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List of Abbreviations

ABS	Anti-lock Braking System
COMeSafety	Communication for eSafety (EC funded project 2007-2009)
COOPERS	Cooperative Systems for intelligent road safety (EC co-funded project 2006-2010)
CVIS	Cooperative Vehicle-Infrastructure Systems (EC co-funded project 2006-2010)
ESP	Electronic Stability Program
ETA	Estimated Time of Arrival
ETSI	European Telecommunications Standards Institute
FCD	Floating Car Data
FRAME	Framework Architecture Made for Europe
GIDS	Generic Intelligent Driver Support (EC co-funded project 1989-91) [1]
HGV	Heavy Goods Vehicle
HMI	Human Machine Interface
HOV	High Occupancy Vehicle
IP	Integrated Project
ISA	Intelligent Speed Adaptation
ITS	Intelligent Transport System
O-D	Origin to Destination
PRE-DRIVE	PREparation for DRIVing implementation and Evaluation of C-2-X communication technology (EC funded project 2008-)
PT	Public Transport
RSU	Road Side Unit
SAFESPOT	Cooperative systems for road safety "Smart Vehicles on Smart Roads" (EC co-funded project 2006-2010)
TCC	Traffic Control Centre
TIC	Traffic Information Centre
UML	Unified Modelling Language
V2I	Vehicle to Infrastructure
V2V	Vehicle to Vehicle
V2X	Vehicle to Vehicle/Infrastructure
VRU	Vulnerable Road User
XFCD	Extended Floating Car Data

Executive Summary

This document has two principal aims. As a deliverable of the E-FRAME project its primary aim is to describe the extensions to the User Needs that were necessary to include Cooperative Systems within the European ITS Framework (FRAME) Architecture. The secondary aim is to provide a document that describes the FRAME User Needs in general, and that can replace the corresponding document produced by the FPIV project KAREN, some of whose contents are no longer relevant.

Once the use of the User Needs as part of the FRAME Architecture has been described, their structure is explained. This was fixed during the KAREN project and is based on ISO TR 1414813-1:1998. A graphical representation of the structure can be found in Appendix C.

The incorporation of the User Needs for Cooperative Systems had to be done carefully so as not to have a negative effect on the existing FRAME architecture, and so that they would fit naturally to the existing structure. The primary sources of information were the EC co-funded Integrated Projects, COOPERS, CVIS and SAFESPOT, which had a few similarities and many differences. It was therefore necessary to treat them individually for an initial phase and then to merge their separate lists of User Needs during a second phase.

Although Cooperative System applications and services have been studied by other projects, there is no agreement between them as to what they should be called. A taxonomy was therefore created to merge the terms used in the ETSI TR 102 638 and PRE-DRIVE C2X, with those already being used in the FRAME Architecture. It was then possible to incorporate the new User Needs into the existing structure of the FRAME User Needs in a natural manner.

Over 230 User Needs have been added to the FRAME Architecture to capture the application and services proposed and studied by the EC co-funded Integrated Projects, COOPERS, CVIS and SAFESPOT. These are listed in Appendix D and combined with the rest of the FRAME User Needs in Appendix E.

1 Introduction

1.1 The Aims of this Document

This document has two principal aims. As a deliverable of the E-FRAME project its primary aim is to describe the extensions to the User Needs that were necessary to include Cooperative Systems within the European ITS Framework (FRAME) Architecture. The secondary aim is to provide a document that describes the FRAME User Needs in general, and that can replace the corresponding document produced by the FPIV project KAREN [2], some of whose contents are no longer relevant.

A principal objective of the E-FRAME project has been to extend the FRAME Architecture to take into account an innovative area of ITS applications and services known as “Cooperative Systems”. An important part of this process consisted of compiling a list of the high-level specifications of these systems, often referred to as the “User Needs”. The new User Needs themselves, derived from the three major Cooperative Systems EC co-funded Integrated Projects, COOPERS, CVIS and SAFESPOT, can be found in Appendices of this document.

The process of extending the User Needs was conducted in two stages: in the first stage the new User Needs remained in three separate lists, one for each of the above projects that they came from. These were issued as part of Version 4.0 of the FRAME Architecture, and were presented in Deliverable D2, which has now been withdrawn. In the second stage the User Needs were amalgamated into a single list. The unified list is now part of Version 4.1 of the FRAME Architecture and is described in the present document. Readers who wish to know the precise relationship between the lists in D2, and those in this document should contact info@frame-online.net .

1.2 Why Extend the User Needs

The FRAME Architecture (originally called the European ITS Framework Architecture) was developed by the EC funded project KAREN (1998-2000) and first published in October 2000. The underlying aim of this initiative was to promote the deployment of (mainly road-based) ITS in Europe by producing a framework which would provide a systematic basis for planning ITS implementations, facilitate their integration when multiple systems were to be deployed, and help to ensure inter-operability, including across European borders.

The KAREN project was followed by further EC-funded initiatives, notably the projects FRAME-S and FRAME-NET (2001-04), which were responsible for supporting architecture users, and also for developing some tools to facilitate the use of the FRAME Architecture. A fuller version of this background can be found in Appendix A.

One of the most important lessons learned from these and other ITS architecture activities in Europe (and elsewhere) is **the need to keep an ITS Architecture up to date**: If it is to remain useful, an ITS Architecture must be kept constantly maintained (the US National ITS Architecture is now on Version 6.1 after over 15 years of existence through continuous funding from the US Government).

The aim of the original KAREN project was to define ITS User Needs until at least 2010. Since 2000, however, some areas of ITS have evolved more rapidly and radically than had been foreseen.

Although the User Needs were updated during the early part of the FRAME projects, the FRAME Architecture contains only a few references to more recent ITS developments, such as those associated with the Intelligent Vehicle or eSafety initiatives. One particular and highly significant area – in which the European Commission has invested very heavily over the last five years – is called “Cooperative Systems”. These are so-called because they exploit the potential of vehicle-vehicle and/or vehicle-to-infrastructure communication to allow the exchange of data – or cooperation – between road vehicles, or between vehicles and the road infrastructure. These systems were not covered by FRAME Architecture. Filling this gap was one of the principal objectives of the E-FRAME project.

1.3 Organisation of the document

Section 2 describes the use that is made of the User Needs within the FRAME Architecture, and their structure. More detailed descriptions are provided in Appendix B and Appendix C.

Section 3 describes how the User Needs for Cooperative Systems were created and organised.

Section 4 describes a joint taxonomy for Cooperative System applications and services that brings together the terms used by FRAME, ETSI and PRE-DRIVE C2X.

A full list of User Needs for Cooperative System can be found in Appendix D, and the resulting full List of FRAME User Needs are presented in Appendix E.

2 User Needs and the FRAME Architecture

2.1 Defining the FRAME Architecture

When taken as a whole, the User Needs provide a set of high-level specifications for the FRAME Architecture (see Appendix B for a more detailed explanation). Most User Needs define part of an ITS application or service in terms of its functional objectives, though a few relate to physical location or communications issues. In order to keep the number and size of the User Needs to manageable proportions many details have been omitted; some of these will be found in the descriptions of the corresponding Functions, whilst others are genuine options that will be defined by the system purchaser or the supplier.

There is not a one-to-one correspondence between the User Needs and the Functions of the FRAME Architecture. The FRAME Architecture is defined by its (low-level) Functional Viewpoint, which is large and complex, and the User Needs provide a structured natural language entry point to it.

2.2 Using the FRAME Architecture

Since the FRAME Architecture comprises most ITS applications and services, the creation of an ITS Architecture for a nation, region, city or project from the FRAME Architecture is a process which involves selecting the necessary and consistent sub-set of the FRAME Architecture. The User Needs are used in the first part of a process to identify those parts of the (low-level) Functional Viewpoint that will be required for the sub-set (see Figure 1).

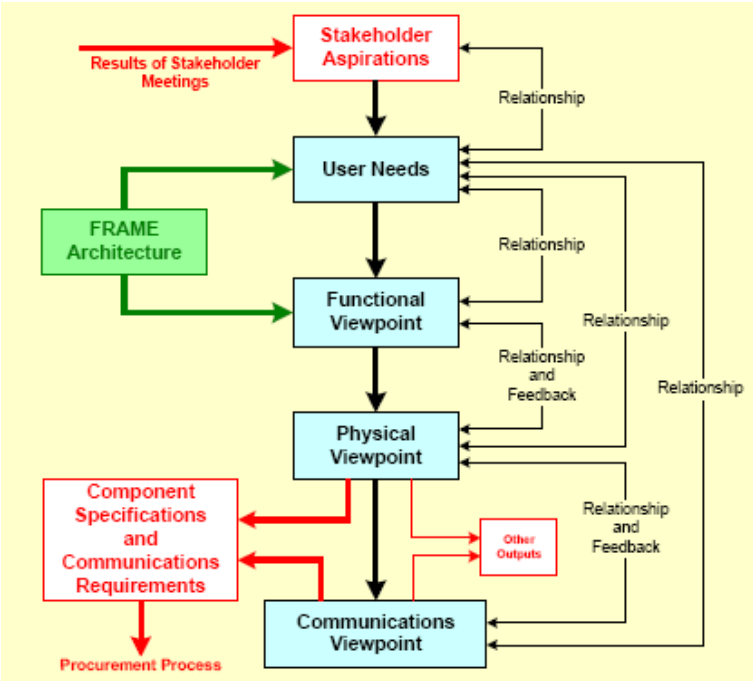

Figure 1 – Using the FRAME Architecture

The Aspirations should be written by the Stakeholders[1] and represent a statement of the features that they wish the ITS services and applications to possess; typically they comprise one-two pages of bullet points written in natural language. The next stages are performed by the ITS Architect[2] using the FRAME Architecture.

Whilst the Stakeholders' Aspirations are unstructured statements of desires, the User Needs are structured statements which describe the features that should be exhibited by the ITS, normally one feature per User Need, e.g.

> *The system shall be able to know where it is in the transport network, and hence provide the position of the vehicle or person carrying it.*

A typical region or city requires 1-200 User Needs, taking 10-15 pages, to describe its ITS requirements fully.

Each User Need is cross-referenced to one or more Functions that provide (part of) the functionality described in one or more User Needs, e.g.

> *F 6.3.10 Implement Trip Plan and Track Traveller*

The next phase, to create the Function Viewpoint sub-set, involves the technical process of confirming that all the primary Functions, cross-referenced by the User Needs, are actually required, and then identifying all the secondary Functions needed to supply them with data. This is a non-trivial task and it requires computer-assisted tool support to create a full and consistent Functional Viewpoint sub-set of the FRAME Architecture [3]. The process is not an "exact science", and the result that matters is the Functional Viewpoint sub-set, which contains more detail than do the User Needs. Thus, normally, the User Needs are a means to an end and not an end in themselves.

A Physical Viewpoint has to be created for each deployment by allocating each Function to a physical location, or sub-system (see Figure 2), or within a module that is part of a sub-system [3]. A Communications Viewpoint can be created by analysing the data flow requirements between each physical unit.

The component specifications can be drawn up from the descriptions of the functions contained within each sub-system or module and, together with the communications requirements, can form the basis of a Call for Tender. Such a document will be many tens of pages long.

[1] In practice they are usually written by the Architecture Team in consultation with the Stakeholders.

[2] An ITS Engineer with a knowledge of ITS Architecture.

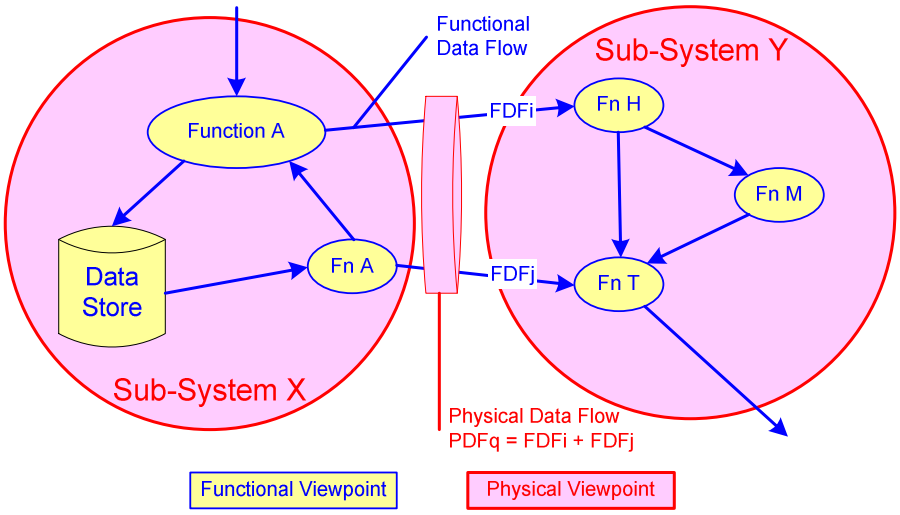

Figure 2 – Example Functional and Physical Viewpoints

2.3 Existing FRAME User Needs

The original set of about 540 User Needs was created during the KAREN project. It was decided that they should be divided into groups whose structure reflected the 32 Fundamental Services defined by ISO TR 14813-1:1998. This was done for political rather than technical reasons. Since these did not have a consistent logical structure, KAREN defined nine high-level groups and split the 32 ISO services between them, and then added a separate group for the "non-functional" and architectural User Needs. The final structure is as follows:

- User Need Group (N)
  - 1 General
    - Generic to the Framework Architecture
    - Generic to (a subset of) ITS
  - 2 Infrastructure Planning and Maintenance
  - 3 Law Enforcement
  - 4 Financial Transactions
  - 5 Emergency Services
  - 6 Travel Information and Guidance
  - 7 Traffic, Incidents and Demand Management
  - 8 Intelligent Vehicle Systems
  - 9 Freight and Fleet Management
  - 10 Public Transport Management

These are further subdivided into Services and Topics:

- Service (M)
  - Based on the ISO TR 14813-1:1998 list of 32 Fundamental Services – since they were based on the original US National ITS Architecture Fundamental Services, a few had no relevance for the EU.
- Topics (P)
  - With '0' for high-level User Needs

- Unique number (Q)
  (Consecutive number within each topic concerned)

Each User Need thus has a unique number of the form, N.M.P.Q, e.g. 7.1.9.4 is:

- Traffic, Incidents and Demand Management (Group 7)
- Traffic Control (Fundamental service)
- Adaptive Traffic Control (Topic 9)
- User Need Nº 4

A graphical form of the User Needs structure, together with the new services and topics for Cooperative Systems, can be found in Appendix C.

2.4 Configuration Management

The requirement for the FRAME Architecture to be kept up-to-date has the potential to be in conflict with the need for an ITS Architecture to provide a stable basis for future development. All changes are therefore performed in accordance with the Configuration Management rules of the FRAME Architecture [4], which state that once a User Need (or Function) has been published with a particular identifier, that identifier can never be used again for another User Need (or Function). This is to ensure that all FRAME Architecture subsets will remain compatible in perpetuity.

3 User Needs for Cooperative Systems

3.1 Extending the FRAME Architecture – Overview

The process of extending the FRAME Architecture has to be done carefully to ensure that each new part is consistent with the existing parts. New User Needs can either be used to specify additions to the Functional Viewpoint or, on occasions, reflect some additions that have been made. Although most of the new User Needs for Cooperative Systems were used to specify additions to the Functional Viewpoint, there were a few applications and services that already existed within the FRAME Architecture. Since they are now considered to be part of Cooperative Systems, it was decided to mention them again within the new category and to use the "Similar User Need" facility to highlight the (potential) duplication (see Appendix B.1)

The functionality that has been added to the FRAME Architecture obviously has to fit with the existing functionality. In addition, although no Physical Viewpoint is specified, consideration has to be given to the potential distribution of the Functions and Data Stores so that all likely Physical Viewpoints can be created. In practice this means that each Low-Level Function should be small enough to be performed in a single location, but not so small as to create unnecessary complexity. Details of the changes that have been made to the Functional Viewpoint can be found in Deliverable D15 [5].

3.2 The Sources of the Extra User Needs

A primary objective of the E-FRAME project has been to incorporate within the FRAME Architecture Cooperative System services and applications that reflect the prototypes developed and tested by three major research IPs between 2005 and 2010.

The following sub-sections provide details of the sources used from each IP.

3.2.1 COOPERS

The FRAME User Needs that describe the Cooperative Systems applications and services developed by the COOPERS IP were taken from a single document [6]. Since that project had followed the FRAME Methodology from its inception, little extra work had to be done.

The COOPERS project had concentrated on inter-urban motorway applications, often providing warnings or advice from a Traffic Control Centre directly to a driver via an in-vehicle display.

3.2.2 CVIS

The FRAME User Needs that describe the Cooperative Systems applications and services developed by the CVIS IP were taken from various documents produced by the sub-projects CURB [7], CF&F [8]. COMO [9] and CINT [10]. Each sub-project developed services for a particular aspect of Cooperative Systems. Thus CURB developed services to be used in the urban road network, CF&F developed services for managing freight vehicle parking and CINT developed services for the inter-urban road network. The COMO sub-project

developed monitoring and data collection services that were to be used by the other three sub-projects. They did not all use the same methodology to describe their applications, but an attempt was made to ensure that each FRAME User Need related to one or more CVIS requirement.

3.2.3 SAFESPOT

The FRAME User Needs that describe the Cooperative Systems applications and services developed by the SAFESPOP IP were taken from various documents produced by the sub-projects SP1 [11], SP2A [12]. SP2C [13], SP3 [14], SP4 [15] and SP5 [16]. They did not all use the same methodology to describe their applications, but an attempt was made to ensure that each FRAME User Need related to one or more SAFESPOT requirement.

The SAFESPOT project concentrated on generating safety warnings about conditions on the motorway, non-urban and urban road network that were presented to drivers, principally via in-vehicle displays.

3.3 Adding the Extra User Needs

The addition of the new User Needs for Cooperative System involved:

- Expressing the new User Needs in an appropriate manner (see Section Appendix B.1);
- Checking for multiple instances of the same (sets of) User Needs;
- Classifying each Cooperative System application and service under existing or new Groups, Services and Topics;
- Ensuring that the User Needs in each Topic are listed in a logical sequence.

The above processes also had to be performed in accordance with the Configuration Management rules of the FRAME Architecture (see Section 2.4). Since the E-FRAME project published two versions of the FRAME Architecture, V4.0 after Phase 1 and V4.1 after Phase 2, with the expectation that some rationalisation would take place between the two versions, it was sensible to use temporary identifiers for the new User Needs for Cooperative Systems in V4.0 so that the final list in V4.1 can be in logical readable sequences.

3.4 Rationalising the Cooperative System User Needs

The process of rationalising the three sets of User Needs had to deal with two principal issues. The first related to those User Needs which had the same of similar wording both within and between the IPs. Since the text used to describe a User Need is deliberately short (see Section Appendix B.1), its full meaning is gleaned from the surrounding context. So, in the case of two apparently similar User Needs, it was first necessary to confirm that they did indeed involve the same functionality.

Once this had been checked it was possible to tackle the second issue, which involved grouping together all the User Needs that described some aspect of each Cooperative System application or service (see Section 4). They were then ordered so that different aspects of the same application or service were adjacent, proceeding from the general to the particular. Once these had been reviewed, and no further changes were expected, then, and only then, were they allocated their final User Need numbers.

Both CVIS and SAFESPOT had (different) “common cores” of functionality that were used by most of their applications and services, as did COOPERS though it was not so explicit. Was it necessary to give them an explicit category in the User Needs? After some discussion the project decided not to do so since the FRAME Architecture describes *what* is to be done and not *how* to do it. The “common cores” are related to, but not identical to, the “ITS Station” which is the subject of current standardisation activities [17], and which can then become visible in any Physical Viewpoint.

3.5 Merging Cooperative Systems into the FRAME User Needs

3.5.1 Background to the problem

When the project started to research the details of the Cooperative Systems applications and services produced by these IPs it found that:

- There was no consistency between the ways that they had been described, indeed there was often no consistency between the various sub-projects of an IP;
- Many of the descriptions concentrated on the communications requirements, leaving the reader to imagine the details of the application or service itself;
- Few applications or services had been given names, and when they had it did not appear that a consistent taxonomy had been used.

The COMeSafety project’s ITS Communications Architecture provided a list of applications and services but it is not always easy to understand from the name what each one involves. In the latest version produced by the PRE-DRIVE C2X project [18], the description has been expanded by a single sentence. The ETSI “basic set of applications – definitions” [19] raises similar problems, as it concentrates on the communications requirements with, at best, only a basic description of the functionality, and sometimes none. Finally there is the CEN/ETSI response to Mandate M/453 [20] which again provides names of Cooperative System applications: in this case they are the ones for which standards are to be developed. Unfortunately the names for the Cooperative Systems applications and services used by these three documents are not always the same.

The E-FRAME project was concerned that, when insufficient information is given about an application and service, readers and users will automatically make assumptions about the missing data, based on their own experience. When two or more people do this separately there is a high probability that the “extra data” added by each person will be different. This creates considerable potential for confusion and misunderstandings.

3.5.2 Some Specific Issues to be Resolved

The Cooperative System applications and services can be categorised into the five areas of:

- Traffic Safety;
- Traffic Efficiency;
- Freight and Fleet Applications;
- Value-Added and Other Services;
- Supporting Services.

These, however, are extremely wide-ranging and it is necessary to provide more detail for them to be useful.

In addition, the ETSI definitions (2) lists 53 basic applications but many of these are very similar, e.g.

- Across Traffic Turn Collision Risk Warning;
- Merging Traffic Turn Collision Risk Warning.

Another problem can also occur when more than one name is given to the same application, e.g. ETSI refers to “Traffic light optimal speed advisory” whilst PRE-DRIVE C2X uses “Greenlight optimal speed advisory”. This is analogous to a generic term, e.g. Electronic Stability Control, being given a number of different proprietary names on different vehicle models as each manufacturer tries to differentiate itself in the market place.

Another issue is unclear use of words. When “definitions” are being provided, the misuse, or omission, of one or more words can, at best, result in ambiguity and, at worst, imply a different meaning to the one intended. This is a particular danger when they have been written by non-native English speakers and, in such cases, it may be necessary to edit or re-write the terms and definitions!

