
19. Protection in the event of removal, expulsion or extradition	None
EQUALITY	
20. Equality before the law	None
21. Non-discrimination	None
22. Cultural, religious and linguistic diversity	None
23. Equality between women and men	None
24. The rights of the child	None
25. The rights of the elderly	None
26. Integration of persons with disabilities	None
SOLIDARITY	
27. Workers' right to information and consultation within the undertaking	None
28. Right of collective bargaining and action	None
29. Right of access to placement services	None
30. Protection in the event of unjustified dismissal	None
31. Fair and just working conditions	None
32. Prohibition of child labour and protection of young people at work	None
33. Family and professional life	None

Fundamental Right	**Potential impact SRTI**
34. Social security and social assistance	None
35. Health care	None
36. Access to services of general economic interest	None
37. Environmental protection	Possible
38. Consumer protection	None
CITIZENS' RIGHTS	
39. Right to vote and to stand as a candidate at elections to the European Parliament	None
40. Right to vote and to stand as a candidate at municipal elections	None
41. Right to good administration	None
42. Right of access to documents	None
43. European Ombudsman	None
44. Right to petition	None
45. Freedom of movement and of residence	None
46. Diplomatic and consular protection	None
JUSTICE	
47. Right to an effective remedy and to a fair trial	None
48. Presumption of innocence and right of defence	None
49. Principles of legality and proportionality of criminal offences and penalties	None
50. Right not to be tried or punished twice in criminal proceedings for the same criminal offence	None

Annex M – Assessment against the ITS Directive Principles

Criteria

Be Effective	Make a tangible contribution towards solving the key challenges affecting road transportation in Europe (e.g. reducing congestion, lowering of emissions, improving energy efficiency, attaining higher levels of safety and security including vulnerable road users)
Be Cost Efficient	Optimise the ratio of costs in relation to output with regard to meeting objectives
Be proportionate	Provide, where appropriate, for different levels of achievable service quality and deployment, taking into account the local, regional, national and European specificities
Support continuity of services	Ensure seamless services across the Union, in particular on the trans-European network, and where possible at its external borders, when ITS services are deployed. Continuity of services should be ensured at a level adapted to the characteristics of the transport networks linking countries with countries, and where appropriate, regions with regions and cities with rural areas
Deliver interoperability	Ensure that systems and the underlying business processes have the capacity to exchange data and to share information and knowledge to enable effective ITS service delivery
Support backward compatibility	Ensure, where appropriate, the capability for ITS systems to work with existing systems that share a common purpose, without hindering the development of new technologies
Respect existing national infrastructure and network characteristics	Take into account the inherent differences in the transport network characteristics, in particular in the sizes of the traffic volumes and in road weather conditions
Promote equality of access	Do not impede or discriminate against access to ITS applications and services by vulnerable road users
Support maturity	Demonstrate, after appropriate risk assessment, the robustness of innovative ITS systems, through a sufficient level of technical development and operational exploitation
Deliver quality of timing and positioning	Use of satellite-based infrastructures, or any technology providing equivalent levels of precision for the purposes of ITS applications and services that require global, continuous, accurate and guaranteed timing and positioning services
Facilitate inter-modality	Take into account the coordination of various modes of transport, where appropriate, when deploying ITS
Respect coherence	Take into account existing Union rules, policies and activities which are relevant in the field of ITS, in particular in the field of standardisation