3.5.3 The chosen solution

Whilst a quick and obvious approach might have been to create a new User Need Group entitled “Cooperative Systems”, a deeper analysis of the Cooperative System applications and services reveals that some of them are just different ways of providing services that are already available, e.g. information at the roadside is now to be displayed by in-vehicle devices. The distinctive features provided by Cooperative Systems are that some of its applications and services can only be provided by V2V and/or I2V communications, and use in-vehicle devices to provide drivers with additional information. Other applications and services are extensions to existing systems, e.g. the addition of new facilities to improve and smooth the flow of traffic through intersections controlled by traffic signals.

A distinctive feature of the FRAME Architecture is that it describes functionality in terms of *what* is done, and not *how* it is done, i.e. it is technology independent. As a consequence most of the Cooperative Systems applications and services defined by PRE-DRIVE C2X [18] and ETSI [19] fit naturally into the existing User Need Groups, as follows:

- Traffic Safety – Group 7 (Traffic management);
- Traffic Efficiency – Group 7 (Traffic management);
- Freight and Fleet Applications – Group 9 (Freight and fleet operations);

The Supporting Services are technology dependent and exist as a result of the technology being used to ensure that the desired functionality can be performed. Thus they do not appear in the FRAME Architecture as such.

The Value-Added and Other Services are of two types, some, such as “Enhanced Route Guidance and Navigation”, are extensions to existing parts of the FRAME Architecture. Others, such as “Insurance and Financial Services”, are not normally considered to be part of ITS, indeed it is understood that the “Apps” that will provide them will, at most, only make use of the communications systems that will exist because of other Cooperative Systems

applications and services require them. There are currently no plans to include such applications and services in the FRAME Architecture.

The following section describes the final categorisation used to incorporate the extra User Needs for Cooperative Systems into the FRAME Architecture.

4 Taxonomy of Cooperative System Applications and Services

The various Cooperative System applications described by PRE-DRIVE C2X [18] and ETSI [19] are “small” in the sense that their basic functionality can be described using only a few FRAME User Needs (see below). Many of them can be grouped together to form Topics, which in turn can be grouped to form Services (see above). Using the ETSI names as the primary source, Table 1 contains all the applications described by ETSI and PRE-DRIVE C2X, and also indicates the origin of the names. Those in **blue** are taken from the ETSI TR 102 638 definitions [19] and are identical to many of the names used by PRE-DRIVE C2X [18]. Those in **green** are names used by PRE-DRIVE C2X alone. The names in **black** have been introduced by the E-FRAME project as an aid to clarification. This table also shows that there is some possible duplication of functionality within the ETSI document.

Service	Topic	*Applications included*
Traffic Safety	Road Hazard Warning	Stationary Vehicle(s) Warning
		Post Crash Warning
		Decentralised Floating Car Data (Traffic Jam, Road Works, Slippery Road, Fog, Rain, Wind)
		Traffic Jam Ahead Warning
		Traffic Condition Warning
		Road Work Warning
		Motorcycle Warning
		Hazardous Location Notification
	Ghost Driver Management	Wrong Way Driving Warning
	Lane Utilisation	
	Speed Management	Legal, Regulatory and Contextual Speed Limits
		Curve Speed Warning
	Headway Management	
	Collision Warning	Cooperative Forward Collision Warning
		Pre-Crash Sensing Warning
		Across Traffic Turn Collision Risk Warning
		Left/Right Turn Collision Warning
		Merging Traffic Turn Collision Risk Warning
		Overtaking Vehicle Warning
		Slow Vehicle Warning
		Emergency Electronic Brake Light
		Cooperative Merging Assistance
		Intersection Collision Warning
		Collision Risk Warning from RSU
		Lane Change Assistance/Assistant
	Vulnerable Road User Warning	
	Emergency Vehicle Warning	

Service	Topic	*Applications included*
Traffic Safety (continued)	Glare Reduction	Cooperative Glare Reduction
	Vehicle Breakdown Warning	Car Breakdown Warning
		Safety Function out of Normal Condition Warning
	Cooperative Adaptive Cruise Control	
	Platooning	Cooperative Vehicle- Highway Automation Systems
Traffic Efficiency	Traffic Flow Optimisation	Enhanced Route Guidance
		Traffic Information and Recommended Itinerary
		Limited Access Warning, Detour Notification
		Road Restricted Access, Detour Notification
		Vehicle-to-Roadside Infrastructure Traffic Optimisation
		Ecological Drive
	Advanced Adaptive Traffic Signals	Intersection Management
		Traffic Light Optimal Speed Advisory
		Greenlight Optimal Speed Advisory
	Flexible Lane Allocation	Cooperative Flexible Lane Change
	Traffic Signal Violation Warning	Signal Violation Warning/Signal Pre-emption
		Stop Sign Violation
	In-Vehicle Signage	
	Adaptive Driving	Adaptive Drive Train Management
Value-added and Other Services	eCall	SOS Service
	Enhanced Route Guidance and Navigation	Map Downloading and update
		Point of Interest Notification
	Access Control	Automatic Access Control/Parking Access
	Service Continuity	
	Local Electronic Commerce	Local Commerce
	Car Rental/Sharing Assignment/Reporting	
	Insurance and Financial Services	
	Parking Management	Automatic Access Control/Parking Management
	Road User Charging	Electronic Toll Collect
	Eco Driving	
	Vehicle Support Management	Remote Diagnosis and Just In Time Repair Notification
		Design Re-use and Change Management
		Business Intelligence for High-Volume Service Parts Management
	Stolen Vehicle Alert	
	Media Downloading	

Service	Topic	*Applications included*
Value-added and Other Services (continued)	Instant Messaging	
	Software Provision and Update	Vehicle Software Provisioning and Update
		Vehicle Data Collect for Product Lifecycle Management
	Personal Data Synchronisation	
	Communications Management	Vehicle Relation Management
		Vehicle and RSU Data Calibration
Freight and Fleet Applications	Hazardous Goods Vehicles Management	
	Driver Rest Areas	
	Loading Zone Management	
	Fleet Management	

Table 1 – Taxonomy of Cooperative Systems Services and Applications
Taken from the ETSI Technical Report, COMeSafety/PRE-DRIVE Communications Architecture

The extra User Needs for Cooperative Systems have to fit into the existing structure of the FRAME User Needs and the list of "applications" (right hand column) provided in Table 1 are far too detailed to provide a useful degree of discrimination, since many of them can be described in only one or two User Needs. A more practical solution, which fitted the structure and philosophy of the existing FRAME User Needs, was to use the titles of the Services and Topics in the first two columns.

It was therefore decided to remove two empty services (7.4[3] and 7.5[4]) from the existing list and to replace them with the following three services:

7.4 : Cooperative Systems – Traffic Safety

7.5 : Cooperative Systems – Traffic Efficiency

7.6 : Cooperative Systems – Value Added and Other Services

The fact that they no longer follow ISO TR 14813-1:1998 does not matter, because it has already been replaced by another Technical Report which structures ITS services in a completely different manner such that it would require a major revision to the entire FRAME Architecture if it were to be followed. Indeed, this second Technical Report is itself currently in the process of being revised.

The topics under Freight and Fleet Operations were added to the end of the list of existing topics on Commercial Fleet Management (9.5.6-8). The resultant structure for the FRAME User Needs can be seen in Appendix C, and the new User Needs themselves can be seen in Appendix D.

[3] ISO TR 14813-1:1998 called this "Safety Enhancements for Vulnerable Road Users" and the topic is already covered by the User Needs in 7.1 (Traffic Control).

[4] ISO TR 14813-1:1998 called this "Intelligent Junctions and Links" and no EU User Need was identified by the KAREN project.

Some of the new User Needs relate to high-level quality “non-functional” issues, and these have been added to Group 1 (see Appendix D).

A comparison of the entries in Table 1 with the Topics in Appendix D will show that some are missing. There are three possible reasons for this:

- Lack of information – some the applications listed by ETSI and/or COMeSafety/PRE-DRIVE C2X were not studied by any of the three IPs, and they have very little in the way of a description as to what the application is intended to do, or how (functionally) it is intended to be done, e.g. Cooperative Adaptive Cruise Control.
- Out of Scope – Some of the applications listed under Value Added and Other Services are not related to the current driving task, e.g. Insurance and Financial Services, or Media Download, and thus are not really part of ITS at all. A few, e.g. Glare Reduction, are likely to be provided by vehicle systems which are the responsibility of vehicle manufacturers and thus outside the system boundary of the FRAME Architecture.
- Already Exist – Some of the applications that now come under the category of “Cooperative Systems” have been discussed for many years and are already in the FRAME Architecture, e.g. eCall (which used to be a “May Day call”). When similar applications have been studied by one of the three IPs, the column “Similar User Need” will contain a cross reference to an existing part of the FRAME Architecture.

A complete set of User Needs for V4.1 of the FRAME Architecture can be found in Appendix E.

5 Conclusions

User Needs representing the Cooperative System applications and services investigated by the COOPERS, CVIS and SAFESPOT IPs have been created and incorporated into the List of User Needs for the FRAME Architecture. They can be used in the same way as the earlier User Needs to discover what a particular service or application might do, or to select those parts of a service or application that are required. Functionality has been assigned to the new User Needs, which has then been incorporated into Version 4.1 of the full FRAME Architecture. It is therefore now possible to select those Cooperative System services and applications that are required, and show how they may be integrated with other parts of ITS.

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Appendix A The FRAME Architecture – Background

The FRAME Architecture (originally called the European ITS Framework Architecture) was developed as a result of recommendations from the High Level Group on transport telematics, which were supported by a resolution of the Council of Ministers. It was created by the EC funded project KAREN (1998-2000) and first published in October 2000. The underlying aim of this initiative was to promote the deployment of (mainly road-based) ITS in Europe by producing a framework which would provide a systematic basis for planning ITS implementations, facilitate their integration when multiple systems were to be deployed, and help to ensure inter-operability, including across European borders.

Because the FRAME Architecture is intended for use within the European Union it conforms to the precepts of subsidiarity, and thus does not mandate any physical or organisational structure on a Member State. It comprises a set of User Needs and a Functional Viewpoint only (the User Needs providing a form of requirements for the functionalities contained within the Functional Viewpoint). Most users will only use a sub-set of the FRAME Architecture and a methodology, now supported by computer-based tools, was developed to do this effectively by the EC funded FPV project FRAME-S (2001-04).

After its creation, and in order to enable others to use the FRAME Architecture, it was recognised that a centre of knowledge would be required to which potential users could put questions, from which they could receive training in its use, and which would keep the Architecture up-to-date with the evolution of ITS. This was provided very successfully from 2001 until 2004 by the EC funded projects (FRAME-NET and FRAME-S). The FRAME-NET project provided User Forums and collected and collated the experiences of FRAME Architecture users. The FRAME-S project maintained the FRAME Architecture, produced two tools to assist with its use, and provided many nations and projects with advice. As a result, they were then able to make, or are making, plans to employ the Architecture. Since 2005, and prior to the start of the E-FRAME project, some limited support for existing and potential users of the FRAME Architecture was provided through the FRAME Forum.

At the time of the KAREN project, the FRAME Architecture had already been adopted as the basis for the French national ITS Architecture (ACTIF), and was subsequently adopted as the basis for the Italian national ITS Architecture (ARTIST). Other nations that have used FRAME since then include Austria (TTS-A), the Czech Republic (TEAM), Hungary (HITS) and Romania (NARITS). In addition a number of specific ITS Architectures have been created in the UK including one for Transport for Scotland and another for the County of Kent. More recently, part of Transport for London has been using the FRAME Architecture to plan its future ITS deployments. In a few cases, e.g. VIKING and the COOPERS IP, it has also been used by R&D projects.

During the FRAME projects, and from experience with other ITS architecture activities in Europe and elsewhere, a number of important lessons have been learned. The one most relevant to this document is:

- The need to keep an ITS Architecture up to date: If it is to remain useful, an ITS Architecture must be kept constantly maintained (the US National ITS Architecture is now on Version 6.1 after over 15 years of existence through continuous funding from the

US Government). The aim of the original KAREN project was to define ITS User Needs until at least 2010, but since then some parts of ITS have evolved more rapidly and radically than had been foreseen.

Although the User Needs were updated during the early part of the FRAME projects (2002/3), the FRAME Architecture contains only a few references to more recent ITS developments, such as those associated with the Intelligent Vehicle or eSafety initiatives. One particular and highly significant area – in which the European Commission has invested very heavily over the last five years – is called “Cooperative Systems” (as they involve vehicle-vehicle and/or vehicle-to-infrastructure communication), and it was not covered by FRAME Architecture. Filling this gap was one of the principal objectives of the E-FRAME project.

Appendix B System Lifecycles and Terminology

Most text books on software engineering, e.g. [21], describe the process of creating a product in terms of a basic "waterfall" lifecycle that is similar to that shown in Figure 3.

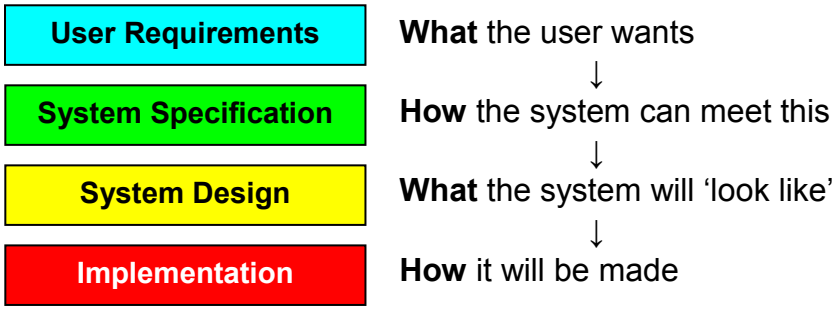


Figure 3 – Typical "Text Book" Development

With regard to this document, important points to note are:

- Each stage is often performed by different people with different backgrounds and experience.
- Each successive stage describes the product in greater detail.
- When those who undertake a given stage in the lifecycle are different from those who performed the previous stage it is essential that the output of the earlier stage is fully understood by both parties. Normally the "language" used is driven by the knowledge of those responsible for the earlier stage.

The process described in Figure 3 is, however, far too simplistic when the 'product' in question is one or more integrated ITS applications, which in turn may have to be integrated with existing systems, and whose size and/or cost is such that it cannot all be deployed at the same time. It is indeed possible that the technology used for the implementation may change during the total deployment. It is for this scenario that the FRAME Architecture has been created, and of which the User Needs are a part.

The basic lifecycle envisaged for typical ITS deployments is shown in Figure 4. It comprises two major stages each similar to Figure 3: the aim of the first is to produce a Call for Tender, which must be written in a technology independent manner. The second is the stage in which the system(s) itself is developed, and usually involves more than one engineering discipline. The FRAME Architecture is used in the first of these two stages as described below.

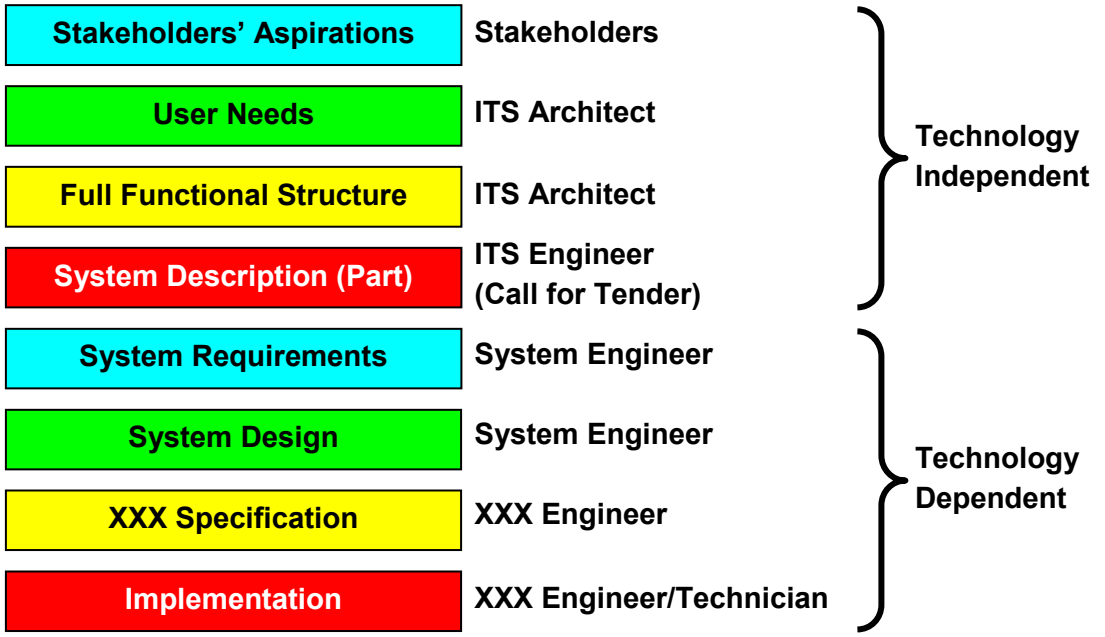


Figure 4 – Large ITS Development

An alternative way of considering the FRAME Architecture is shown in Figure 5, where the bottom section "System Design" corresponds to the bottom four stages of Figure 4. The FRAME Architecture is used to create a "System Structure" into which the various systems designs will fit. The dotted line indicates that the FRAME Architecture does not, of itself, contain all the system structure, parts have to be created as described in Section 2.2 below. Most ITS Architectures do not currently have an explicitly defined "Overall Concept", and the FRAME Architecture does not provide one.

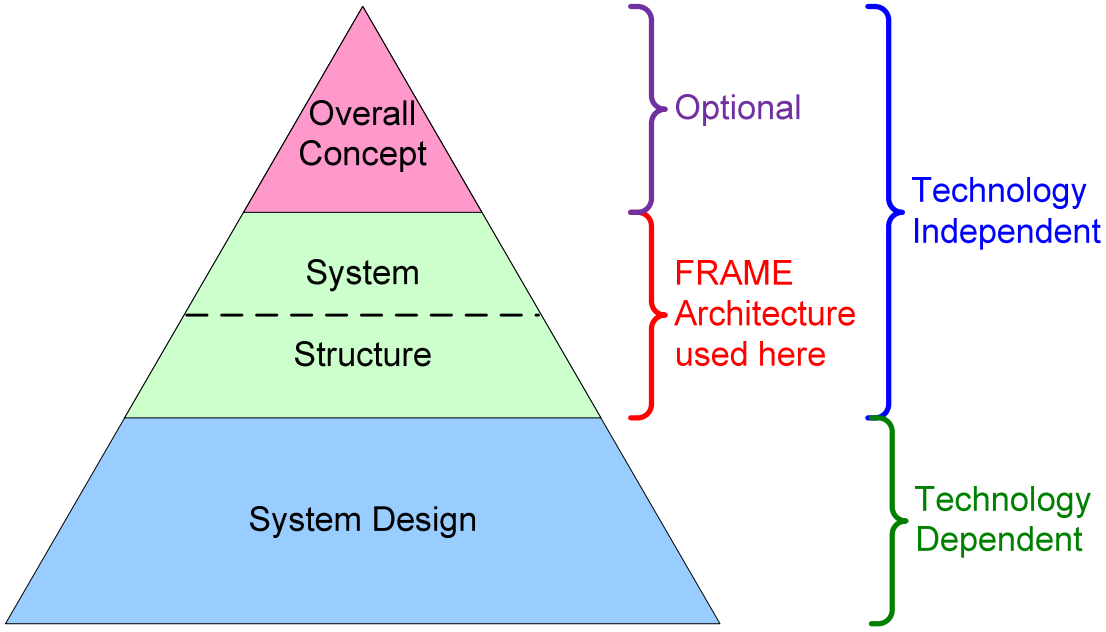


Figure 5 – The Use of the FRAME Architecture in the Planning Process

Appendix B.1 Properties of the FRAME User Needs

The FRAME User Needs have three principal uses, as follows.

- **Specification of the Functional Viewpoint** – One or more User Needs provide the specification for what the functionality in the Functional Viewpoint must do. Each Function is cross-referenced to one or more User Needs for which it helps to provide primary functionality. (There is usually no cross-referencing to secondary functionality, e.g. provision of data to perform a primary function: this is to avoid a large number of irrelevant functions being selected when creating a sub-set (see Section 2.2)).
- **Creating ITS Architecture Sub-sets** –see Section 2.2.
- **Describing ITS Applications and Services** – The User Needs provide a description of most ITS applications and services that might be required anywhere within the European Union. They can therefore be used for this descriptive purpose alone, e.g. by a research student wishing to know what ITS applications and services are being considered.

In order to satisfy these uses the User Needs need to be written in a manner that is clear and unambiguous, and at a level of abstraction that is sufficient to describe the primary functionality but without unnecessary detail. They should thus have the following properties:

- **"Shall language"** – In order to ensure that the User Needs specify what the functionality in the Functional Viewpoint has to do, or features that must be included in the sub-systems and modules defined in the Physical Viewpoint, they are written (in English) using the phraseology "The system shall … ". This ensures that each User Need is written from the systems' point of view, and hence states the functionality required of that system, and not from the users' point of view, which is likely to state how the results are to be used (and may be interpreted in more than one way)[5].
- **Short** – User Needs are the entry points into the Functional Viewpoint, and need to contain sufficient detail to identify the entry point precisely – only. When they are being written each phrase must have the answer "yes" to the question "is this necessary?". A typical User Need comprises one English sentence three to five lines long (the original User Needs produced by KAREN were limited to 255 characters).
- **Technology Independence** – since the FRAME Architecture will have a lifespan longer than the technology that will be used to implement its features, the User Needs should state what the system is required to do, but not the mechanism for achieving it. Those User Needs that do not relate to functionality, e.g. Communications, Physical locations, should also follow this principle.
- **Unambiguous** – the meaning must be absolutely clear from the description. Thus, for example, whenever the word 'information' is used it must be obvious from the context what should be contained within that information, otherwise it should be specified.

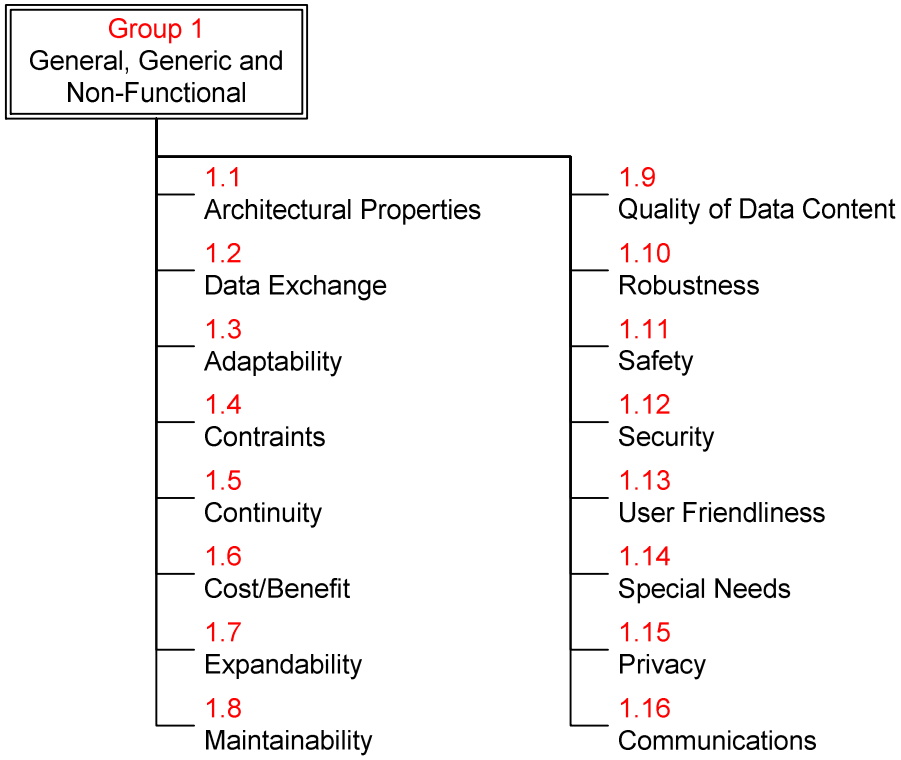
[5] The Stakeholder Aspirations will often be written from the users'/stakeholders' point of view. The task of selecting the corresponding User Needs therefore identifies the part of the FRAME Architecture, that will satisfy them.

- **Testable** – since they form the basis of the FRAME Architecture and what is implemented from it, they must be written in a manner such that it is possible to check that each User Need is represented in some manner in the FRAME Architecture or the implementation.
- **Traceable and Unique** – since it must be possible to trace the manifestation of a User Need in a FRAME Architecture sub-set each User Need must have a unique identifier.
- **Singular** – If a User Need gives rise to a set of functionalities, it is assumed that all those functionalities will be required on every occasion the service is implemented. If this is not the case then it should be broken down into a number of separate User Needs.

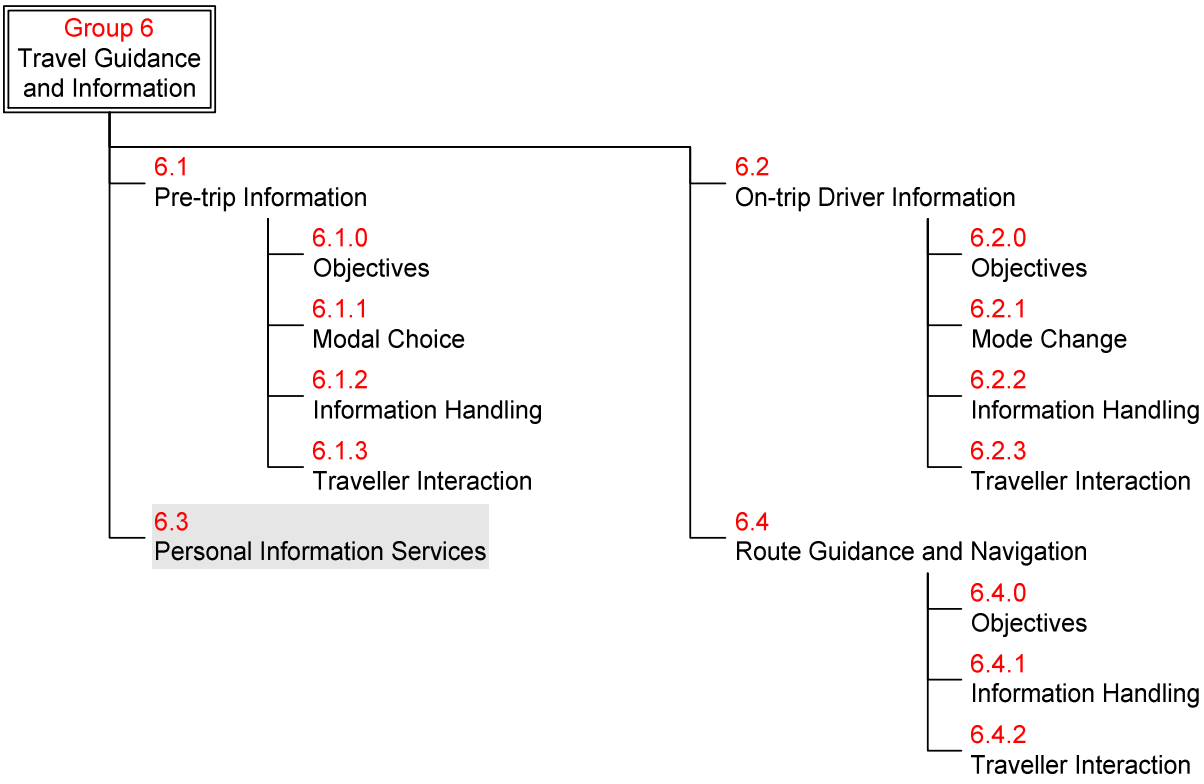
On occasions these properties can be in conflict, in particular when writing User Needs which are *unambiguous* and *singular*, but also *short*, especially as there is a general desire not to have too many User Needs in the entire FRAME Architecture. Whilst no universal way has yet been found to resolve all such conflicts, some can be avoided by starting with a "high-level" User Need that describes a basic form of an application or service, followed by a number of optional extra User Needs that contain the detail of specific features.

- **Similar User Needs** – on occasions the same, or similar, User Needs are required as part of the description of more than one ITS application or service. Early attempts to ensure that each User Needs appeared only once in the entire list proved unworkable (to which application or service should it apply?), so a record is made of other User Needs elsewhere in the list that are similar. Sometimes they relate to the same functionality and sometimes they do not, and it is left the user of the FRAME Architecture as to how much notice is taken of this information on each occasion.

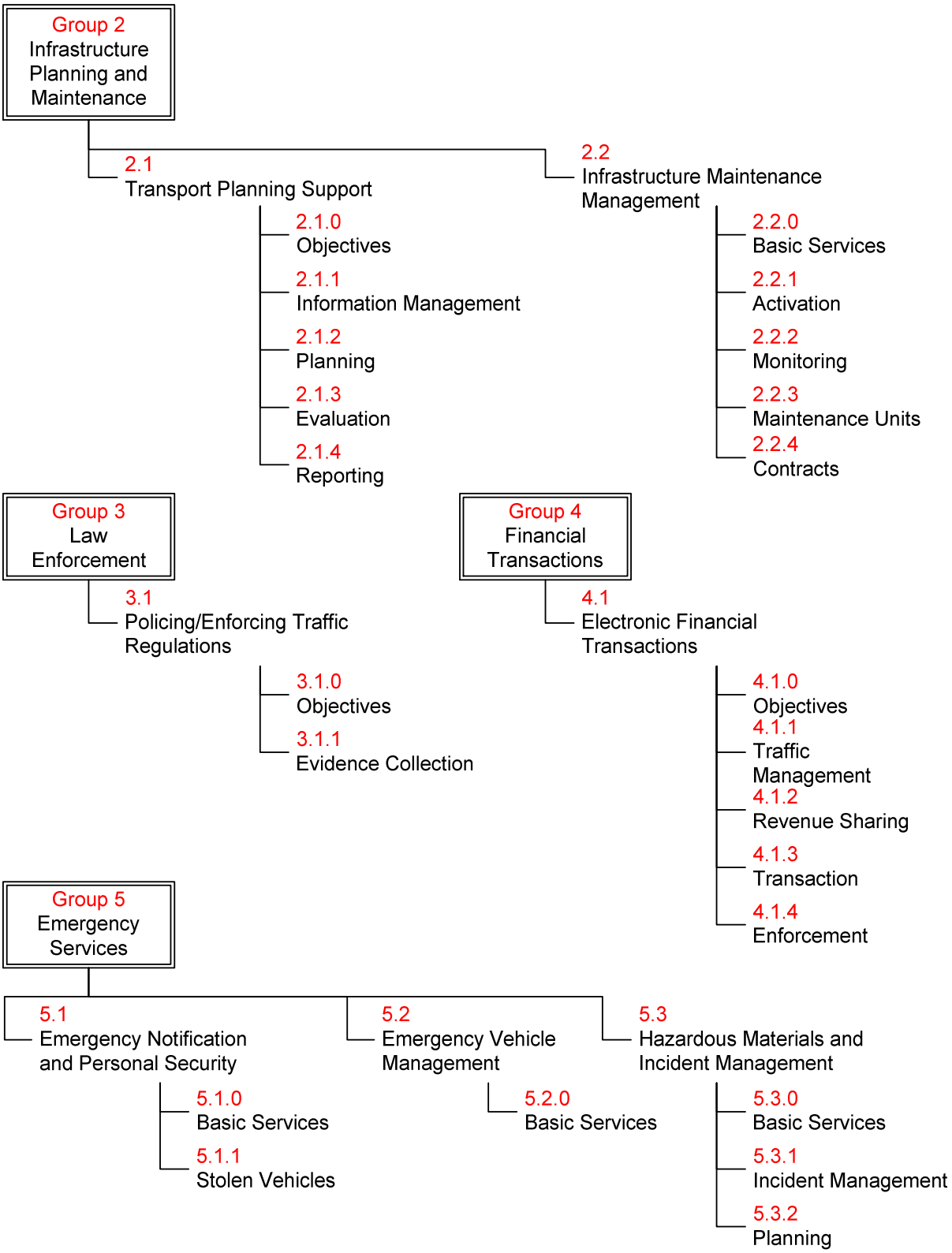
Appendix C Structure of the FRAME User Needs



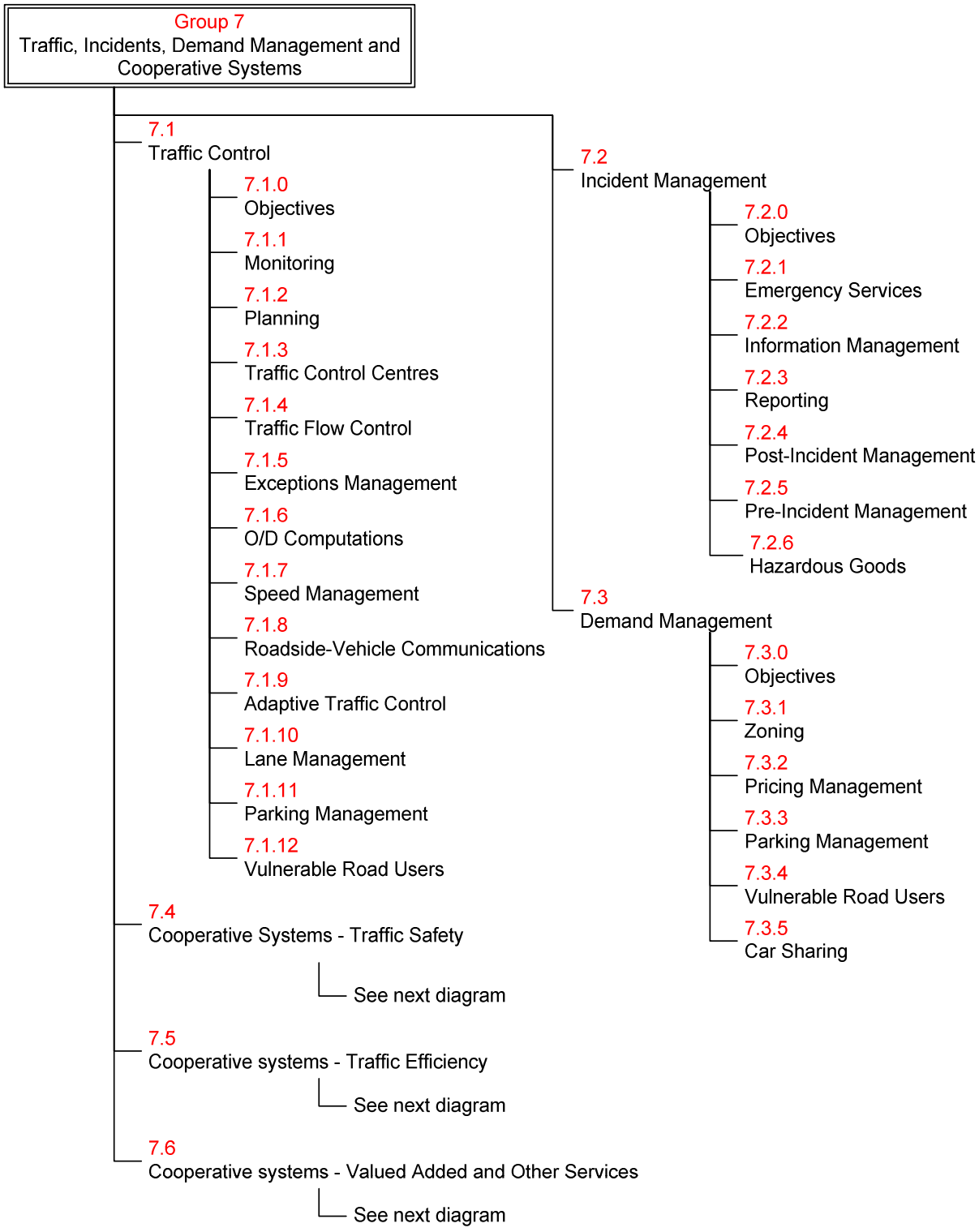
Group 1



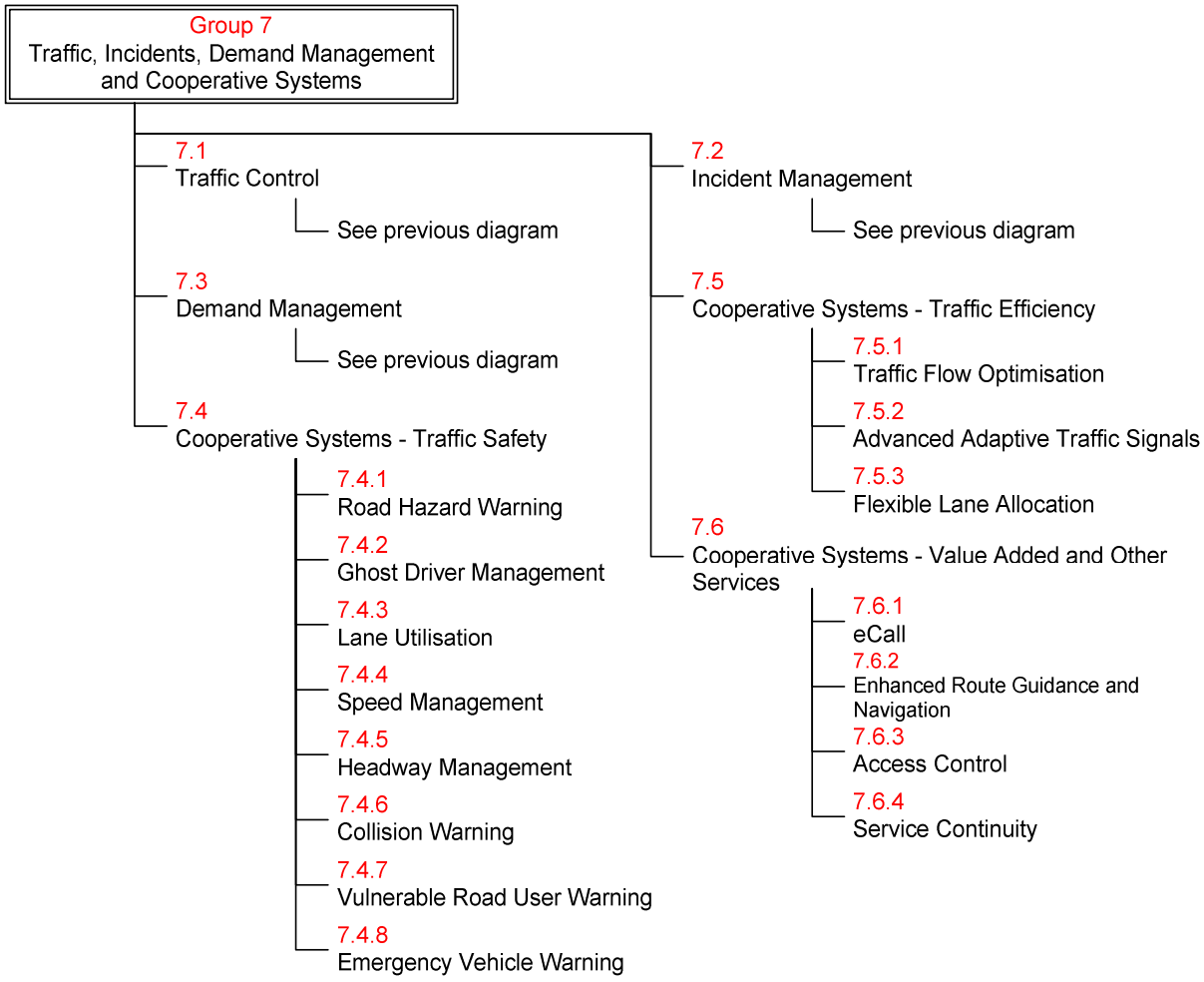
Group 6


Group 2
Infrastructure Planning and Maintenance
2.1
Transport Planning Support
2.1.0
Objectives
2.1.1
Information Management
2.1.2
Planning
2.1.3
Evaluation
2.1.4
Reporting
2.2
Infrastructure Maintenance Management
2.2.0
Basic Services
2.2.1
Activation
2.2.2
Monitoring
2.2.3
Maintenance Units
2.2.4
Contracts
Group 3
Law Enforcement
3.1
Policing/Enforcing Traffic Regulations
3.1.0
Objectives
3.1.1
Evidence Collection
Group 4
Financial Transactions
4.1
Electronic Financial Transactions
4.1.0
Objectives
4.1.1
Traffic Management
4.1.2
Revenue Sharing
4.1.3
Transaction
4.1.4
Enforcement
Group 5
Emergency Services
5.1
Emergency Notification and Personal Security
5.1.0
Basic Services
5.1.1
Stolen Vehicles
5.2
Emergency Vehicle Management
5.2.0
Basic Services
5.3
Hazardous Materials and Incident Management
5.3.0
Basic Services
5.3.1
Incident Management
5.3.2
Planning

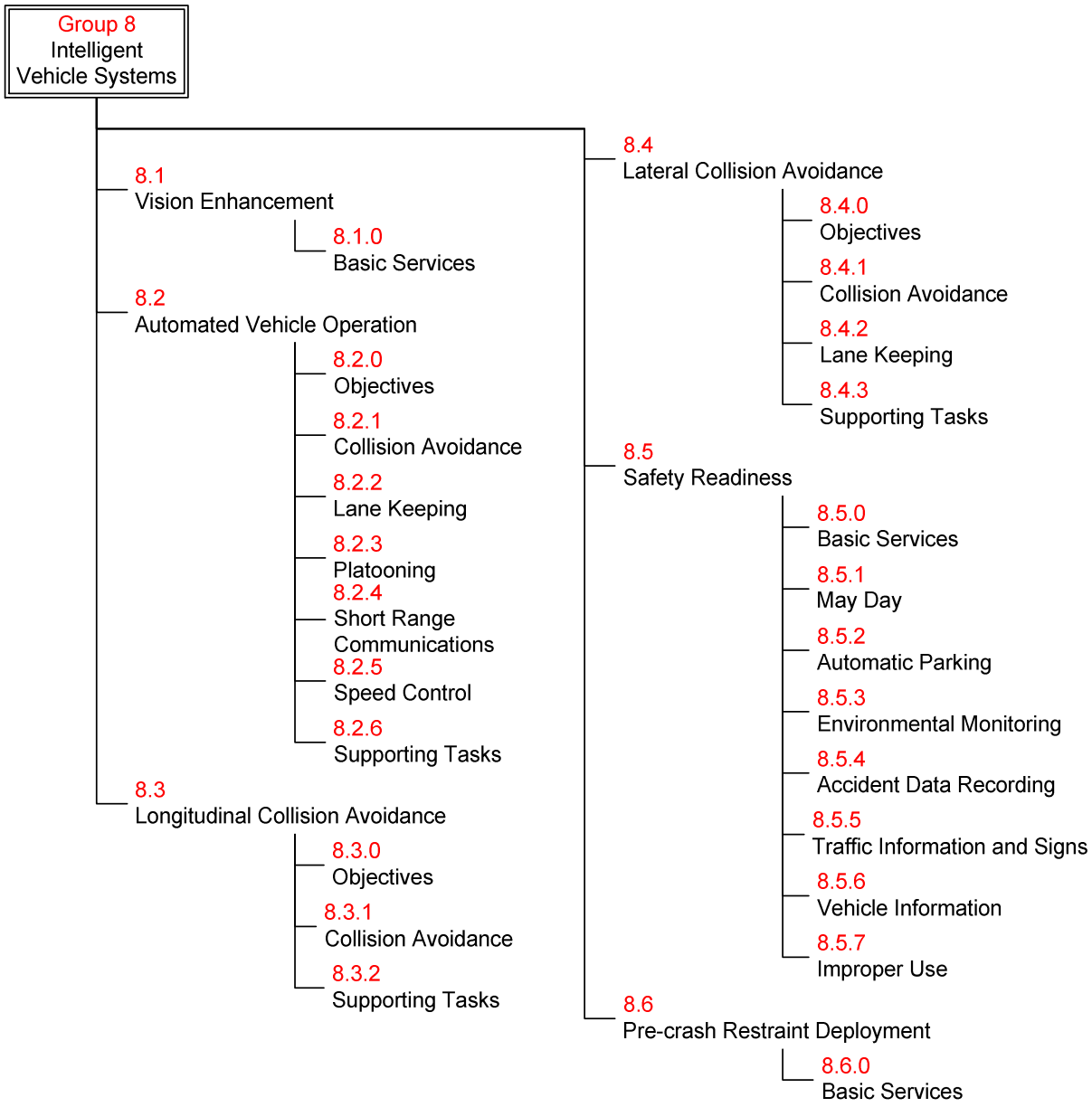
Groups 2-5


Group 7
Traffic, Incidents, Demand Management and Cooperative Systems
7.1
Traffic Control
7.1.0
Objectives
7.1.1
Monitoring
7.1.2
Planning
7.1.3
Traffic Control Centres
7.1.4
Traffic Flow Control
7.1.5
Exceptions Management
7.1.6
O/D Computations
7.1.7
Speed Management
7.1.8
Roadside-Vehicle Communications
7.1.9
Adaptive Traffic Control
7.1.10
Lane Management
7.1.11
Parking Management
7.1.12
Vulnerable Road Users
7.2
Incident Management
7.2.0
Objectives
7.2.1
Emergency Services
7.2.2
Information Management
7.2.3
Reporting
7.2.4
Post-Incident Management
7.2.5
Pre-Incident Management
7.2.6
Hazardous Goods
7.3
Demand Management
7.3.0
Objectives
7.3.1
Zoning
7.3.2
Pricing Management
7.3.3
Parking Management
7.3.4
Vulnerable Road Users
7.3.5
Car Sharing
7.4
Cooperative Systems - Traffic Safety
See next diagram
7.5
Cooperative systems - Traffic Efficiency
See next diagram
7.6
Cooperative systems - Valued Added and Other Services
See next diagram