Assessment

	Be Effective	Be Cost Efficient	Be proportionate	Support continuity of services	Deliver interoperability	Support backward compatibility	national infrastructure and network	Promote equality of access	Support maturity	Deliver quality of timing and positioning	Facilitate inter-modality	Respect coherence	
0	--	0	0	-	-	-	+	0	0	Not Appl.	Not Appl.	0	-4
1	-	+++	+++	-	+	+++	+++	0	0			++	12
1bis	-	+++	+++	-	++	+++	+++	0	0			++	13
2	+	++	++	0	+	+++	++	0	+			++	14
3	++	+++	-	0	+	+++	+	0	+			++	12
4	+++	+++	--	0	+	+++	+	0	+			++	12
5	+	+	+++	+	++	++	++	0	++			++	16
6	+	--	++	+	+	+++	++	0	+			0	9
7	+	--	++	+	++	++	++	0	+			+	10
8	++	-	+	++	++	++	++	0	++			++	14
9	+++	+++	---	++	+++	+++	-	0	++			++	14
10	+++	+++	---	++	+++	+++	--	0	++			+++	14
11	++	-	-	0	+	+++	+	0	+			++	8
12	+++	+++	---	++	+++	-	-	0	++			++	10
13	+++	++	---	+++	+++	0	--	0	++			+++	11
14	+++	++	+	+	+	+++	++	0	+			++	16
15	+++	+++	--	++	++	+++	+	0	++			++	16
16	+++	-	+	+	++	-	--	0	++			++	7
17	+++	++	+	++	++	++	+	0	++			++	17
18	+++	-	--	++	+++	0	-	0	++			+++	9

Explanatory Notes:-

- All IA scenarios which mandate the provision of SRTI on the road network will increase the market demand for Detection Equipment required for the provision of SRTI.

Be effective:

- Scenarios that support more complete SRTI and wider road coverage are considered more effective

Be cost efficient:

- Scenarios that provide higher BCRs are considered more cost efficient

Be proportionate:

- Scenarios requiring higher investments are considered less proportionate

Support continuity of service, deliver interoperability and respect coherence:

- Scenarios that contribute most to cross-border harmonization, i.e. this that mandate large road coverage and require deployment of specific distribution channels, score higher on these three criteria

Support backward compatibility:

- Scenarios that build on currently available content and services score higher
- Scenarios that require adjustment of existing systems (all) score lower

Respect existing national infrastructure and network characteristics:

- Scenarios requiring limited policy and organisational adjustment by Member States score higher on this criterium

Promote equality of access:

- All scenarios are considered equal because all make SRTI available to road users free of charge at the point of use

Support maturity:

- Scenarios that build on proven technology support maturity better, and the internal market

Annex N – Preliminary Assessment of Scenarios

Scenario 1 - Functional Specification Only

Scenario 1 is the scenario whereby the functional specifications only are adopted. This would mean that there would be no requirement for MS to deploy the services, other than to make SRTI available for publication and dissemination via DATEXII on a non-discriminatory basis.

This scenario requires only limited action by public authorities and does not interfere with current market conditions, but has a low impact on road safety since the deployment is not warranted.

Scenario 1 shows relatively high alignment with the principles of the ITS Directive, scoring relatively high on proportionality, support for backward compatibility, respecting existing national arrangements and coherence.

Scenario 1bis – Functional Specifications mandatory for existing services

Scenario 1bis is the scenario whereby Member States are not obliged to collect new data. Making the existing data available through a DATEX II node however is mandatory. Also deployment of SRTI according to the specifications is mandatory only for Member States with some forms of SRTI systems already in place.

This scenario has a positive impact on content aggregators as it provides easy access to public road data but could affect service providers which core business rely on 'end of queue' warnings. Broadcasters are not penalised as no delivery channel is mandated. The impact on road safety is not very high since the deployment of services is limited.

Scenario 1bis shows relatively high alignment with the principles of the ITS Directive, scoring relatively high on proportionality, support for backward compatibility, respecting existing national arrangements and coherence.

Scenario 2 - Mini SRTI on TERN*

Scenario 2 is the scenario that identifies a set of functional specifications, with the addition of mandating that the minimum SRTI service should be deployed on the TERN + motorways network.

Scenario 2 produces a low impact on road safety. This is mainly due to the limited road type coverage; motorways are already quite safe. As a result, despite the relatively low implementation and operational costs, the BCR is low.

Scenario 2 shows relatively high alignment with the principles of the ITS Directive, scoring relatively high on support for backward compatibility and respecting coherence. The functional nature of the specifications limits the effects on existing arrangements while contributing to harmonisation of cross border services.

Scenario 3 - Mini SRTI on TERN* & Main/National Roads

As scenario 2, scenario 3 deals with the minimum set of SRTI data, but extends the network coverage to include the TERN, motorways and secondary roads.