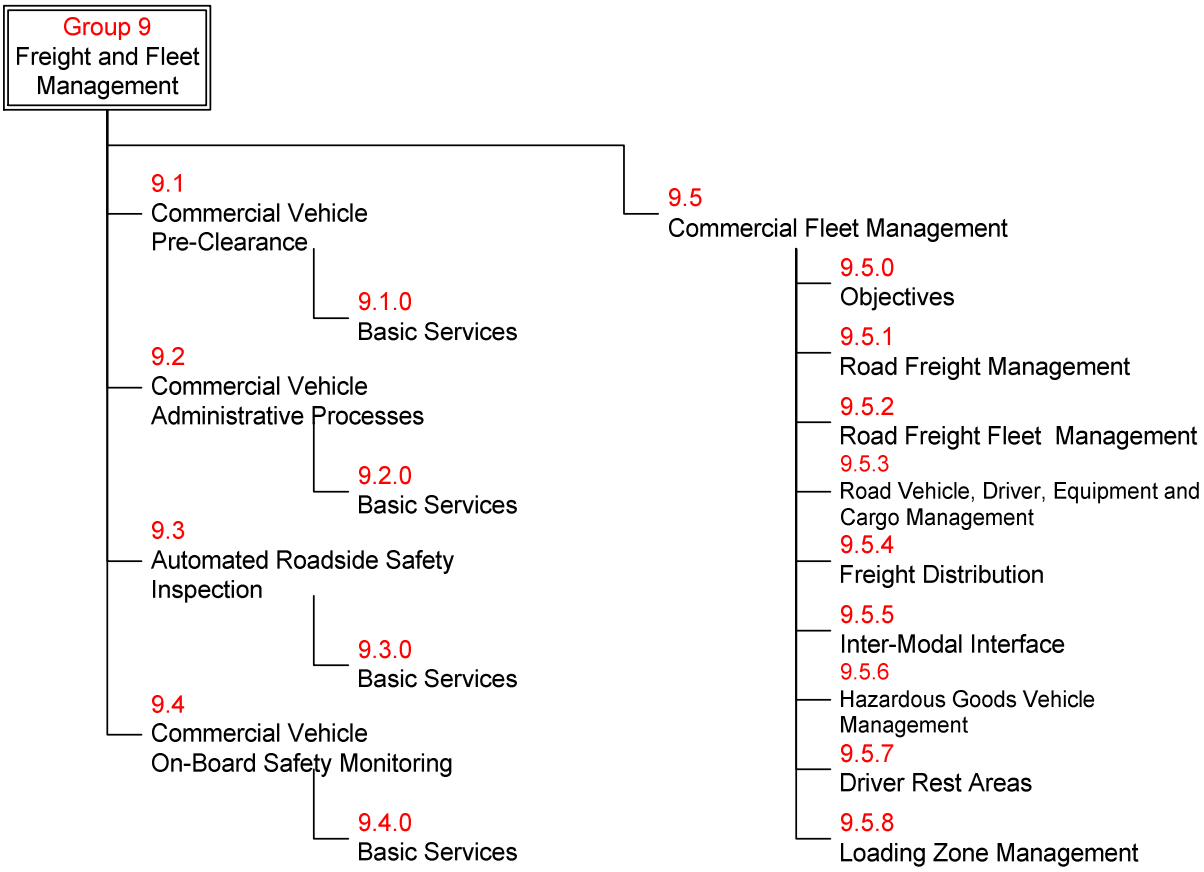
Group 7a


Group 7
Traffic, Incidents, Demand Management and Cooperative Systems
7.1
Traffic Control
See previous diagram
7.3
Demand Management
See previous diagram
7.4
Cooperative Systems - Traffic Safety
7.4.1
Road Hazard Warning
7.4.2
Ghost Driver Management
7.4.3
Lane Utilisation
7.4.4
Speed Management
7.4.5
Headway Management
7.4.6
Collision Warning
7.4.7
Vulnerable Road User Warning
7.4.8
Emergency Vehicle Warning
7.2
Incident Management
See previous diagram
7.5
Cooperative Systems - Traffic Efficiency
7.5.1
Traffic Flow Optimisation
7.5.2
Advanced Adaptive Traffic Signals
7.5.3
Flexible Lane Allocation
7.6
Cooperative Systems - Value Added and Other Services
7.6.1
eCall
7.6.2
Enhanced Route Guidance and Navigation
7.6.3
Access Control
7.6.4
Service Continuity

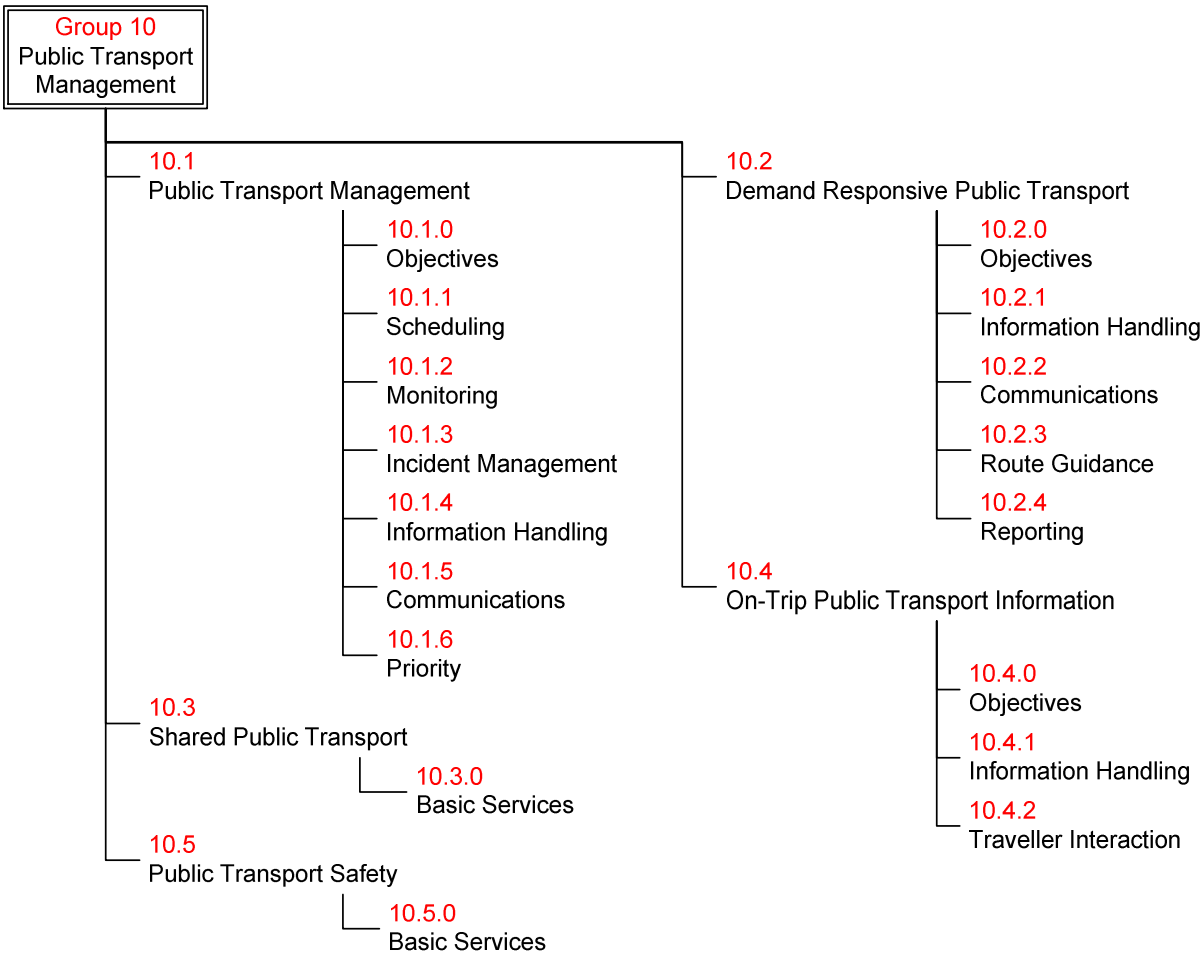
Group 7b


Group 8
Intelligent
Vehicle Systems
8.1
Vision Enhancement
8.1.0
Basic Services
8.2
Automated Vehicle Operation
8.2.0
Objectives
8.2.1
Collision Avoidance
8.2.2
Lane Keeping
8.2.3
Platooning
8.2.4
Short Range
Communications
8.2.5
Speed Control
8.2.6
Supporting Tasks
8.3
Longitudinal Collision Avoidance
8.3.0
Objectives
8.3.1
Collision Avoidance
8.3.2
Supporting Tasks
8.4
Lateral Collision Avoidance
8.4.0
Objectives
8.4.1
Collision Avoidance
8.4.2
Lane Keeping
8.4.3
Supporting Tasks
8.5
Safety Readiness
8.5.0
Basic Services
8.5.1
May Day
8.5.2
Automatic Parking
8.5.3
Environmental Monitoring
8.5.4
Accident Data Recording
8.5.5
Traffic Information and Signs
8.5.6
Vehicle Information
8.5.7
Improper Use
8.6
Pre-crash Restraint Deployment
8.6.0
Basic Services

Group 8


Group 9
Freight and Fleet Management
9.1
Commercial Vehicle Pre-Clearance
9.1.0
Basic Services
9.2
Commercial Vehicle Administrative Processes
9.2.0
Basic Services
9.3
Automated Roadside Safety Inspection
9.3.0
Basic Services
9.4
Commercial Vehicle On-Board Safety Monitoring
9.4.0
Basic Services
9.5
Commercial Fleet Management
9.5.0
Objectives
9.5.1
Road Freight Management
9.5.2
Road Freight Fleet Management
9.5.3
Road Vehicle, Driver, Equipment and Cargo Management
9.5.4
Freight Distribution
9.5.5
Inter-Modal Interface
9.5.6
Hazardous Goods Vehicle Management
9.5.7
Driver Rest Areas
9.5.8
Loading Zone Management

Group 9


Group 10
Public Transport Management
10.1
Public Transport Management
10.1.0
Objectives
10.1.1
Scheduling
10.1.2
Monitoring
10.1.3
Incident Management
10.1.4
Information Handling
10.1.5
Communications
10.1.6
Priority
10.2
Demand Responsive Public Transport
10.2.0
Objectives
10.2.1
Information Handling
10.2.2
Communications
10.2.3
Route Guidance
10.2.4
Reporting
10.3
Shared Public Transport
10.3.0
Basic Services
10.4
On-Trip Public Transport Information
10.4.0
Objectives
10.4.1
Information Handling
10.4.2
Traveller Interaction
10.5
Public Transport Safety
10.5.0
Basic Services

Group 10

Appendix D FRAME User Needs for Cooperative Systems

Abbreviations and Terms

The following words and abbreviations have the following meanings when used within the FRAME User Needs.

Abbreviation or Term	Meaning
ABS	Anti-lock Braking System
Access Control Centre	The (organisation and) systems that control access to a specific area, e.g. designated residential area, commercial premises.
Blue corridor	The result of informing the drivers of other vehicles that an emergency vehicle is approaching in time for those vehicles to move out of the way of the emergency vehicle.
Blue wave	The synchronisation of traffic signals to (try to) ensure that an emergency vehicle never has to stop at a traffic signal.
eCall	A system that enables the emergency services to be called either automatically, or at the request of a vehicle occupant.
ESP	Electronic Stability Program
ETA	Estimated Time of Arrival
FCD	Floating Car Data – a basic set of data obtained from a vehicle that is part of the current traffic. See also XFCD.
HGV	Heavy Goods Vehicle – a truck/lorry with a weight of over 3500kg and for which special regulations can apply.
Holding zone	A designated area used to park goods carrying vehicles if their final destination for (un)loading is not currently available.
Host vehicle	A vehicle which is carrying the system in question.
HOV	High Occupancy Vehicle – A vehicle with one or more passengers in addition to the driver.
Ghost driver	A vehicle that is being driven the wrong way along a carriageway, e.g. one-way street, motorway.
Green wave	The synchronisation of traffic signals to (try to) ensure that most vehicles do not have to stop at a traffic signal.
Hazardous goods	Goods carried on a vehicle that require the application of special safety precautions during their transport, and that may need to be declared to the road authorities before transit.

Abbreviation or Term	Meaning
ISA	Intelligent Speed Adaptation – a system within a vehicle that keeps that vehicle below a given speed, unless overridden by the driver.
Link	A section of a road network, normally between two (not necessarily consecutive) road intersections (e.g. motorway junctions).
O-D	Origin to Destination – used to indicate the start and finish points of a (partial) journey.
PT	Public Transport – busses or trams that share (part of) the road system with road vehicles.
Rest area	A designated area for vehicles, in particular heavy goods vehicles, to be parked in order that their drivers can rest for a length of time.
Service provider	An organisation that supplies an ITS service to users, often for payment. It may or may not own (part) of the equipment used to provide that service, but it does provide the contact point for the users.
System	A set of interacting or interdependent components forming an integrated whole that conform to the FRAME Architecture.
TCC	Traffic Control Centre – the organisation and systems that control or manage the road traffic on a set of roads, either urban or inter-urban.
TIC	Traffic Information Centre – the organisation and systems that provide traffic and travel information to pre-trip and on-trip travellers, both passengers and drivers.
V2I	Vehicle–to–Infrastructure communications – Communications from a vehicle to a stationary unit either at the road side, or at a communications centre.
V2V	Vehicle–to–Vehicle communications
Virtual cone zone	A set of electromagnetic signals that, together, indicate a section of road for which there is no access for normal traffic.
VRU	Vulnerable Road Users – e.g. pedestrians and cyclists
XFCD	Extended Floating Car Data – a full set of data obtained from a vehicle that is part of the current traffic. See also FCD.

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
Area 1 Quality Issues		*General "non-functional" topics that can be added to a Call for Tender when required*	
	Already exists	Systems that conform to the Framework Architecture shall exchange information in a manner that permits road and traffic conditions to be understood by all parties.	1.2.4
	1.2.7	Systems that conform to the Framework Architecture shall classify incidents, their severity and reference their locations in a standard way.	1.2.4
	1.2.8	Systems that conform to the Framework Architecture shall provide coherent and consistent advice to all drivers affected by an incident or congestion.	
	1.3.7	Systems developed from the Framework Architecture shall be able to use a digital map which contains the necessary additional data, e.g. speed limits, curvature of corners, (bus) lanes, traffic signals.	
	Already exists	The Framework Architecture shall enable all information systems developed from it to provide data with a stated accuracy, either as additional information or as part of the documentation, at all times.	1.9.1
	1.10.6	Systems developed from the Framework Architecture shall be able to check input data for reasonableness before it is used by a later part of the system.	
	1.10.7	Systems developed from the Framework Architecture shall be able to obtain vehicle data in a manner that does not affect the correct functioning of the safety functions of the host vehicle.	
	1.10.8	Systems developed from the Framework Architecture shall be able to inform drivers via an in-vehicle device when it is not operating correctly.	
	1.11.5	Systems developed from the Framework Architecture shall display information in a manner that will avoid driver overload, and distraction from the primary driving task.	
	1.11.6	Systems developed from the Framework Architecture shall display messages to the driver in a priority order that relates to the current traffic and driving situation and the workload of the driver.	1.13.5

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	1.12.3	Systems that conform to the Framework Architecture shall encrypt all personal information prior to it being transmitted.	
	1.12.4	System that conform to the Framework Architecture shall be able to maintain its own integrity, e.g. only react to authorised sources, and check that input data is reasonable.	
	1.13.7	The Systems developed from the Framework Architecture shall ensure that all the information presented to the driver on one or more channels is unambiguous and consistent.	1.13.1
	1.13.8	System that conform to the Framework Architecture shall display traffic signs according to the Vienna convention.	
	1.15.1	Systems developed from the Framework Architecture shall be able to provide an un-attributable, but unique, identifier to each vehicle for the duration of a trip in order to provide basic privacy.	
	1.16.1	Systems developed from the Framework Architecture shall be able to send messages through more than one vehicle and/or road-side device (multi-hop).	
	1.16.2	Systems that conform to the Framework Architecture shall be able to transmit data correctly without a re-transmission (i.e. use error correcting codes).	
	1.16.3	Systems that conform to the Framework Architecture shall manage the communications in a manner which ensures that the communications infrastructure is not overwhelmed by too many messages.	
	1.16.4	Systems developed from the Framework Architecture shall be able to communicate with each vehicle individually, or by class (location, type, speed, lane, area, approaching or leaving a junction).	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
Cooperative Systems – Traffic Safety	**7.4**	*These are applications and services that enhance the safety of traffic by providing Road Hazard Warnings, Ghost Driver Management, advice on Lane Utilisation, Speed Management, Headway Management, Collision Warnings, VRU Warnings, and Warnings about Emergency Vehicles. These User Needs are associated with functions that are expected to use V2V and V2I technologies (Cooperative Systems).*	
Road Hazard Warning	**7.4.1**	*The activities associated with the collection of data, e.g. FCD and weather conditions, about the current situation, identification as to whether a hazardous condition exists, and then the provision of warnings to drivers that are appropriate to that hazard (motorcycle, traffic conditions, traffic queues, hazardous locations). In this set, each User Needs starts with a title that indicates its rôle in this scenario.*	
	7.4.1.1	*(X)FCD* – The system shall be able to maintain a database of the road network.	
	7.4.1.2	*(X)FCD* – The system shall be able to determine the intended route of the host vehicle.	6.4.0.1 7.5.1.2
	7.4.1.3	*(X)FCD* – The system shall be able to determine the relative position of the host vehicle on a road (e.g. lane, distance from a datum point) at all times (urban, inter-urban, tunnels etc.).	8.4.2.1
	7.4.1.4	*(X)FCD* – The system shall be able to obtain information (values and status) from the host vehicle's systems (e.g. ABS, ESP, Longitudinal and Lateral Acceleration, Speed, Wipers) without affecting the safe functioning of those systems.	8.5.3.4
	7.4.1.5	*(X)FCD* – The system shall be able to determine the environmental conditions in the vicinity of the host vehicle.	
	7.4.1.6	*(X)FCD* – The system shall be able to determine the visibility in the vicinity of the host vehicle, and classify the cause of the reduction, e.g. fog, rain, darkness.	
	7.4.1.7	*(X)FCD* – The system shall be able to infer XFCD, i.e. the road conditions (e.g. reduced friction, aquaplaning) and traffic conditions (e.g. vehicle breakdown, traffic incident), from the state of the host vehicle systems' data (e.g. speed, acceleration, brakes, lights).	
	7.4.1.8	*(X)FCD* – The system shall be able to maintain a database of dynamic fused XFCD from the host vehicle's systems and sensors.	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.4.1.9	*(X)FCD* – The system shall be able to send XFCD from the host vehicle to a road-side device.	8.2.4.1
	7.4.1.10	*(X)FCD* – The system shall enable data received from vehicles by a road-side device to be integrated, analysed and fused.	8.2.4.1
	7.4.1.11	*(X)FCD* – The system shall enable a road-side device to send fused traffic data to the TCC.	
	7.4.1.12	*(X)FCD* – The system shall enable a road-side device to send weather and environmental conditions to the TCC road-side device.	
	7.4.1.13	*(X)FCD* – The system shall be able to fuse the XFCD data from a number of vehicles with the host vehicle data to create a more accurate view of the road and traffic conditions in that area.	
	7.4.1.14	*(X)FCD* – The system shall be able to send fused FCD to the TCC from an road-side device.	
	7.4.1.15	*(X)FCD* – The system shall be able to send XFCD to the TCC from the host vehicle.	
	7.4.1.16	*(X)FCD* – The system shall be able to add traffic data from the infrastructure (e.g. induction loops, radar) to the fused XFCD data of the road-side device.	
	7.4.1.17	*(X)FCD* – The system shall be able to communicate with another vehicle either directly, or via an road-side device. (Communications).	8.2.4.1
	7.4.1.18	*(X)FCD* – The system shall be able to match a visual image of a vehicle with the (un-attributable – for privacy protection) identity of a vehicle that is providing FCD and/or XFCD.	
	7.4.1.19	*Hazard Detection* – The system shall be able to determine the existence of a sharp curve from the road network database.	
	7.4.1.20	*Hazard Detection* – The system shall be able to determine that the host vehicle is partially occupying an adjacent lane for a short time, e.g. due to manoeuvre round a sharp bend, or lane width reductions.	
	7.4.1.21	*Hazard Detection* – The system shall be able to detect the presence of fire or smoke on the host vehicle.	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.4.1.22	*Hazard Detection* – The system shall enable the host vehicle to send information about its own safety behaviour (i.e. whether or not the vehicle was being driven in an unsafe manner, e.g. excessive speeding, swapping of lanes, overtaking, driver inattention) to a road-side device.	
	7.4.1.23	*Hazard Detection* – The system shall be able to detect presence of other vehicles and traffic participants in the vicinity of the host vehicle, and determine its type, e.g. car, lorry, emergency, maintenance, cycle, pedestrian.	
	7.4.1.24	*Hazard Detection* – The system shall be able to determine the status of the traffic in the vicinity of the host vehicle, e.g. congestion, stationary vehicle(s).	
	7.4.1.25	*Hazard Detection* – The system shall be able to detect the presence of stationary objects (seen or deduced) in the carriageway ahead of the host vehicle, and to warn the driver via an in-vehicle device.	
	7.4.1.26	*Hazard Detection* – The system shall be able to detect the presence of stationary objects (seen or deduced) in the opposite carriageway to that of the host vehicle, and to send a warning to other vehicles.	
	7.4.1.27	*Hazard Detection* – The system shall enable the TCC to determine whether an incident has occurred.	
	7.4.1.28	*Hazard Detection* – The system shall enable an road-side device to determine whether an incident has occurred.	
	7.4.1.29	*Motorcycle Warning* – The system shall be able to detect that the host motorcycle has fallen onto the road pavement, and send this information to other vehicles.	
	7.4.1.30	*Motorcycle Warning* – The system shall be able to detect that the host motorcycle has fallen onto the road pavement, and send this information to a road-side device.	
	7.4.1.31	*Traffic Condition Warning* – The system shall be able to warn drivers in a timely manner of moving incidents (e.g. road/winter maintenance vehicles, long/wide loads) via an in-vehicle display.	7.2.5.1