Because of the increased network coverage, scenario 3 has a relatively high impact on road safety, but also high data collection costs. The resulting BCR is high because of the savings resulting from increased road safety on the main/national roads.

The Qualitative Assessment of market impacts shows that scenario 3 has the greatest overall benefit to the existing TTI Market, where it is expected to be a positive impact for all private sector actors in the TTI value chain.

Scenario 3 showed moderate compliance with the principles of the ITS Directive, scoring relatively low on cost efficiency and proportionality as a result of the high costs required for the deployment on the main/national roads.

Scenario 4 - Full SRTI on TERN*, Mini SRTI on Main/National Roads

Scenario 4 covers the same roads as scenario 3, but includes 'end-of-queue' information in the definition of SRTI.

The inclusion of 'end-of-queue' information enhances the impact on traffic safety, but also drives higher implementation costs. Still the resulting BCR is relatively high.

The qualitative assessment of market impacts shows that scenario 4 has a relatively high overall benefit. It could however have an adverse effect on private data aggregators and service providers, as it will touch on their key business proposition of providing traffic flow information.

Scenario 4 shows moderate compliance with the principles of the ITS Directive. Although scoring high on effectiveness, it scores relatively low on cost efficiency and proportionality. This is largely the result of the high investments for detecting 'end-of-queue' in particular on secondary roads.

Scenario 5 - Mini SRTI on TERN* + broadcast via RDS-TMC

Scenario 5 mandates the provision of minimum SRTI on the TERN and motorways, and requires that the service should be broadcast via RDS-TMC as a minimum.

This scenario produces a low impact on road safety. Despite the low implementation and operational costs, the BCR is low. This is mainly due to the limited road type coverage.

Scenario 5 shows the highest alignment with the principles of the ITS Directive, scoring relatively high on proportionality.

Scenario 6 – Full SRTI on TERN* + broadcast via VMS

Scenario 6 mandates the provision of minimum SRTI on the TERN and motorways, and requires that the service should be broadcast via VMS as a minimum.

This scenario provides a relatively low impact on road safety, mainly due to the limited road type coverage, but also to the limited amount of information that can be communicated in a very limited timespan via VMS. To achieve a reasonable coverage of motorways a very large number of VMS need to be deployed, resulting in very high operational costs. As a result of the high costs and limited impact on road safety, the BCR is the lowest of all scenarios.

This is reflected in the rating of the compliance with the principles of the ITS Directive, where scenario 6 scores relatively low on cost efficiency and respecting coherence.

Scenario 7 - Full SRTI on TERN* + broadcast via SRTI smartphone app

Scenario 7 mandates the provision of minimum SRTI on the TERN and motorways, and requires that the service should be available via a National SRTI smartphone application complementing the provision via existing RDS-TMC services.

Because of the limited road type coverage, this scenario produces a relatively low impact on road safety. Despite the low implementation and operational costs, the BCR is also relatively low.

Scenario 7 shows high alignment with the principles of the ITS Directive, scoring relatively high on cost effectiveness and delivering interoperability.

Scenario 8 - Full SRTI on TERN* + broadcast via RDS-TMC

Scenario 8 builds on the previous scenario by mandating the provision of all SRTI data types on the TERN and motorways. The benefits to be accrued by adopting this scenario are linked to the provision of the full set of SRTI data types. The additional costs for this scenario are related to the cost of collecting the end of queue data for the TERN/motorway network.

Because of the limited road type coverage, this scenario too produces a relatively low impact on road safety. This, in combination with the higher implementation and operational costs, results in a relatively low BCR.

Scenario 8 shows relatively high alignment with the principles of the ITS Directive, scoring high on supporting continuity of services and supporting maturity.

Scenario 9 - Full SRTI on TERN* & Mini SRTI on Main/National Roads via RDS-TMC & TPEG-DAB

Scenario 9 differs from scenario 6 by extending the network coverage to include secondary roads as well, and the broadcast channel should include TPEG DAB as well as RDS-TMC. The full set of SRTI data would be collected under this scenario.