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.4.1.32	*Traffic Condition Warning* –The system shall be able to send to vehicles following the host vehicle information about the traffic conditions, or the traffic signs, near the host vehicle, that it may be useful to receive in advance.	7.4.1.49 7.4.2.6 7.4.3.10 7.4.4.18 8.5.5.2
	7.4.1.33	*Traffic Queue Detection* – The system shall be able to locate the tail end of a traffic queue and estimate its speed of propagation.	
	7.4.1.34	*Traffic Queue Detection* – The system shall be able to inform drivers, via in-vehicle and road-side devices, of slow moving obstacles (e.g. person, animal, slow vehicle) and advise on the appropriate action (e.g. speed and lane).	
	7.4.1.35	*Hazardous Location Notification* – The system shall be able to warn drivers in a timely manner of incidents ahead (e.g. road works, accident, traffic queue) via an in-vehicle display. Where available and relevant this information shall include lane(s)/road section(s) affected and expected delay.	7.2.2.3 7.2.4.1
	7.4.1.36	*Hazardous Location Notification* – The system shall be able to warn the driver in a timely manner, via an in-vehicle display, of adverse road surfaces and weather conditions along the planned route.	7.2.5.1
	7.4.1.37	*Hazardous Location Notification* – The system shall be able to warn driver, via an in-vehicle device, of adverse driving conditions ahead (e.g. slippery road, low visibility, queuing traffic) and advise on the appropriate action (e.g. speed).	6.2.2.4 7.1.1.6 7.1.2.6 7.2.5.1
	7.4.1.38	*Hazardous Location Notification* – The system shall be able to warn drivers, via a road-side device, of adverse driving conditions ahead (e.g. slippery road, low visibility, queuing traffic) and advise on the appropriate action (e.g. speed).	6.2.2.4 7.1.1.6 7.1.2.6 7.2.5.1

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.4.1.39	*Hazardous Location Notification* – The system shall be able to warn the driver, via an in-vehicle device, that the host vehicle is about to enter a curve that has been classified as a black spot for that category of vehicle, and recommend a suitable speed and trajectory.	
	7.4.1.40	*Hazardous Location Notification* – The system shall be able to warn the driver, via an in-vehicle device, that the host vehicle is about to enter a section of road whose surface has less grip than normal (low μ).	
	7.4.1.41	*Hazardous Location Notification* – The system shall be able to inform drivers, via an in-vehicle device, of obstacles in the carriageway and advise on the appropriate action (e.g. speed and lane).	7.4.6.14
	7.4.1.42	*Hazardous Location Notification* – The system shall be able to inform drivers, via road-side devices, of obstacles in the carriageway and advise on the appropriate action (e.g. speed and lane).	7.4.6.14
	7.4.1.43	*Hazardous Location Notification* – The system shall enable a road-side device to select and activate a traffic management strategy in the event of an incident (including poor driving conditions).	
	7.4.1.44	*Hazardous Location Notification* – The system shall be able to send information about incidents ahead in the next section from a road-side device to drivers via an in-vehicle device.	
	7.4.1.45	*Hazardous Location Notification* – The system shall be able to estimate the condition of the road surface in the vicinity of the host vehicle and send warnings to other vehicles.	8.2.4.1
	7.4.1.46	*Hazardous Location Notification* – The system shall be able to estimate the condition of the road surface in the vicinity of the host vehicle and send warnings to a road-side device.	8.2.4.1
	7.4.1.47	*Hazardous Location Notification* – The system shall be able to send information about incidents on the road network ahead from the TCC to drivers via an in-vehicle device.	
	7.4.1.48	*Hazardous Location Notification* – The system shall provide "copies" of the traffic signs that are relevant to the current section of the road (e.g. speed limit, road hazards, junctions) to the driver at all times via an in-vehicle display.	7.4.2.5 7.4.3.9 7.4.4.17 8.5.5.1

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.4.1.49	*Hazardous Location Notification* – The system shall be able to send to following vehicles "copies" of the traffic signs, or information about the local traffic (e.g. sudden congestion), that it may be useful to receive in advance.	7.4.1.32 7.4.2.6 7.4.3.10 7.4.4.18 8.5.5.2
Ghost Driver Management	**7.4.2**	*The activities associated with the management of the situation when a vehicle is being driven the wrong way along a road or carriageway.*	
	7.4.2.1	The system shall be able to detect that a (non-self-reporting) vehicle is travelling in the wrong direction along a “one-way” road (i.e. a ghost driver), and warn other vehicles “ahead” of that vehicle.	
	7.4.2.2	The system shall be able to warn drivers in a timely manner of self-reporting ghost drivers via an in-vehicle display.	7.2.5.1
	7.4.2.3	The system shall be able to detect that the host vehicle is travelling in the wrong direction along a “one-way” road (i.e. a ghost driver), and warn/advise that driver to correct the situation.	
	7.4.2.4	The system shall be able to detect that a vehicle is overtaking (i.e. in the wrong lane) on a two-lane road and that there is another vehicle approaching in that lane, and provide a warning to the drivers of both vehicles via their in-vehicle devices.	
	7.4.2.5	The system shall provide "copies" of the traffic signs that are relevant to the current section of the road (e.g. speed limit, road hazards, junctions) to the driver at all times via an in-vehicle display.	7.4.1.48 7.4.3.9 7.4.4.17 8.5.5.1
	7.4.2.6	The system shall be able to send to following vehicles "copies" of the traffic signs, or information about the local traffic (e.g. sudden congestion), that it may be useful to receive in advance.	7.4.1.32 7.4.1.49 7.4.3.10 7.4.4.18 8.5.5.2

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
Lane Utilization	**7.4.3**	*The activities associated with the management of the use of lanes on a multi-lane road, including providing restrictions, the management of obstacles and of hard shoulder running.*	
	7.4.3.1	The system shall be able to provide lane usage information to the driver via an in-vehicle display.	
	7.4.3.2	The system shall be able to provide lane restriction information (e.g. HGV, HOV) from outside the vehicle, and to confirm that it is consistent with the information that has been sent directly to that vehicle.	7.1.10.1
	7.4.3.3	The system shall be able to provide instructions not to change lanes to the driver via an in-vehicle device in order to stabilise the total traffic flow. These instructions may either apply to all types of vehicle, or to sub-sets.	
	7.4.3.4	The system shall provide information to the driver via an in-vehicle display when auxiliary lanes are now available for use by that type of vehicle (e.g. hard shoulder running).	
	7.4.3.5	The system shall ensure that the auxiliary lane is free from obstacles before it is released for use.	
	7.4.3.6	The system shall be able to provide lane usage information to the driver via an in-vehicle display when there are temporary restrictions to lane usage (e.g. at road works).	7.1.5.2
	7.4.3.7	The system shall be able to advise a driver, via an in-vehicle device, which lane to use when passing an incident/accident.	
	7.4.3.8	The system shall be able to advise a driver, via an in-vehicle device, where to stop safely (e.g. an appropriate exit lane, hard shoulder)	
	7.4.3.9	The system shall provide "copies" of the traffic signs that are relevant to the current section of the road (e.g. speed limit, road hazards, junctions) to the driver at all times via an in-vehicle display.	7.4.1.48 7.4.2.5 7.4.4.17 8.5.5.1

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.4.3.10	The system shall be able to send to following vehicles "copies" of the traffic signs, or information about the local traffic (e.g. sudden congestion), that it may be useful to receive in advance.	7.4.1.32 7.4.1.49 7.4.2.6 7.4.4.18 8.5.5.2
Speed Management	**7.4.4**	*The activities associated with providing warning to drivers on the current legal speed limit and/or the current recommended speed limit.*	7.1.7.n
	7.4.4.1	The system shall be able to recommend a safe speed limit according to the prevailing traffic, weather and road conditions based on the current legal speed limit.	8.2.5.1 8.2.5.4
	7.4.4.2	The system shall be able to warn drivers, via an in-vehicle display, of different legal speed limits as a result of particular weather conditions.	7.1.7.3
	7.4.4.3	The system shall provide legal speed limits continuously to the driver, via an in-vehicle display, according to the type of the host vehicle and the lane in which it is travelling (Intelligent Speed Adaptation – ISA). A suitable message should be provided if the service provision cannot be guaranteed.	8.2.5.1 8.2.5.4
	7.4.4.4	The system shall be able to provide recommended speed limits continuously to the driver, via an in-vehicle display, according to the type of the host vehicle and the lane in which it is travelling (Intelligent Speed Adaptation – ISA). A suitable message should be provided if the service provision cannot be guaranteed.	8.2.5.1 8.2.5.4
	7.4.4.5	The system shall enable the driver of the host vehicle, via an in-vehicle device, to receive safety-related information (e.g. legal speed limit, recommended speed limit) from other vehicles in the vicinity.	8.2.5.1 8.2.5.4
	7.4.4.6	The system shall enable the driver of the host vehicle, via an in-vehicle device, to receive safety-related information (e.g. legal speed limit, recommended speed limit) from a road-side device.	8.2.5.1 8.2.5.4
	7.4.4.7	The system shall enable the driver of the host vehicle, via an in-vehicle device, to receive safety-related information (e.g. legal speed limit, recommended speed limit) from the TCC.	8.2.5.1 8.2.5.4

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.4.4.8	The system shall be able provide recommended speed limits from outside the vehicle, and to confirm that they are consistent with the limits that have been sent directly to that vehicle.	8.2.5.2
	7.4.4.9	The system shall enable a road-side device to display safety-related information (e.g. legal speed limit, recommended speed limit) to drivers via a road–side device.	8.2.5.2
	7.4.4.10	The system shall enable the TCC to display safety-related information (e.g. legal speed limit, recommended speed limit) to drivers via a road-side device.	8.2.5.2
	7.4.4.11	The system shall be able to compare the reported speed of a vehicle with the current legal speed limit and send a warning to that vehicle for display to the driver, via an in-vehicle device, if its current speed is greater than the legal speed limit.	
	7.4.4.12	The system shall be able to compare the reported speed of a vehicle with the current legal speed limit and display a warning to the driver, via a road-side device, if its current speed is greater than the legal speed limit.	
	7.4.4.13	The system shall be able to compare the reported speed of a vehicle with the current recommended speed limit and send a warning to that vehicle for display to the driver, via an in-vehicle device, if its current speed is greater than the recommended speed limit.	
	7.4.4.14	The system shall be able to compare the reported speed of a vehicle with the current recommended speed limit and display a warning to the driver, via a road-side device, if its current speed is greater than the recommended speed limit.	
	7.4.4.15	The system shall be able to warn the driver, via an in-vehicle device, that the host vehicle is exceeding the maximum speed limit.	
	7.4.4.16	The system shall inform the driver, via an in-vehicle display, that there is a modification to the speed limit ahead, and the reason for it.	
	7.4.4.17	The system shall provide "copies" of the traffic signs that are relevant to the current section of the road (e.g. speed limit, road hazards, junctions) to the driver at all times via an in-vehicle display.	7.4.1.48 7.4.2.5 7.4.3.9 8.5.5.1

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.4.4.18	The system shall be able to send to following vehicles "copies" of the traffic signs, or information about the local traffic (e.g. sudden congestion), that it may be useful to receive in advance.	7.4.1.32 7.4.1.49 7.4.2.6 7.4.3.10 8.5.5.2
Headway Management	**7.4.5**	*The activities associated with providing a driver with a safe recommended headway from the vehicle in front.*	
	7.4.5.1	The system shall enable the TCC to calculate recommended headways for the current traffic and environment conditions.	
	7.4.5.2	The system shall provide the current minimum headway for the current speed limit to the driver via an in-vehicle device.	
	7.4.5.3	The system shall be able to recommend a safe minimum headway according to the current speed limit, traffic, weather and road conditions to the driver via an in-vehicle device.	
	7.4.5.4	The system shall inform the driver, via an in-vehicle display, that there is a modification to the recommended headway ahead, and the reason for it.	
	7.4.5.5	The system shall be able to warn the driver, via an in-vehicle device, that the host vehicle is violating the minimum headway.	
Collision Warning	**7.4.6**	*The activities associated with identifying the possibility of collision with another vehicle in various circumstances and sending a consequential warning to the driver.*	
	7.4.6.1	The system shall be able to determine the type and current position of other vehicle(s) in the vicinity of the host vehicle, and to predict their future path(s).	
	7.4.6.2	The system shall be able to determine that there is a high probability of a collision between the host vehicle and another vehicle.	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.4.6.3	The system shall be able to warn the driver approaching a junction, via an in-vehicle device, of other equipped vehicles approaching that junction.	
	7.4.6.4	The system shall be able to warn the driver approaching a junction, via an in-vehicle device, of an equipped emergency vehicle that is approaching that junction.	
	7.4.6.5	The system shall be able to determine that the host vehicle is (about to) change lanes and warns the driver, via and in-vehicle device, if there are other equipped vehicles on potential collision path (e.g. motor-cycle in a blind spot).	
	7.4.6.6	The system shall be able to determine that the host vehicle is (about to) overtake, or turn across the road, and warns the driver, via and in-vehicle device, if there are other equipped vehicles on potential collision path (e.g. motor-cycle in a blind spot).	
	7.4.6.7	The system shall be able to compare the current trajectory of a vehicle with the road geometry and send a warning to that vehicle for display to the driver, via an in-vehicle device, that it is about to depart its lane.	
	7.4.6.8	The system shall be able to compare the current trajectory of a vehicle with the road geometry and send a warning to the driver, via a road-side device, that it is about to depart its lane.	
	7.4.6.9	The system shall be able to compare the current trajectory of a vehicle with the road geometry and send a warning to the drivers of other vehicles that might be affected, via an in-vehicle device, that an oncoming vehicle lane departure into their lane is imminent.	
	7.4.6.10	The system shall be able to compare the current trajectory of a vehicle with the road geometry and send a warning to the drivers of other vehicles that might be affected, via a road-side device, that an oncoming vehicle lane departure into their lane is imminent.	
	7.4.6.11	The system shall be able to warn the driver, via an in-vehicle device, that another equipped vehicle is approaching the host vehicle from the front and in the same (partial) lane.	
	7.4.6.12	The system shall be able to warn the driver, via an in-vehicle device, that another equipped vehicle is approaching the host vehicle from the rear in the same (partial) lane and, when possible, provide advice, e.g. change to a safe adjacent lane, accelerate.	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.4.6.13	The system shall be able to warn the driver, via an in-vehicle device, that a slower equipped vehicle is ahead of the host vehicle and in the same (partial) lane and, when possible, provide advice, e.g. change to a safe adjacent lane, decelerate, brake.	
	7.4.6.14	The system shall be able to warn the driver, via an in-vehicle device, that there is a stationary object ahead of the host vehicle and in the same (partial) lane and, when possible, provide advice, e.g. change to a safe adjacent lane, brake.	7.4.1.41 7.4.1.42
	7.4.6.15	The system shall be able to advise the driver, via an in-vehicle device, of a recommended speed and distance from the vehicle ahead, based on the speed and characteristics (e.g. mass, load being carried) of the host vehicle and of the vehicle ahead.	
	7.4.6.16	The system shall be able to calculate the current and future trajectories of each vehicle and VRU approaching the host vehicle at an urban intersection and assess the potential for collisions with the host vehicle.	
	7.4.6.17	The system shall be able to warn the driver of the host vehicle, via an in-vehicle device, of any collisions that could occur with other vehicles and/or VRU that are approaching an urban intersection.	
	7.4.6.18	The system shall be able to use a road-side device to warn drivers of any collisions that could occur with other vehicles and/or VRU that are approaching an urban intersection.	
	7.4.6.19	The system shall be able to calculate the trajectory of each vehicles and VRU approaching a T-junction, predict their future trajectories, assess potential conflicts and advise the driver on the minor road when to exit and join the main road.	
	7.4.6.20	The system shall be able to receive the status of traffic signals/signs that the host vehicle is approaching.	
	7.4.6.21	The system shall be able to provide advice to the driver approaching a junction, via an in-vehicle device, recommendations in terms of lane, speed, when traffic signal will change.	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.4.6.22	The system shall be able to advise a driver, via an in-vehicle device, how to approach a complex urban junction, e.g. speed required to go through green phase, imminent red phase warning, reduce speed to avoid queuing traffic, another vehicle or VRU, recommended lane choice.	
	7.4.6.23	The system shall be able to provide a warning to the driver, via an in-vehicle display, that other drivers ahead are performing an emergency brake manoeuvre.	
	7.4.6.24	The system shall be able to inform vehicles behind the host vehicle that it is performing an emergency brake manoeuvre.	
	7.4.6.25	The system shall be able to provide a warning to the driver, via an in-vehicle display, that other vehicles behind are behaving in a dangerous manner (e.g. over speed limit, below minimum headway).	
Vulnerable Road User Warning	**7.4.7**	*The activities associated with warning a driver that a VRU is in a dangerous location.*	
	7.4.7.1	The system shall be able to warn the driver, via an in-vehicle device, that a VRU has been detected in a dangerous location by a system at the road side.	
	7.4.7.2	The system shall be able to warn the driver, via an in-vehicle device, that a VRU has been detected in a dangerous location by a system on the host vehicle.	
Emergency Vehicle Warning	**7.4.8**	*The activities associated with facilitating a smooth journey (blue wave) for emergency vehicles.*	
	7.4.8.1	The system shall enable drivers to be warned, via an in-vehicle device, that there are one, or more, stationary assistance/emergency vehicles ahead of them.	
	7.4.8.2	The system shall enable drivers to be warned, via a road-side device, that there are one, or more, stationary assistance/emergency vehicles ahead of them.	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.4.8.3	The system shall enable an emergency vehicle to request a “blue wave” from those other vehicles that are in its path.	
	7.4.8.4	The system shall enable an emergency vehicle to request a green signal for when that vehicle passes a controlled intersection.	
	7.4.8.5	The system shall enable the trajectory of an emergency vehicle to be predicted and compared with the trajectories of other vehicles in the vicinity, and to warn the drivers of those other vehicles with a potential conflict, via an in-vehicle device.	
	7.4.8.6	The system shall be able to inform the driver of the host vehicle, via an in-vehicle device, that an emergency vehicle is approaching, and in sufficient time to enable a “blue corridor” to be created by all equipped vehicles.	
	7.4.8.7	The system shall be able to advise the driver, via an in-vehicle device, of an appropriate lane to use to create a “blue corridor”.	
	7.4.8.8	The system shall enable the host emergency vehicle to “place” virtual cones around the site of an accident.	
	7.4.8.9	The system shall enable the driver of the host vehicle to be advised, via an in-vehicle device, not to enter a zone defined by virtual cones.	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
Cooperative Systems – Traffic Efficiency	**7.5**	*These are applications and services that enhance the efficiency of traffic by providing Traffic Flow Optimisation, Advanced Adaptive Traffic Signals and Flexible Lane Allocation. These User Needs are associated with functions that are expected to use V2V and V2I technologies (Cooperative Systems).*	
Traffic Flow Optimisation	**7.5.1**	*The activities associated with optimising the traffic flow by providing routes suitable for the vehicle, and alternatives when there is congestion.*	
	7.5.1.1	The system shall enable a traveller to request and receive journey plans in advance, assess different plans according to certain criteria (e.g. vehicle type, travel time, cost, expected traffic density, planned events, facilities en route, parking), and to save one for future use.	6.1.0.4 6.1.0.5 6.1.0.6 7.6.2.3
	7.5.1.2	*(X)FCD* – The system shall be able to send the intended route of the host vehicle (e.g. from a navigation system) to a road-side device.	7.4.1.2 8.2.4.1
	7.5.1.3	The system shall be able to monitor the current inter-urban traffic and weather/environmental conditions, identify incidents, assess their impact, make short term predictions, and select and initiate an appropriate mitigation strategy.	7.1.1.3 7.1.3.5
	7.5.1.4	The system shall be able to monitor the current inter-urban traffic and weather/environmental conditions for the road network and recommend and/or set an appropriate traffic management strategy.	7.1.1.3 7.1.3.5
	7.5.1.5	The system shall be able to manage the traffic in an area using a number of local semi-autonomous traffic management units, whose rules can be modified when required.	
	7.5.1.6	The system shall enable the TCC to receive information about emergencies, e.g. eCall, ghost drivers.	
	7.5.1.7	The system shall enable the TCC to obtain travel times from cellular telephone service providers.	
	7.5.1.8	The system shall enable the TCC to inform drivers, via an in-vehicle device, about (foreseen and unexpected) incidents on the driver's planned route.	7.1.7.6

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.5.1.9	The system shall be able to warn the driver, via an in-vehicle device, of incidents in the urban road network as they are detected.	
	7.5.1.10	The system shall enable the service provided to the traveller to be passed from one TCC to another as the traveller moves from one area of coverage to another.	
	7.5.1.11	The system shall be able to provide the driver, via an in-vehicle device, and on request, details of the (predicted) traffic situation in a defined area of interest, and for a time horizon, that has been selected by the driver. This information shall be updated at (selected) intervals.	
	7.5.1.12	The system shall enable the driver to store data relating to the characteristics of the host vehicle for that trip (e.g. loaded weight, hazardous goods, (trailer) dimensions).	9.5.7.1
	7.5.1.13	The system shall be able to determine the characteristics of the host vehicle (e.g. Type, (Total) weight, Width, Length (including trailer)).	9.5.7.2
	7.5.1.14	The system shall enable the host vehicle to receive information from other vehicles about the goods being carried by those vehicles.	9.5.7.3
	7.5.1.15	The system shall be able to provide the driver via an in-vehicle device with a route to a selected destination that takes account of the vehicle type, the state of the traffic on the road network and any incidents/congestion (route options may be offered and one selected by the driver).	7.2.2.3
	7.5.1.16	The system shall be able to calculate an optimal speed for each type of vehicle through designated sections of the road network and provide that information to drivers via an in-vehicle device.	
	7.5.1.17	The system shall be able to compute an alternative local route for vehicles approaching a location to be avoided (e.g. one where there is a traffic incident or congestion above a given severity), and does not create congestion downstream. The alternative route computed may depend upon the vehicle type, and may need to be changed as the incident or congestion to be avoided evolves over time.	7.1.0.5 7.1.5.7 7.2.0.1
	7.5.1.18	The system shall be able to inform the driver, via an in-vehicle device, that an incident has been detected ahead on the selected route and provide a revised route.	6.2.1.1

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.5.1.19	The system shall be able to present an alternative route that avoids an incident or congestion to the driver via an in-vehicle device, and to update that route if necessary.	
	7.5.1.20	The system shall enable the TCC to instruct drivers, via an in-vehicle device, of an alternative route that should be followed (to avoid an incident).	
	7.5.1.21	The system shall be able to “follow” those vehicles that have been provide with individual routes and to prove the effectiveness of those suggested routes, making changes to the algorithms that will be used in the future if necessary.	7.1.1.1
	7.5.1.22	The system shall be able to inform the driver via an in-vehicle device that part(s) of the selected route include one or more Flexible Lane Allocation sections.	
	7.5.1.23	The system shall inform the driver via an in-vehicle device that the vehicle has departed from the selected route and a revised route has been requested.	6.4.0.4
	7.5.1.24	The system shall be able to calculate a predicted time for a total journey made up from separate links. The predicted time shall be updated regularly as the time for each link changes.	6.4.1.3 7.1.6.1
	7.5.1.25	The system shall enable the TCC to recommend the use of alternative routes for different types of vehicle.	6.4.0.4 7.1.5.6 7.3.1.2 9.5.2.12
	7.5.1.26	The system shall enable the TCC to command the use of alternative routes for different types of vehicle.	6.4.0.4 7.1.5.6 7.3.1.2 9.5.2.12
	7.5.1.27	The system shall be able to provide current and predicted journey times to another navigation device via an open interface (to enable dynamic navigation on the other device).	
	7.5.1.28	The system shall enable the TCC to inform traveller information service providers of the current traffic management strategy.	7.1.0.9
	7.5.1.29	The system shall be able to analyse traffic data using an off-line simulation tool.	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.5.1.30	The system shall be able to use a simulation model for predicting the effects of implementing a given cooperative traffic management scenario.	7.3.0.4 7.3.0.5
Advanced Adaptive Traffic Signals	**7.5.2**	*The activities associated with improving the flow of traffic through a signalised junction.*	
	7.5.2.1	The system shall enable a road-side device to receive information on the status of traffic signals.	
	7.5.2.2	The system shall enable the driver of a host vehicle to request a series of green phases from traffic signals (i.e. a green wave) for the route that is about to be taken.	
	7.5.2.3	The system shall enable a traffic signal controller to receive a request for a green phase from an approaching vehicle; in the event that more than one conflicting request is received at the same time they shall be prioritised (e.g. emergency vehicles before private vehicles), possibly by the TCC operator.	7.1.9.1
	7.5.2.4	The system shall be able to determine the queue length in front of traffic signals in urban areas.	
	7.5.2.5	The system shall enable the traffic signal controller to determine the expected arrival time of a vehicle at the junction using data received from that vehicle (e.g. current location and speed profile, estimated time of arrival).	
	7.5.2.6	The system shall enable the traffic signal controller to inform the driver, via an in-vehicle display, that a green phase will be available when the host vehicle arrives at that junction at a recommended speed; this includes the ability to warn that a green phase is not possible.	
	7.5.2.7	The system shall be able to calculate an optimal speed for each vehicle through a section of road.	
	7.5.2.8	The system shall enable a traffic signal controller that has received a green phase request to inform downstream controllers that a green wave vehicle is approaching.	
	7.5.2.9	The system shall be able to keep track of the speed profiles of green wave vehicles between signalised junctions.	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.5.2.10	The system shall be able to warn other vehicles that a green wave is in operation.	
	7.5.2.11	The system shall be able to determine that the host vehicle is about to go through a red traffic signal, and to broadcast a warning to vehicles in the vicinity.	
	7.5.2.12	The system shall enable the host vehicle to receive a message that another vehicle is about to go through a red traffic signal, and to provide a warning to the driver, via an in-vehicle device.	
Flexible Lane Allocation	**7.5.3**	*The activities associated with the temporary use of PT lanes by other authorised vehicles.*	
	7.5.3.1	The system shall permit approved vehicles to use a section of a bus lane when it is not being used by PT or other specific vehicles (e.g. taxis and emergency services).	
	7.5.3.2	The system shall be able to predict the usage of a particular section of a bus lane for a short time into the future (e.g.15 minutes).	
	7.5.3.3	The system shall enable an approved vehicle that wishes to use a section of bus lane to provide its characteristics, destination and speed for lane use management.	
	7.5.3.4	The system shall enable the driver to set the destination of the host vehicle that wishes to use a bus lane, if this cannot be provided by the navigation system for lane use management.	
	7.5.3.5	The system shall be able to determine whether there is congestion on the normal road and, if so, whether a temporary licence should be given to the approved vehicle that is making a request to use a corresponding section of a bus lane without causing delays to scheduled PT vehicles.	
	7.5.3.6	The system shall inform the driver whether a licence has been granted to become an approved vehicle and, if so, for how long it will remain valid.	
	7.5.3.7	The system shall monitor the approved vehicles on the bus lanes and, if its licence has expired, that vehicle will be ordered to leave the bus lane at the end of that section.	
	7.5.3.8	The system shall monitor the usage of the bus lanes, and if a green wave cannot be sustained for a PT vehicle, then approved vehicles shall be ordered to leave the bus lane at the end of that section, and no further licences will be granted until suitable conditions are resumed.	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.5.3.9	The system shall monitor the congestion in each section of a bus lane and if a "critical/emergency" situation arises then approved vehicles shall be ordered to leave that section and the up-stream section(s) of bus lanes.	
	7.5.3.10	The system shall monitor the usage of the bus lanes and record the identification, time and location of any vehicle that does not have permission to use it, for further processing by an enforcement agency.	
	7.5.3.11	The system shall collect traffic information (e.g. number of vehicles, speeds, queue lengths, violation details) on the roads covered by flexible bus lane allocation for statistical purposes, and to improve the algorithms used to decide when non-PT vehicles can use the bus lane.	
Cooperative Systems – Value-Added and Other Services	**7.6**	*These are applications and services that provide eCall, Enhanced Route Guidance and Navigation, Access Control and Service Continuity. These User Needs are associated with functions that are expected to use V2V and V2I technologies (Cooperative Systems).*	
eCall	**7.6.1**	*These activities are associated with providing emergency support after a traffic/vehicle/driver incident.*	5.1.0.n 7.2.0.n 7.2.1.n
	7.6.1.1	The system shall be able to detect that the host vehicle has been involved in an incident/accident and to call the emergency services either automatically or on command of the driver/passenger (eCall).	
	7.6.1.2	The system shall be able to send a request for assistance (eCall) message to the emergency services from a road-side device.	8.5.1.1

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
Enhanced Route Guidance and Navigation	**7.6.2**	*The activities are associated with providing personalised and up-to-date route guidance.*	6.4.n.n
	7.6.2.1	The system shall be able to provide data to add to, or to replace, that used to form a digital map.	
	7.6.2.2	The system shall enable the driver of the host vehicle to provide the destination and personal settings for the journey (e.g. desired route, way points, special needs).	6.4.1.4
	7.6.2.3	The system shall enable a traveller to request and receive personalised journey plans in advance, assess different plans according to certain criteria (e.g. vehicle type, travel time, cost, expected traffic density, planned events, facilities en route, parking), and to save one for future use.	6.1.0.4 6.1.0.5 6.1.0.6 7.5.1.1
	7.6.2.4	The system shall enable the traveller information service provider to receive current inter-urban traffic management, and weather, conditions and planned events.	
	7.6.2.5	The system shall enable the traveller information service provider to be provided with current an predicted inter-urban traffic conditions.	
	7.6.2.6	The system shall enable the traveller to request and receive (anticipated) weather/environmental conditions on, or before, a planned trip.	
	7.6.2.7	The system shall be able to calculate the expected time of arrival at a destination or way point based on the driver's profile and the anticipated traffic conditions.	6.4.1.3
	7.6.2.8	The system shall be able to provide the driver, via an in-vehicle device, with a personalised route.	
	7.6.2.9	The system shall be able to provide the driver, via an in-vehicle device, with an estimated time of arrival which is updated at regular intervals.	
	7.6.2.10	The system shall enable the driver to (request and) receive, via an in-vehicle device, personalised on-trip information about incidents that may affect the planned journey.	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	7.6.2.11	The system shall enable a traveller to request and receive, via an in-vehicle device, personalised on-trip alternative journey plans (to avoid an incident) and to accept/reject the proposal(s).	
	7.6.2.12	The system shall be able to provide the pre-trip driver, via an in-vehicle device, with suggested alternative routes.	
	7.6.2.13	The system shall enable a traveller to request and receive, via an in-vehicle device, on-trip information about facilities on, or near, the planned route (e.g. fuel stations, refreshment areas).	
	7.6.2.14	The system shall be able to send O-D data, from the navigation system, and current location data from the host vehicle to the TCC to enable geo-referenced travel times to be produced.	
	7.6.2.15	The system shall enable the service provided to the traveller to be passed from one Service Provider to another as the traveller changes areas of coverage.	
Access Control	**7.6.3**	*These activities are associated with controlling access to a specific area into which only designated vehicles can go.*	7.3.1
	7.6.3.1	The system shall enable the host vehicle to receive the information from a road-side device that it is about to enter a “sensitive are”, and then to contact the relevant Access Control Centre.	
	7.6.3.2	The system shall enable the host vehicle to detect (e.g. using map matching) that it is about to enter a “sensitive area” and to contact the relevant Access Control Centre.	
	7.6.3.3	The system shall enable the Access Control Centre to give, or deny, permission for an equipped vehicle to enter a “sensitive area”.	
	7.6.3.4	The system shall enable the Access Control Centre to monitor all equipped vehicles, and the traffic, within a “sensitive area” and to send instructions to the drivers of the equipped vehicles.	
	7.6.3.5	The system shall enable the Access Control Centre to store information about each equipped vehicle.	
	7.6.3.6	The system shall enable the host vehicle to close the contact with the Access Control Centre when it leaves the “sensitive area” and to create a report for the freight vehicle driver.	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
Service Continuity	**7.6.4**	*These activities are associated with ensuring that applications and services are provided throughout a journey.*	
	7.6.4.1	The system shall be able to exchange relevant information between adjacent TCCs and TICs to ensure the continuity of services for travellers.	2.1.0.1
Freight and Fleet Management	**9**		
Hazardous Goods Vehicle Management	**9.5.6**	*The activities associated with managing the transit of hazard goods through an area.*	
	9.5.6.1	The system shall enable the relevant authority to plan and manage routes that are suitable for use by vehicles carrying hazards goods.	
	9.5.6.2	The system shall enable a driver of a vehicle carrying hazardous goods to request from the relevant authority, via an on-board device, an approved route from the current position of the host vehicle to a stated destination.	5.3.2.1 7.3.1.2 9.5.2.9
	9.5.6.3	The system shall enable the driver of a vehicle carrying hazardous goods to be guided, via an in-vehicle device, along an approved route by the relevant authority.	
	9.5.6.4	The system shall enable a vehicle carrying hazardous goods to be monitored, via an in-vehicle device, by the relevant authority.	5.3.0.n 9.5.1.5
	9.5.6.5	The system shall enable the relevant authority to detect incidents within its area and to re-route any vehicle carrying hazardous goods that will be affected by the consequences of that incident	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	9.5.6.6	The system shall enable the relevant authority to monitor all vehicles carrying hazardous goods within its area of responsibility, to confirm that they are proceeding as planned, and to contact the driver of any vehicle that is not behaving correctly.	
	9.5.6.7	The system shall enable vehicles carrying hazardous goods to be transferred from one authority to another as they pass from one area of responsibility to another.	
	9.5.6.8	The system shall enable a vehicle carrying hazardous goods to request appropriate assistance in the case of an incident or accident (eCall).	5.1.0.n 5.3.1.3 5.3.1.4 7.2.6.1
Driver Rest Areas	**9.5.7**	*The activities associated with booking and managing freight driver rest areas.*	
	9.5.7.1	The system shall enable the driver to store data relating to the characteristics of the host vehicle for that trip (e.g. loaded weight, hazardous goods, (trailer) dimensions).	7.5.1.12
	9.5.7.2	The system shall be able to determine the characteristics of the host vehicle (e.g. Type, (Total) weight, Width, Length (including trailer)).	7.5.1.13
	9.5.7.3	The system shall enable the host vehicle to receive information from other vehicles about the goods being carried by those vehicles.	7.5.1.14
	9.5.7.4	The system shall enable the freight vehicle driver, to request a reservation for a rest area parking place. The request will include the planned route, estimated time, required duration, potential flexibility, possible hazardous goods and vehicle type.	
	9.5.7.5	The system shall enable a rest area parking reservation to be made based on the request that has been received, or to state that one is not available and/or propose and alternative booking, and to send the details to the freight vehicle driver and the fleet operator.	
	9.5.7.6	The system shall enable the driver to accept or reject alternative proposals for a rest area parking place.	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	9.5.7.7	The system shall be able to receive an ETA from a vehicle that is approaching a rest area, based on current traffic conditions, and to send confirmation to the driver that the reserved parking place is still available together with information about the other services that are available.	
	9.5.7.8	The system shall enable the driver to determine the ETA to the booked rest area parking place, based on current traffic information, and to confirm/modify/cancel details of the booking.	
	9.5.7.9	The system shall be able to identify the vehicle that arrives at a rest area, and to inform the driver which parking slot to use and how to get there.	
	9.5.7.10	The system shall be able to receive a message that a vehicle is leaving the rest area.	
Loading Zone Management	**9.5.8**	*The activities associated with booking urban (un)loading places*	
	9.5.8.1	The system shall enable the freight vehicle driver, to request a reservation for an urban parking place to enable un/loading. The request will include the desired location, time, duration, potential flexibility, possible hazardous goods and vehicle type.	
	9.5.8.2	The system shall enable an un/loading zone parking allocation to be made based on the request that has been received, or to state that one is not available and/or propose an alternative booking, and to send the details to the freight vehicle driver and the fleet operator.	
	9.5.8.3	The system shall enable the driver to accept or reject alternative proposals for an urban parking place.	
	9.5.8.4	The system shall be able to receive an ETA from a vehicle that is approaching an urban parking place, and to receive confirmation that the urban parking place (or holding zone) is still/now available and/or receive updates to the booking.	
	9.5.8.5	The system shall be able to inform the driver, via an in-vehicle device, of a holding zone that may be used in the event that a suitable urban parking place is not available, or the booked urban parking place is no long available, at the desired time.	

New E-FRAME User Needs for Cooperative Systems			
	No	**User Need**	**Similar**
	9.5.8.6	The system shall enable the urban parking zone to be monitored for any vehicle that is parked with or without permission, including overstaying.	
	9.5.8.7	The system shall be able to provide up-to-date micro-routing information to a booked parking place (or holding zone).	
	9.5.8.8	The system shall be able to receive a message that a vehicle is leaving the urban parking place.	

Appendix E The Full List of FRAME User Needs

Abbreviations and Terms

The following words and abbreviations have the following meaning when used within the FRAME User Needs.

Abbreviation or Term	Meaning
ABS	Anti-lock Braking System
Access Control Centre	The (organisation and) systems that control access to a specific area, e.g. designated residential area, commercial premises.
Black box	A system within a vehicle that records key data and, whenever an incident occurs, e.g. an accident, stores that data for future analysis.
Blue corridor	The result of informing the drivers of other vehicles that an emergency vehicle is approaching in time for those vehicles to move out of the way of the emergency vehicle.
Blue wave	The synchronisation of traffic signals to (try to) ensure that an emergency vehicle never has to stop at a traffic signal.
Consignee	The receiver of goods
Consignor	The sender of goods
Demand responsive public transport	A form of public transport whose precise route can be varied at the request of the passengers, e.g. to pick up or drop off.
eCall	A system that enables the emergency services to be called either automatically, or at the request of a vehicle occupant.
Electronic towbar	A system which enables a platoon of HGVs to be established, i.e. only the first vehicle requires a human driver.
Equipment	When related to HGVs, this term refers to the part that is carrying the goods.
ESP	Electronic Stability Program
ETA	Estimated Time of Arrival
FCD	Floating Car Data – a basic set of data obtained from a vehicle that is part of the current traffic. See also XFCD.
FFM	Freight and Fleet Management
HGV	Heavy Goods Vehicle – a track/lorry with a weight of over 3500kg and for which special regulations can apply.

Holding zone	A designated area used to park goods carrying vehicles if their final destination for (un)loading is not currently available.
Host vehicle	A vehicle which is carrying the system in question.
HOV	High Occupancy Vehicle – A vehicle with one or more passengers in addition to the driver.
Ghost driver	A vehicle that is being driven the wrong way along a carriageway, e.g. one-way street, motorway.
Green wave	The synchronisation of traffic signals to (try to) ensure that most vehicles do not have to stop at a traffic signal.
Hazardous goods	Goods carried on a vehicle that require the application of special safety precautions during their transport, and that may need to be declared to the road authorities before transit.
ISA	Intelligent Speed Adaptation – a system within a vehicle that keeps that vehicle below a given speed, unless overridden by the driver.
Link	A section of a road network, normally between two (not necessarily consecutive) road intersections (e.g. motorway junctions).
O-D	Origin to Destination – used to indicate the start and finish points of a (partial) journey.
P+R	Park and Ride – A car park with associated public transport, normally to get the vehicle occupants into city centres.
Platooning	A system whereby vehicles are grouped together with electronic coupling so that they follow the behaviour of the lead vehicle automatically.
POI	Point of Interest – a specific point location that someone may find useful or interesting.
PT	Public Transport – busses or trams that share (part of) the road system with road vehicles.
Ramp metering	The use of a basic traffic signal to regulate the flow of traffic entering a motorway according to current traffic conditions
Rest area	A designated area for vehicles, in particular heavy goods vehicles, to be parked in order that their drivers can rest for a length of time.
Service provider	An organisation that supplies an ITS service to users, often for payment. It may or may not own (part) of the equipment used to provide that service, but it does provide the contact point for the users.
System	A set of interacting or interdependent components forming an integrated whole that conform to the FRAME Architecture.
Tachograph	A device that records a vehicle's speed over time.

TCC	Traffic Control Centre – the organisation and systems that control or manage the road traffic on a set of roads, either urban or inter-urban.
TIC	Traffic Information Centre – the organisation and systems that provide traffic and travel information to pre-trip and on-trip travellers, both passengers and drivers.
Tidal Flow	The use of a lane on which traffic may travel in either direction, depending on certain conditions, e.g. at rush hours.
V2I	Vehicle–to–Infrastructure communications – Communications from a vehicle to a stationary unit either at the road side, or at a communications centre.
V2V	Vehicle–to–Vehicle communications
Virtual cone zone	A set of electromagnetic signals that, together, indicate a section of road for which there is no access for normal traffic.
VMS	Variable Message Sign – an electronic traffic sign often used to give travelers information about incidents or special events
VRU	Vulnerable Road Users – e.g. pedestrians and cyclists
Weigh in motion	Devices designed to capture and record axle weights and gross vehicle weights as vehicles drive over a measurement site.
XFCD	Extended Floating Car Data – a full set of data obtained from a vehicle that is part of the current traffic. See also FCD.