Thanks to the high road type coverage and the combined reach of TMC and DAB, this scenario produces a relatively high impact on road safety, but also high implementation costs. The resulting BCR is high because of the road safety related savings that can be achieved on the main/national roads.

Scenario 9 shows moderate compliance with the principles of the ITS Directive. Despite scoring high on effectiveness and delivering interoperability and backward compatibility, it scores relatively low on cost efficiency, proportionality and respecting national infrastructure and network characteristics.

Scenario 10 - Full SRTI on TERN* & Mini SRTI on Main/National Roads via RDS-TMC & TPEG-DAB & TPEG-IP

Scenario 10 builds on the previous scenario by adding TPEG-IP as an additional broadcast method. The additional benefit in this scenario is that users with access to IP connected devices (smart phones) could receive SRTI. It is not expected that there would be any additional costs for this solution beyond those already covered by scenario 7.

This scenario achieves a high impact on road safety of all scenarios. The more extensive road type coverage and the high reach of end-users through the different delivery channels jointly produce this result. Despite the high implementation costs, the resulting BCR is relatively high because of the road safety related savings that can be achieved on the main/national roads.

The Qualitative Assessment of market impacts shows that scenario 10 has a relatively high overall benefit, but that it will have an adverse effect on the market of Private Data Aggregators and Private RTTI Broadcasters.

Scenario 10 shows moderate compliance with the principles of the ITS Directive. Despite scoring high on effectiveness and delivering interoperability and backward compatibility and respecting coherence, it scores relatively low on cost efficiency, proportionality and respecting national infrastructure and network characteristics.

Scenario 11 - Full SRTI on TERN*

Scenario 11 differs from scenario 2 by mandating the *full* SRTI service on the TERN + other motorways. This results in an increased reduction in the number of accidents experienced on the TERN + other motorways network.

Scenario 11 produces a relatively low impact on road safety because of the limited road type coverage. As a result, despite the moderate implementation and operational costs, the BCR is low.

Scenario 11 shows moderate alignment with the principles of the ITS Directive, despite scoring relatively high on effectiveness. This is related to the limited road type coverage, but also to the functional nature of the specifications. However this scenario 11 limits the effects on existing arrangements while contributing to harmonisation of cross border services.

Scenario 12 - Full SRTI on TERN* & Mini SRTI on Main/National Roads via TPEG-DAB

Scenario 12 is based on scenario 4. The difference between the scenarios is that scenario 12 mandates the broadcast of the SRTI service via a TPEG-DAB channel. Therefore, the additional cost is for each MS to set up such a broadcast.

The inclusion of end-of-queue on TERN and road coverage extending to the underlying road network, results in an impact on road safety that is high. Despite the high data collection costs, the resulting BCR is high.

The Qualitative Assessment of market impacts shows that scenario 4 has a moderate overall benefit. It will however have an adverse effect on the market for Private Data Aggregators, as it will touch on their key business proposition of providing traffic flow information.

Scenario 12 shows moderate compliance with the principles of the ITS Directive. Although scoring high on effectiveness, it scores relatively low on cost efficiency and proportionality. This is largely the result of the high investments for detecting end-of-queue on secondary roads.

Scenario 13 - Full SRTI On TERN* (80%) + Main/National Roads (60%) Via RDS-TMC/TPEG DAB/TPEG IP

Scenario 13 is based on scenario 10, but provides full SRTI instead of mini SRTI on main/national roads.

This scenario achieves the highest impact on road safety of all scenarios. The more extensive road type coverage with high quality SRTI, and the high reach of end-users through the different delivery channels jointly produce this result. Despite the high implementation costs, the resulting BCR is relatively high because of the road safety related savings that can be achieved on the main/national roads.

The Qualitative Assessment of market impacts shows that scenario 13 has a medium overall benefit, but that it will have an adverse effect on the market of Private Data Aggregators and RTTI Broadcasters.

Scenario 13 shows moderate compliance with the principles of the ITS Directive. Despite scoring high on effectiveness and delivering interoperability and backward compatibility and respecting coherence, it scores relatively low on proportionality and respecting national infrastructure and network characteristics.

Scenario 14 – Full SRTI on TERN* (80%) + Main/National Roads (60%)

Scenario 14 provides full SRTI on both TERN* as well as main/national roads.

This scenario 14 achieves a very high impact on road safety. The more extensive road type coverage with full coverage of the SRTI information categories, jointly produce this result. Despite the high implementation costs, the resulting benefit-cost ratio is relatively high because of the road safety related savings that can be achieved on the main/national roads.

Although it has a negative impact on private data aggregators, the qualitative assessment of market impacts shows that scenario 14 has the highest overall benefit of all scenarios. This is mainly because it will make high-quality SRTI available across Europe and beyond the TERN.

Scenario 14 shows very high compliance with the principles of the ITS Directive, scoring positive on all criteria.

Scenario 15 – Full SRTI On TERN* (80%) + Mini SRTI on Main/National Roads (60%) Via RDS-TMC

Scenario 15 is based on Scenario 8, but provides full SRTI on both TERN* and mini SRTI main/national roads.

This scenario achieves a high impact on road safety. The more extensive road type coverage with high quality SRTI, and the relatively high reach of end-users through TMC jointly produce this result. The implementation costs are moderate for the low-cost estimate and relatively high for the high-cost estimate. The resulting BCRs are relatively high for the low-cost estimate, and moderate for the high-cost estimate.

The Qualitative Assessment of market impacts shows that scenario 15 has a moderately high overall benefit, but that it will have an adverse effect on the market of Private Data Aggregators and RTTI Broadcasters.

Scenario 15 shows high compliance with the principles of the ITS Directive, scoring high on effectiveness, cost efficiency and backward compatibility. It scores relatively low on proportionality because of the high road coverage and SRTI quality requirements.

Scenario 16 – Full SRTI On TERN* (80%) Via TPEG-DAB

Scenario 16 is based on scenario 12. The difference between the scenarios is that scenario 16 requires only TERN* coverage.

Scenario 16 produces a low road safety impact due to the limited road coverage. Although the data collection and sharing costs are relatively low, the resulting BCR is relatively low.

The Qualitative Assessment of market impacts shows that scenario 16 has a relatively low benefit, scoring relatively low on all criteria.

Scenario 16 shows moderate compliance with the principles of the ITS Directive. Although scoring high on effectiveness, it scores relatively low on cost efficiency. This is largely the result of the high investments for detecting end-of-queue on secondary roads.

Scenario 17 – Full SRTI on TERN* (80%) And SRTI Lite On Main/National Roads (60%) Via RDS-TMC

Scenario 17 is similar to scenario 15, but provides SRTI Lite instead of Full SRTI on main/national roads.

This scenario achieves a moderate impact on road safety, because of the mix of SRTI and road coverage. Because of the relatively low costs, it produces a moderate BCR.

The Qualitative Assessment of market impacts shows that scenario 15 has a moderate overall benefit, but that it will have an adverse effect on the market of Private Data Aggregators and RTTI Broadcasters.

Scenario 17 shows the highest compliance with the principles of the ITS Directive, scoring high on effectiveness, and positive on other criteria.

Scenario 18 – Full SRTI on TERN* (80%) Via RDS-TMC & TPEG-DAB & TPEG SRTI APP

Scenario 18 is similar on scenario 13, but provides Full SRTI on TERN* only.

This scenario achieves a low impact on road safety. Despite the high quality SRTI, and the high reach of end-users through the different delivery channels, the limited road type coverage produce a low impact. Despite the low implementation and data sharing costs, the resulting BCR is relatively low because of the limited road type coverage.

The Qualitative Assessment of market impacts shows that scenario 18 has the lowest overall benefit of all scenarios. It scores relatively low for all stakeholders, but in particular for the Private Data Aggregators and RTTI Broadcasters.

Scenario 18 shows moderate compliance with the principles of the ITS Directive. Despite scoring high on effectiveness, delivering interoperability and respecting coherence, it scores relatively low on proportionality and respecting national infrastructure and network characteristics.