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
General	**1**	*This group contains the properties that either the Framework Architecture should possess, or that systems built in conformance to the Framework Architecture should possess.*	
1.1 Architectural Properties	**1.1.1**	The Framework Architecture description shall include functional, information, physical and communication perspectives.	
	1.1.2	The Framework Architecture description shall include a number of reference models to describe the relationships between the services needed within the traffic and transport system.	
	1.1.3	The Framework Architecture description shall include a glossary to explain all the main concepts described in the architecture.	
	1.1.4	The Framework Architecture shall be provided in a form which enables it to be up-dated after delivery.	
	1.1.5	The Framework Architecture shall be technology independent.	
	1.1.6	The Framework Architecture shall facilitate the creation of modular and flexible designs, so that manufacturers can produce their own versions of equipment.	
	1.1.7	The Framework Architecture shall allow equipment performing the same service to be provided by various suppliers.	
	1.1.8	The Framework Architecture shall allow the same service to be provided by various service providers.	
	1.1.9	The Framework Architecture shall allow the user to select from one of a number of suppliers of the same service.	
	1.1.10	The Framework Architecture shall support interaction between services provided by private and public bodies.	
	1.1.11	The Framework Architecture shall allow current organisational responsibilities and legal liabilities to be retained.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	1.1.12	The Framework Architecture shall, where possible, describe migration path(s) that can be followed to enable architectures defined for existing traffic and transport management, as well as other ITS control and information systems, to become compliant.	
	1.1.13	The Framework Architecture shall allow the use of existing and emerging communication infrastructures, or describe possible migration paths to explain how they can become compliant.	
	1.1.14	The Framework Architecture shall support the integration of Traffic Information Centres and Traffic Control Centres into national and international networks.	
	1.1.15	The Framework Architecture description shall identify clearly the relevant interfaces to other modes of transport.	
1.2 Data Exchange	**1.2.1**	The Framework Architecture shall provide a high level description of the message sets and data communication protocols to be used in data transfers.	
	1.2.2	The Framework Architecture shall provide a high level description of data stores and data flows, and shall have a single data dictionary.	
	1.2.3	Systems that conform to the Framework Architecture shall exchange information in a manner that permits a given geographic location to be understood by all parties.	
	1.2.4	Systems that conform to the Framework Architecture shall exchange information in a manner that permits road and traffic conditions to be understood by all parties.	
	1.2.5	The Framework Architecture shall provide a high level description of the message sets used to exchange data with external interfaces.	
	1.2.6	The Framework Architecture shall support the use of seamless communications. This shall mean that the use of different communication networks is transparent i.e. switches are made without the intervention of the final user.	
	1.2.7	Systems that conform to the Framework Architecture shall classify incidents, their severity and reference their locations in a standard way.	1.2.4

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	1.2.8	Systems that conform to the Framework Architecture shall provide coherent and consistent advice to all drivers affected by an incident or congestion.	
1.3 Adaptability	**1.3.1**	Systems that conform to the Framework Architecture shall be able to provide facilities that accommodate the needs of disabled and elderly persons, when relevant.	
	1.3.2	Systems that conform to the Framework Architecture shall be able to provide facilities to enable data about the travel network to be entered and updated.	
	1.3.3	The Framework Architecture shall not constrain its functionality to be implemented in a single topographical domain, be it urban, inter-urban or rural.	
	1.3.4	The Framework Architecture shall not constrain its functionality to be implemented by specific local organisations.	
	1.3.5	The Framework Architecture shall not constrain user interfaces to be of a particular type, or from a particular manufacturer.	
	1.3.6	The Framework Architecture shall not require that each of its user interfaces must operate on a specific item of equipment, unless it is for safety reasons.	
	1.3.7	Systems developed from the Framework Architecture shall be able to use a digital map which contains the necessary additional data, e.g. speed limits, curvature of corners, (bus) lanes, traffic signals.	
1.4 Constraints	**1.4.1**	The Framework Architecture shall require all systems developed from it to comply with current European and National laws concerning data security, user anonymity and the protection of individual privacy.	
	1.4.2	The Framework Architecture shall require all systems developed from it to comply with the traffic laws and regulations that apply in Europe.	
	1.4.3	The Framework Architecture shall conform to relevant MoU, European directives and guidelines, and European (de facto-) standards.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
1.5 Continuity	**1.5.1**	The Framework Architecture shall provide functionality such that the quality of information content is continuous and consistent, both in time and space (i.e. as the traveller moves).	
	1.5.2	The Framework Architecture shall provide functionality that can accommodate environmental stress and infrastructure failures.	
1.6 Cost/Benefit	**1.6.1**	Whenever possible and practical, the Framework Architecture shall use the same data as input to several parts of its functionality.	
	1.6.2	The Framework Architecture shall avoid the need for unnecessary multiple data sources or redundant data management.	
	1.6.3	The Framework Architecture shall require all systems developed from it to be able to use the most cost-effective means of communication available.	
	1.6.4	The Framework Architecture shall require all systems developed from it to enable operating costs to be reduced whenever possible, when compared with the systems that they replace.	
	1.6.5	The Framework Architecture shall require all systems developed from it that require payment from a user to be able to manage fees/fares.	
	1.6.6	The Framework Architecture shall require all systems developed from it that require payment from a user to be able to receive fees/fares.	
	1.6.7	Systems upgraded to conform to the Framework Architecture, and providing the same services, shall produce financial benefit to their owners.	
1.7 Expandability	**1.7.1**	The Framework Architecture shall allow systems developed from it to have an evolutionary development strategy that enables their continuous upgrading.	
	1.7.2	The Framework Architecture shall provide services that are not constrained to operate in a particular geographic region.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
1.8 Maintainability	**1.8.1**	The Framework Architecture shall require all systems developed from it to be capable of being repaired.	
	1.8.2	The Framework Architecture shall require all systems developed from it to be easily maintainable with minimum disturbance.	
1.9 Quality of Data Content	**1.9.1**	The Framework Architecture shall enable all information systems developed from it to provide data with a stated accuracy, either as additional information or as part of the documentation, at all times.	
	1.9.2	The Framework Architecture shall require all systems developed from it to check all input data for validity, whenever possible, and to report failures.	
	1.9.3	The Framework Architecture shall enable all systems developed from it to check data values by comparing different sources, when available, so as to ensure high-accuracy and completeness.	
	1.9.4	The Framework Architecture shall require all systems developed from it to manage local/regional/national databases in a consistent way.	
1.10 Robustness	**1.10.1**	The Framework Architecture shall allow all systems developed from it to be able to detect errors in operation, when higher integrity is required, e.g. for financial, security or safety reasons.	
	1.10.2	Systems that conform to the Framework Architecture shall be able to monitor each safety-related component (including software), warn the user in case of problems, and disable it, or reduce it to a safe state.	
	1.10.3	The Framework Architecture shall require all safety-related systems developed from it to be fault-tolerant.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	1.10.4	The Framework Architecture shall require all systems developed from it to be reliable with respect to the legal and/or quality requirements necessary for each application.	
	1.10.5	The Framework Architecture shall require all systems developed from it to be able to operate in all potential climatic and traffic conditions.	
	1.10.6	Systems developed from the Framework Architecture shall be able to check input data for reasonableness before it is used by a later part of the system.	
	1.10.7	Systems developed from the Framework Architecture shall be able to obtain vehicle data in a manner that does not affect the correct functioning of the safety functions of the host vehicle.	
	1.10.8	Systems developed from the Framework Architecture shall be able to inform drivers via an in-vehicle device when it is not operating correctly.	
1.11 Safety	**1.11.1**	The Framework Architecture shall provide functionality that operates in a manner that does not generate a safety hazard for its users.	
	1.11.2	The Framework Architecture shall provide functionality that operates in a manner that does not encourage unsafe behaviour.	
	1.11.3	The Framework Architecture shall provide functionality that operates in a safe manner during degraded modes of operation.	
	1.11.4	The Framework Architecture shall provide functionality that is ultimately under the control of the human operator.	
	1.11.5	Systems developed from the Framework Architecture shall display information in a manner that will avoid driver overload, and distraction from the primary driving task.	
	1.11.6	Systems developed from the Framework Architecture shall display messages to the driver in a priority order that relates to the current traffic and driving situation and the workload of the driver.	1.13.5

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
1.12 Security	**1.12.1**	The Framework Architecture shall require that systems developed from it are capable of surviving accidental and intentional attacks on their integrity.	
	1.12.2	The Framework Architecture shall require systems developed from it to provide protection against unauthorised access.	
	1.12.3	Systems that conform to the Framework Architecture shall encrypt all personal information prior to it being transmitted.	
	1.12.4	System that conform to the Framework Architecture shall be able to maintain its own integrity, e.g. only react to authorised sources, and check that input data is reasonable.	
1.13 User Friendliness	**1.13.1**	The Framework Architecture shall require all systems developed from it to have user interfaces with similar "look and feel" and similar end user assistance.	
	1.13.2	The Framework Architecture shall require all systems developed from it to be simple and efficient for travellers to use, and easy to understand.	
	1.13.3	The Framework Architecture shall require all interactive systems developed from it to have a user interface syntax that is easy to learn and to remember (especially for users with specific needs).	
	1.13.4	Systems developed from the Framework Architecture shall produce their output within a time that is sufficient to be useful, and within normal expectations,	
	1.13.5	The Framework Architecture shall require all systems developed from it to provide facilities that enable their users to control the speed and frequency of information presentation.	
	1.13.6	The Framework Architecture shall ensure that the safety and security of systems developed from it are not compromised by their ease of use.	
	1.13.7	The Systems developed from the Framework Architecture shall ensure that all the information presented to the driver on one or more channels is unambiguous and consistent.	1.13.1

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	1.13.8	Systems that conform to the Framework Architecture shall display traffic signs according to the Vienna convention.	
1.14 Special Needs	**1.14.1**	The Framework Architecture shall require systems developed from it to accommodate those users with one or more impairments (e.g. of upper/lower limbs/body, stature, coordination or power, vision, hearing, speech, cognition, epilepsy, etc.) where relevant.	
	1.14.2	The Framework Architecture shall require system developed from it to accommodate those users who travel with baggage and/or extra equipment (e.g. mothers with push-chairs, disabled persons in wheel-chairs, (guide) dogs, etc.) where relevant.	
	1.14.3	The Framework Architecture shall require systems developed from it to be able to take their input from a variety of alternative devices (e.g. keys, voice, buttons, touch-screen, smart card, etc.) to suit travellers with special needs, where relevant.	
	1.14.4	The Framework Architecture shall require systems developed from it to be able to provide output in a variety of alternative modes (e.g. (enlarged) text, symbols, graphics, speech, tactile, HUD, etc.) to suit travellers with special needs, where relevant.	
	1.14.5	The Framework Architecture shall require systems developed from it to be able to repeat information on request, in particular for those with special needs, where relevant.	
	1.14.6	The Framework Architecture shall require systems developed from it to be able to recognise the identity of a traveller using a variety of alternative methods, where relevant.	
	1.14.7	The Framework Architecture shall require systems developed from it to be able to have adaptable user interfaces that may be customised by the traveller, in particular those with special needs, where relevant.	
	1.14.8	The Framework Architecture shall require systems developed from it to be able to be able to read pre-recorded personal details (e.g. impairment and/or medical details), in particular of those with special needs, where relevant.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
1.15 Privacy	**1.15.1**	Systems developed from the Framework Architecture shall be able to provide an un-attributable, but unique, identifier to each vehicle for the duration of a trip in order to provide basic privacy.	
1.16 Communications	**1.16.1**	Systems developed from the Framework Architecture shall be able to send messages through more than one vehicle and/or road-side device (multi-hop).	
	1.16.2	Systems that conform to the Framework Architecture shall be able to transmit data correctly without a re-transmission (i.e. use error correcting codes).	
	1.16.3	Systems that conform to the Framework Architecture shall manage the communications in a manner which ensures that the communications infrastructure is not overwhelmed by too many messages.	
	1.16.4	Systems developed from the Framework Architecture shall be able to communicate with each vehicle individually, or by class (location, type, speed, lane, area, approaching or leaving a junction).	
Infrastructure Planning and Maintenance	**2**	*This group contains the activities associated with long term planning, modelling and reporting as well as the maintenance of the infrastructure. These User Needs have links with Groups 6-10.*	
2.1 Transport Planning Support			
2.1.0 Objectives	**2.1.0.1**	The system shall be able to exchange traffic and travel information between adjacent TICs to enhance local information and to improve strategic planning.	
	2.1.0.2	The system shall be able to provide facilities to enable co-operation and decision making between all relevant authorities, (e.g. Ministries, local authorities, police forces etc.) to define optimum traffic management strategies.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
2.1.1 Information Management	**2.1.1.1**	The system shall be able to produce information for travellers on the traffic and travel conditions of all transport modes relevant to the geographical area covered.	
	2.1.1.2	The system shall be able to provide links to non-transport information systems using "open" communication protocols.	
	2.1.1.3	The system shall be able to collect traffic data for road network use analysis and prediction calculations.	
2.1.2 Planning	**2.1.2.1**	The system shall be able to model the road network for strategic planning calculations.	
	2.1.2.2	The system shall be able to develop and implement traffic environmental management strategies based on current and predicted traffic conditions.	
	2.1.2.3	The system shall be able to assist in the planning of (inter-modal) routes.	
	2.1.2.4	The system shall be able to simulate a demand management strategy on the road network.	7.3.0.4
	2.1.2.5	The system shall be able to simulate potential capacity reduction, e.g. due to road works.	7.3.0.5
2.1.3 Evaluation	**2.1.3.1**	The system shall be able to measure the effect of a strategy, and to modify it when necessary.	
2.1.4 Reporting	**2.1.4.1**	The system shall collect and report data as required by legally appointed authorities.	
	2.1.4.2	The system shall be able to archive (a summary of) historical data on transport demand and transport supply for all transport modes.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
2.2 Infrastructure Maintenance Management			
2.2.0 Basic Services	**2.2.0.1**	The system shall provide support for road maintenance and infrastructure management.	
	2.2.0.2	The system shall be able to recommend short term road maintenance activities, including winter maintenance, based on data collected from the road infrastructure possibly combined with the current and/or forecast weather conditions.	
	2.2.0.3	The system shall be able to recommend maintenance work schedules such that they cause the minimum disruption to traffic.	
	2.2.0.4	The system shall be able to support a database of maintenance operations.	
	2.2.0.5	The system shall be able to transmit current and future maintenance schedules to TCCs.	
	2.2.0.6	The system shall be able to maintain statistics on road usage to evaluate the need for possible maintenance.	
2.2.1 Activation	**2.2.1.1**	The system shall be able to activate fixed de-icing equipment on parts of the road network.	
2.2.2 Monitoring	**2.2.2.1**	The system shall be able to receive infrastructure equipment status data remotely.	
	2.2.2.2	The system shall be able to monitor the structural integrity of items of infrastructure, e.g. roads, bridges, tunnels, gantries, etc.	
	2.2.2.3	The system shall be able to support a database of the road network, infrastructure and road-side equipment.	
2.2.3 Maintenance Units	**2.2.3.1**	The system shall be able to transfer information to, and between, road maintenance units.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
2.2.4 Contracts	**2.2.4.1**	The system shall be able to support the management and control of maintenance contracts.	
3 Law Enforcement		*This group contains the activities associated with the enforcement of traffic laws and regulations, and the collection of evidence. These User Needs have links with Groups 6-10.*	
3.1 Policing/Enforcing Traffic Regulations			
3.1.0 Objectives	**3.1.0.1**	The system shall enforce the traffic laws and regulations of the region automatically (where possible).	
	3.1.0.2	The system shall be able to collect the evidence of a violation of the traffic laws and regulations in a manner suitable to justify the application of a legal punishment	
	3.1.0.3	The system shall be able to provide support for the enforcement of safe driver behaviour and the provision of vehicle priorities.	
	3.1.0.4	The system shall not obstruct or slow down traffic in any way, except when it is part of access control.	
	3.1.0.5	The system shall be able to communicate with Police Command and Control Systems.	
3.1.1 Evidence Collection	**3.1.1.1**	The system shall be able to collect evidence on vehicles that commit traffic signal violations.	7.1.7.1
	3.1.1.2	The system shall be able to collect evidence on vehicles that exceed a local (variable) speed limit.	7.1.7.2
	3.1.1.3	The system shall be able to measure the characteristics (e.g. length, weight etc.) of a vehicle automatically, whilst the vehicle is in motion ("Weigh in Motion").	9.3.0.2

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	3.1.1.4	The system shall be able to identify the cargo being carried by a heavy goods vehicle automatically.	
4 Financial Transactions		*This group contains the activities associated with the payment for traffic or travel services, and includes the manner of the transaction, its enforcement, and the sharing of revenues. These User Needs have links with Groups 6-10.*	
4.1 Electronic Financial Transactions			
4.1.0 Objectives	**4.1.0.1**	The system shall be able to use a variety of relevant payment methods either electronic or not, including central account and post payment, central account and prepayment, on-board account etc.	
	4.1.0.2	The system shall manage customer data, e.g. identification, account, rights of residents, etc.	
	4.1.0.3	The system shall give exact details of any financial transaction to the traveller.	
	4.1.0.4	The system shall be able to manage tariff policies (define fares/fees according to selected criteria).	
	4.1.0.5	The system shall be able to use a variety of payment or receipt means, including contactless "smart cards".	
4.1.1 Traffic Management	**4.1.1.1**	The system shall have a minimum impact on the traffic flow, e.g. a short transaction duration.	
	4.1.1.2	The system shall have a minimum impact on the driving task.	
	4.1.1.3	The system shall not do anything to reduce the safety of either the travellers in the vehicle, or the staff close to the equipment, e.g. in toll booths.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
4.1.2 Revenue Sharing	**4.1.2.1**	The system shall be able to share revenues between road network operators.	
	4.1.2.2	The system shall enable a single payment to be paid for services offered by different related transport systems (e.g. metro, bus, train, road and parking).	
4.1.3 Transaction	**4.1.3.1**	The system shall be able to exchange information between a toll collection unit and a vehicle.	9.5.3.15
	4.1.3.2	The system shall make "atomic" electronic financial transactions, i.e. that are never partially complete whatever the circumstances, even in degraded system modes.	
	4.1.3.3	The system shall have the maximum security necessary for electronic financial transactions.	
	4.1.3.4	The system shall have a low number of incorrect transactions (e.g., non-effective transactions < 1 in 10E-6; erroneous transactions < 1 in 10E-8);	
4.1.4 Enforcement	**4.1.4.1**	The system shall be able to collect evidence on the non-payment of tolls, and other illegal financial transactions.	
5 Emergency Services		*This group contains 'eCall' and stolen vehicle management (for any vehicle), the prioritising of emergency vehicles, hazardous goods (i.e. goods that need to be tracked) and incident management. These User Needs have links with Groups 6-10.*	
5.1 Emergency Notification and Personal Security			
5.1.0 Basic Services	**5.1.0.1**	The system shall be able to make an 'eCall'.	8.5.1.1 5.1.0.7
	5.1.0.2	The system shall be able to detect that the vehicle has been involved in an accident, identify its location, and initiate 'eCall' automatically.	5.3.1.1 8.5.1.2

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	5.1.0.3	The system shall enable the driver, or any other vehicle occupant, to make an 'eCall', and to receive confirmation that the call has been acknowledged, from outside the vehicle, i.e. at the roadside.	5.3.1.2 8.5.1.3
	5.1.0.4	The system shall be able to give the driver an immediate acknowledgement to his/her emergency call, i.e. to indicate that assistance is on the way.	
	5.1.0.5	The system shall be able to identify the driver / vehicle making an emergency call.	
	5.1.0.6	The system shall be able to provide two-way data and/or voice communications between the vehicle and the emergency control centre.	
	5.1.0.7	The system shall be able to send an 'eCall' automatically if a critical vehicle component goes into an unsafe condition, or some other emergency is detected, e.g. driver ill (see 8.5.0.2).	5.1.0.1 8.5.1.1 8.5.1.4
	5.1.0.8	The system shall be able to minimise the response time for rescuing drivers who have requested assistance from the emergency services, e.g. breakdown, medical emergency, accident etc.	7.2.0.6
5.1.1 Stolen Vehicles	**5.1.1.1**	The system shall be able to detect when a vehicle is (about to) be driven by an unauthorised person (i.e. stolen)	
	5.1.1.2	The system shall be able to detect a vehicle when it has been stolen.	
	5.1.1.3	The system shall be able to stop a vehicle when it has been stolen.	
	5.1.1.4	The system shall be able to provide the location of a vehicle when it has been stolen and/or to indicate when it passes a certain point.	
5.2 Emergency Vehicle Management			
5.2.0 Basic Services	**5.2.0.1**	The system shall support a green wave for emergency vehicles.	7.1.9.1

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	5.2.0.2	The system shall inform traffic management about the route that is intended for each green wave before it is used.	
	5.2.0.3	The system shall provide the identity of each traffic signal at which priority is needed to the traffic management, and the 'timing window' in which priority is to be given.	
	5.2.0.4	The system shall receive an indication from the emergency vehicle of its need to be given priority at each set of traffic signals before its arrival in the immediate vicinity.	
	5.2.0.5	The system shall enable emergency vehicles to pass through the road network without any priority at signalised junctions, e.g. during a return from an incident.	
5.3 Hazardous Materials and Incident Notification			
5.3.0 Basic Services	**5.3.0.1**	The system shall monitor the movements of hazardous goods, and provide appropriate support in the case of an incident.	
	5.3.0.2	The system shall be able to provide the location of hazardous goods.	
	5.3.0.3	The system shall be able to receive data on the status, character and quantity of hazardous cargo on vehicles within a pre-defined area of interest, and inform the relevant authorities of any non-compliance.	9.5.1.5
5.3.1 Incident Management	**5.3.1.1**	The system shall be able to detect that the vehicle has been involved in an accident, identify its location and cargo, and generate an emergency alert automatically.	5.1.0.2 7.2
	5.3.1.2	The system shall be able to identify its location and cargo, and generate an emergency alert on the command of the vehicle driver.	5.1.0.3
	5.3.1.3	The system shall be able to advise the emergency services on any hazardous goods that have been involved in an incident.	7.2.6.1

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	5.3.1.4	The system shall be able to provide relevant information to the emergency services on the type of hazardous good(s) involved in an incident.	
	5.3.1.5	Systems shall exchange information on hazardous goods in a manner that is understood by all parties.	
5.3.2 Planning	**5.3.2.1**	The system shall be able to support the planning (e.g. routes) and execution (e.g. authorisation) of the movement of hazardous goods.	7.1.4.9 9.5.2.9
	5.3.2.2	The system shall be able to support the creation of emergency plans.	
6 Travel Information and Guidance		*This group contains all the activities concerned with the handling of pre-trip and on-trip information, including mode choice and change, and route guidance*	
6.1 Pre-trip Information			
6.1.0 Objectives	**6.1.0.1**	The system shall provide emergency, or urgent, information to all road users free of charge.	
	6.1.0.2	The system shall be able to require payment for non-emergency, or non-urgent, information.	
	6.1.0.3	The system shall be able to provide accurate, credible, timely, and easy to comprehend traffic and travel information where it may be of benefit to the user.	
	6.1.0.4	The system shall be able to provide information on alternative routes, e.g. where they are quicker, cheaper, shorter, scenic, etc.	
	6.1.0.5	The system shall enable travellers to plan their trip using their own travel criteria, e.g. modes of transport, time of departure/arrival, road selection criteria, etc.	
	6.1.0.6	The system shall enable travellers to plan their trip according to the needs of their disabilities	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	6.1.0.7	The system shall be able to provide information so that travellers may share a vehicle with others for all or part of a (multi-modal) journey.	10.3.0.2
6.1.1 Modal Choice	**6.1.1.1**	The system shall be able to influence modal shifts according to a specified transport policy.	
	6.1.1.2	The system shall be able to provide trip information on other modes of transport, e.g. for demand-spreading when major events occur, or when weather conditions, strikes, cultural or sports events etc. cause problems for one mode.	
	6.1.1.3	The system shall be able to provide current and forecast traffic and travel information for all modes at local, regional, national and international levels.	
	6.1.1.4	The system shall be able to provide extensive multi-modal trip information, e.g. prices, fares, routes, forecast & current traffic situations, traffic control, demand mgt measures, local warnings, special events, weather conditions, hotels etc.	10.1.4.2
6.1.2 Information Handling	**6.1.2.1**	The system shall inform the User when changes occur to the criteria upon which the pre trip information had been given.	6.2.0.6
	6.1.2.2	The system shall be able to provide information on the cancellation of departures from an inter-modal interchnge (e.g. railway station, an airport , a port or a coach station) due to the weather; strikes or other reasons.	
	6.1.2.3	The system shall be able to provide route information to all drivers, e.g. restrictions, travel times, etc.	
	6.1.2.4	The system shall be able to support a database of events with links between events that occur concurrently and at the same or adjacent locations.	6.2.2.7
	6.1.2.5	The system shall be able to analyse, process and retrieve data from different combinations of sources (including floating car).	6.2.2.10

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	6.1.2.6	The system shall be able to provide road and traffic information adapted to different classes of users, e.g. travellers, radio broadcasters, service operators.	6.2.2.9
	6.1.2.7	The system shall provide information using graphical representation or text. Graphical form shall include the use of maps as well as text.	6.2.3.1
	6.1.2.8	The system shall provide information in the native language at the output location, and/or from a user selected choice of other appropriate foreign languages.	6.2.3.3 10.4.2.2
	6.1.2.9	The system shall provide Information Management tools for the operator.	6.2.2.12
	6.1.2.10	The system shall be able to provide access information for those travellers with special needs (e.g. physical access, lifts, escalators, parking & toilets, nappy changing rooms, access for (guide) dogs, etc.) at relevant areas, e.g. transit areas.	
	6.1.2.11	The system shall be able to provide information about "Points of Interest", e.g. location, opening times, price of service, nearest transport service points.	
	6.1.2.12	The system shall be able to receive information about a point of interest from the providers/owners/managers of that "Point of Interest".	
	6.1.2.13	The system shall be able to provide information to travellers so as to influence their choice of destination and/or mode of travel, e.g. to protect the environment of a "Point of Interest", or geographic area.	
	6.1.2.14	The system shall be able to provide information to travellers about the personal support services, e.g. doctor, in a specific locality.	
	6.1.2.15	The system shall be able to receive information about a personal support service, e.g. doctor, from the providers/owners/managers of that service.	
6.1.3 Traveller Interaction	**6.1.3.1**	The system shall be able to provide facilities for the necessary user identification when a traveller requests information that may result in the purchase or booking of services.	
	6.1.3.2	The system shall be able to require payment for one-off usage of the service.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	6.1.3.3	The system shall enable the traveller to use cash or electronic means to pay for the one-off usage of the service, where appropriate.	
	6.1.3.4	The system shall be able to provide access to reservations and pre-payment services.	
	6.1.3.5	The system shall be able to provide (multi-modal) booking & pre-payment services from all places that provide (multi-modal) route planning information, e.g. railway stations, airports, ports etc.	
	6.1.3.6	The system shall enable a traveller to book a parking space at Park and Ride sites as part of a (multi-modal) trip.	
	6.1.3.7	The system shall provide information via (public) terminals located at strategic locations: e.g. home, office, inter-modal interchanges (e.g. bus, railway and metro stations), vehicle, restaurant, etc.	
	6.1.3.8	The system shall be able to provide customised pre-trip information to hand-held and in-vehicle devices.	6.2.3.5
	6.1.3.9	The system shall communicate with other information systems using "open" standard protocols.	
	6.1.3.10	The system shall provide information for fixed and mobile terminals using "open" standard communication protocols.	6.2.3.4
6.2 On-trip Information			
6.2.0 Objectives	**6.2.0.1**	The system shall provide emergency, or urgent, information to all users free of charge.	9.5.3.5 9.5.3.6
	6.2.0.2	The system shall be able to require payment for non-emergency, or non-urgent, information.	
	6.2.0.3	The system shall be able to be activated automatically by another system, e.g. traffic management.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	6.2.0.4	The system shall provide traffic information (e.g. travel conditions on roads and other modes, accidents, special events, car park status, etc.) to the traveller during his/her trip in a timely manner. .	
	6.2.0.5	The system shall be able to provide urban and inter-urban traffic and travel information to drivers about the domain they are not currently in.	
	6.2.0.6	The system shall inform the User when changes occur to the criteria upon which the trip information had been given.	6.1.2.1
	6.2.0.7	The system shall be able to know where it is in the transport network, and hence provide the position of vehicle or person carrying it.	
6.2.1 Mode Change	**6.2.1.1**	The system shall be able to provide alternative routes or mode-switch recommendations when it detects, or is informed, that problems have occurred on a mode.	
	6.2.1.2	The system shall be able to display alternative routes or modes at inter-modal interchanges, or at places where tourism information is available.	
	6.2.1.3	The system shall be able to provide information about other transport modes: e.g. location of P+R areas, PT timetable, etc.	
6.2.2 Information Handling	**6.2.2.1**	The system shall be able to inform travellers on the current average travel time between fixed points.	
	6.2.2.2	The system shall be able to provide real-time P+R and PT information to vehicle drivers.	
	6.2.2.3	The system shall be able to provide cyclists and pedestrians with information about suitable routes.	
	6.2.2.4	The system shall provide road and traffic safety advice based on current weather and traffic conditions.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	6.2.2.5	The system shall be able to provide all drivers with information on current road travel conditions, e.g. route restrictions, travel times, etc.	
	6.2.2.6	The system shall be able to provide routing information for Commercial traffic to/from a (cargo) modal interchange.	
	6.2.2.7	The system shall be able to support a database of events with links between events that occur concurrently and at the same or adjacent locations.	6.1.2.4
	6.2.2.8	The system shall be able to provide road information according to different geographic scales, e.g. local, regional, national, international.	
	6.2.2.9	The system shall be able to adapt the information to different classes of users, e.g. travellers, radio broadcasters, service operators.	6.1.2.6
	6.2.2.10	The system shall be able to collect data from a variety of different sources, e.g. road/traffic management, police, weather services, floating car etc.	6.1.2.5
	6.2.2.11	The system shall be able to provide operators with an overall view of all active events in an area.	
	6.2.2.12	The system shall provide Information Management tools for the operator.	6.1.2.9
	6.2.2.13	The system shall be able to provide information to vehicle drivers in case of medical emergency, e.g. location of rest areas, medical assistance, etc.	
	6.2.2.14	The system shall be able to modify a travel plan if the traveller does not follow the original travel plan.	
6.2.3 Traveller Interaction	**6.2.3.1**	The system within the vehicle, or in the centre, shall support various types of presentation to the user, e.g. text, graphics, symbols, speech, etc.	6.1.2.7
	6.2.3.2	The system shall normally provide messages from a finite set of well defined message texts.	7.2.5.2

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	6.2.3.3	The system shall provide information in the native language at the output location, and/or from a user selected choice of other appropriate foreign languages, when applicable.	6.1.2.8 10.4.2.2
	6.2.3.4	The system shall provide information using "open" standard communication protocols.	6.1.3.10
	6.2.3.5	The system shall be able to provide customised on-trip information to hand-held and in-vehicle devices.	6.1.3.8
	6.2.3.6	The system shall enable drivers to customise the style and content of the information that they receive from hand-held and in-vehicle devices.	
	6.2.3.7	The system shall be able to retain the customisation details in a manner that is independent of any physical output device.	
	6.2.3.8	The system shall be able to provide road and traffic information using road-side equipment, e.g. VMS.	
	6.2.3.9	The system shall be able to provide in-vehicle road, traffic, route guidance and parking information via locally sited equipment, e.g. beacon.	
Personal Information Services	**6.3**	*This is a special case of Groups 6.1, 6.2, 6.4 and 10.4 (ISO Services 1, 2, 3 and 5)*	
6.4 Route Guidance and Navigation			
6.4.0 Objectives	**6.4.0.1**	The system shall provide travellers with recommended routes to specified destinations.	9.5.2.8 9.5.3.22
	6.4.0.2	The system shall not base its decisions on a restricted sub-set of the road network, e.g. motorways only.	
	6.4.0.3	The system shall know where it is within the road network.	9.5.2.13 10.1.2.1

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	6.4.0.4	The system shall be able to modify its navigation instructions if an incorrect turn is made.	
	6.4.0.5	The system shall be able to provide a driver with a suitable alternative route, when the original planned route becomes unavailable.	
6.4.1 Information Handling	**6.4.1.1**	The system shall be able to provide guidance to Car Parks (with parking spaces).	
	6.4.1.2	The system shall be able to use real-time information to compute the recommended route.	
	6.4.1.3	The system shall be able to compute the total predicted journey time over the route selected.	7.1.6.1 9.5.2.10 10.2.1.3
	6.4.1.4	The system shall be able provide customised navigation information to the destination using a variety of selection criteria, including use by a traveller with special needs.	10.2.3.1
	6.4.1.5	The system shall be able to provide guidance to "Points of Interest".	
	6.4.1.6	The system shall provide information which is consistent with any other information being presented about the road.	
	6.4.1.7	The system shall be able to provide reports on the effectiveness of the navigation instructions that have been provided.	
6.4.2 Traveller Interaction	**6.4.2.1**	The system shall provide route guidance using visual and voice instructions.	
	6.4.2.2	The system shall contain menus which are structured in a logical manner and oriented towards the requirements of the driver (e.g. the most frequently used function shall be the easiest to select).	
	6.4.2.3	The system shall enable bi-directional voice and data communication with the vehicle.	
	6.4.2.4	The system shall enable the use of portable equipment to provide route guidance.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
7 Traffic, Incidents and Demand Management		*The activities associated with traffic control, incident management and demand management, including monitoring, planning, flow control, exceptions management, speed management, lane and parking management, HOV, road pricing and zoning, and VRUs*	
7.1 Traffic Control			
7.1.0 Objectives	**7.1.0.1**	The system shall support the existing and new traffic management needs of authorities by providing a flexible yet comprehensive approach to determine traffic management strategies (including bridge and tunnel control).	
	7.1.0.2	The system shall be able to implement identified control strategies that conform with specified policy.	
	7.1.0.3	The system shall not do anything to reduce road safety.	7.2.0.2
	7.1.0.4	The system shall manage road traffic in such a way that levels of environmental (i.e. atmospheric and noise) pollution may be reduced.	9.5.4.1
	7.1.0.5	The system shall manage road traffic in such a way that congestion (travel time) may be reduced.	
	7.1.0.6	The system shall be able to help co-ordinate the activities of TICs and TCCs.	
	7.1.0.7	The system shall be able to exchange information between TICs and TCCs, including across national boundaries.	
	7.1.0.8	The system shall enable the data that it stores to be extracted by an operator onto a variety of media and used for other purposes, or by other organisations.	
	7.1.0.9	The system shall ensure that traveller information service providers are aware of the traffic management strategy, so that they can provide information that conforms to it.	
	7.1.0.10	The system shall be able to control urban roads and traffic.	
	7.1.0.11	The system shall be able to control inter-urban roads and traffic.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.1.0.12	The system shall be able to use different traffic management techniques to control separate areas of the road network.	
	7.1.0.13	The system shall be able to manage the urban/inter-urban interface.	
7.1.1 Monitoring	**7.1.1.1**	The system shall be able to monitor sections of the road network to provide the current traffic conditions (e.g. flows, occupancies, speed and travel times etc.) as real time data.	
	7.1.1.2	The system shall monitor urban roads and traffic.	
	7.1.1.3	The system shall monitor inter-urban roads and traffic.	
	7.1.1.4	The system shall be able to monitor traffic flow at, and the operation of, the road intersections of the network over which it has the control.	
	7.1.1.5	The system shall be able to monitor the entire road network (network state surveillance tool).	
	7.1.1.6	The system shall be able to monitor and record weather conditions, e.g. wind, fog, rain level, ice, etc.	
	7.1.1.7	The system shall be able to monitor and record environmental (atmospheric and noise) pollution conditions, and provide an alarm when a certain threshold is exceeded.	
	7.1.1.8	The system shall be able to measure the range of visibility and detect reductions caused by adverse weather and pollution conditions (but not darkness).	
7.1.2 Planning	**7.1.2.1**	The system shall be able to use consistent historical data to complement real-time data, when necessary.	
	7.1.2.2	The system shall be able to predict short, medium, and long-term traffic conditions, e.g. for minutes, hours and days ahead.	
	7.1.2.3	The system shall be able to use historical data to complement predicted data, when necessary.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.1.2.4	The system shall be able to analyse road and traffic data to predict possible critical situations.	
	7.1.2.5	The system shall be able to predict weather conditions, in particular the formation of fog and/or ice.	
	7.1.2.6	The system shall be able to predict short, medium and long-term (e.g. for minutes, hours and days ahead) road travel produced environmental (atmospheric and noise) pollution conditions based on traffic and weather conditions.	
	7.1.2.7	The system shall be able to provide historical and predicted data.	
7.1.3 Traffic Control Centres	**7.1.3.1**	The system shall enable a TCC operator to control, possibly remotely, infrastructure elements (e.g. traffic lights, VMS).	
	7.1.3.2	The system shall enable a TCC operator to log all significant events and to record free text messages prior to their output to travellers.	
	7.1.3.3	The system shall be able to provide a graphical representation of the road network which includes relevant features (e.g. equipment, events, traffic condition etc.) to TCC operators.	
	7.1.3.4	The system shall be able to activate control devices (e.g. traffic lights, VMS), either individually or in groups.	
	7.1.3.5	The system shall enable TCC operators to make temporary changes to the normal control strategy in real-time.	
	7.1.3.6	The system shall be able to implement planned control strategies for planned events, e.g. sport, cultural, etc.	
	7.1.3.7	The system shall be able to support a database of all known (future) events.	
7.1.4 Traffic Flow Control	**7.1.4.1**	The system shall be able to control the entries and exits to motorways.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.1.4.2	The system shall be able to provide ramp metering (e.g. using traffic signals or barriers) at selected locations (e.g. slip road entrances to high speed roads).	
	7.1.4.3	The system shall provide Tidal Flow Control (reservation of lanes for exclusive use in one direction for a period, then the other direction for another period, on parts of the road network).	
	7.1.4.4	The system shall be able to provide advice to drivers as they approach car parks (on-street and off-street, as well as motorway service area parking).	
	7.1.4.5	The system shall be able to provide priority to selected travellers (e.g. cyclists, pedestrians) and/or vehicles (e.g. PT, emergency) through the road network, including on motorways (when applicable).	7.1.9.3
	7.1.4.6	The system shall be able to provide control measures for bridges so that warnings of weather conditions, vehicle restrictions and closure can be provided.	
	7.1.4.7	The system shall be able to provide control measures for "tunnel" environments i.e. vehicle restrictions, fire detection, atmospheric pollution and closure.	
	7.1.4.8	The system shall be able to provide co-ordinated traffic management operations during periods of mass movement across (many) regions.	
	7.1.4.9	The system shall be able to provide specific traffic management for exceptional vehicles (e.g. very dangerous cargo, wide loads, etc.) when requested.	5.3.2.1 9.5.2.9
7.1.5 Exceptions Management	**7.1.5.1**	The system shall be able to provide control measures to protect road maintenance work and workers.	
	7.1.5.2	The system shall be able to command drivers to change lanes on multi-lane roads.	
	7.1.5.3	The system shall be able to change the direction of traffic flow on a carriageway in an orderly manner so that it does not create a safety hazard to any road user.	
	7.1.5.4	The system shall be able to reverse the direction of traffic flow on parts of the urban network.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.1.5.5	The system shall be able to close roads and advise drivers of a suitable diversionary route for a period of time.	
	7.1.5.6	The system shall be able to command certain classes of vehicle (e.g. heavy vehicles or tourist traffic) to take an alternative route for a period of time.	9.5.2.12 9.5.3.11
	7.1.5.7	The system shall be able to recommend re-routing strategies to reduce congestion or atmospheric pollution.	
	7.1.5.8	The system shall request confirmation of all exceptional measures before they are executed.	
7.1.6 O/D Computations	**7.1.6.1**	The system shall be able to provide Origin/Destination computations, and route assignment estimations, for the road network.	6.4.1.3 9.5.2.10 10.2.1.3
7.1.7 Speed Management	**7.1.7.1**	The system shall be able to show the maximum authorised speed of vehicles on selected carriageways to be shown to drivers, and to detect violators.	3.1.1.1
	7.1.7.2	The system shall be able to set variable speed limits on parts of the road network.	3.1.1.2
	7.1.7.3	The system shall be able to calculate recommended speed limits for given traffic and weather conditions, and road network characteristics.	
	7.1.7.4	The system shall be able to transmit recommended speed limits to equipped vehicles.	7.1.7.6 8.2.5.2
	7.1.7.5	The system shall be able to support a database of all speed limits on the road network.	
	7.1.7.6	The system shall be able to provide vehicles with information about the road network, e.g. speed limits, road hazards, junctions etc.	7.1.7.4

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
7.1.8 Roadside-Vehicle Communications	**7.1.8.1**	The system shall be able to transmit information to a vehicle to update its on-board database.	
7.1.9 Adaptive Traffic Control	**7.1.9.1**	The system shall be able to provide green wave management for all vehicles.	5.2.0.1
	7.1.9.2	The system shall be able to minimise delays of all vehicles using adaptive signal control	
	7.1.9.3	The system shall be able to override the current method of traffic control to grant priority to selected vehicles, e.g. PT, emergency vehicles.	7.1.4.5 10.1.6.1
	7.1.9.4	The system shall be able to give priority to PT vehicles in a manner that minimises the impact on other road users.	
7.1.10 Lane Management	**7.1.10.1**	The system shall be able to reserve certain traffic lanes exclusively to specific classes of vehicles (e.g. high occupancy vehicles, or buses) and to detect violators.	
7.1.11 Parking Management	**7.1.11.1**	The system shall be able to monitor the current usage of the parking facilities.	
	7.1.11.2	The system shall be able to forecast the need for parking slots.	
	7.1.11.3	The system shall be able to identify those vehicles, or their drivers, which violate the parking regulations, e.g. fail to pay, stay too long, etc.	
7.1.12 Vulnerable Road Users	**7.1.12.1**	The system shall be able to control pedestrian and cycle crossings.	
	7.1.12.2	The system shall be able to monitor and control pedestrian and cycle crossings in order to optimise their use.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
7.2 Incident Management			
7.2.0 Objectives	**7.2.0.1**	The system shall detect and respond to various incidents on the road network.	5.3.1 10.1.3.2
	7.2.0.2	The system shall not do anything to reduce road safety.	7.1.0.3
	7.2.0.3	The system shall not do anything that might aggravate, or cause, an incident.	
	7.2.0.4	The system shall assist the emergency services to provide an effective response to road traffic incidents.	
	7.2.0.5	The system shall collect and filter emergency calls from travellers in the road network using a variety of types of communication, e.g. road-side telephones, mobile phones, (automatic) on-board 'MayDay' etc.	
	7.2.0.6	The system shall minimise the time between the occurrence of an incident and its detection.	5.1.0.8
	7.2.0.7	The system shall be able to validate that an incident has occurred in order to avoid false alarms.	
	7.2.0.8	The system shall be able to suggest one or more responses for dealing with an incident.	
	7.2.0.9	The system shall be able to run (pre-)defined incident mitigation strategies automatically.	
7.2.1 Emergency Services	**7.2.1.1**	The system shall be able to locate and identify emergency vehicles on the road network.	
	7.2.1.2	The system shall be able to co-ordinate the emergency and rescue services once an incident has been detected, and until the situation has returned to normal.	
	7.2.1.3	The system shall provide communications between the emergency services, hospitals and TCCs for the provision of incident information.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
7.2.2 Information Management	**7.2.2.1**	The system shall be able to collect and store data on each incident, e.g. location, type, severity, number & type of vehicles involved, the emergency/rescue vehicles needed etc.	
	7.2.2.2	The system shall be able to identify and classify all incidents on the road network.	
	7.2.2.3	The system shall be able to provide information on each incident to TICs for onward transmission to travellers.	
7.2.3 Reporting	**7.2.3.1**	The system shall be able to produce incident data statistics, e.g. frequencies of occurrence, by time, type and location; identification of "high risk" locations on the road network; performance of the incident detection system.	
7.2.4 Post-Incident Management	**7.2.4.1**	The system shall be able to minimise the consequences of an incident on the road network for those travellers who are not involved.	
	7.2.4.2	The system shall be able to monitor the aftermath of an incident.	
7.2.5 Pre-Incident Management	**7.2.5.1**	The system shall be able to detect "non-vehicle" incidents before they can escalate into traffic accidents, e.g. bad weather conditions, objects on the road, ghost drivers, etc.	
	7.2.5.2	The system shall be able to provide local warnings on dangerous sections of the road network.	6.2.3.2
7.2.6 Hazardous Goods	**7.2.6.1**	The system shall be able to advise the emergency services on any hazardous goods that have been involved in an incident.	5.3.1.3
7.3 Demand Management			
7.3.0 Objectives	**7.3.0.1**	The system shall provide information that will influence travellers' decisions regarding aspects of their journey, e.g. destinations, time, mode of travel, route etc.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.3.0.2	The system shall receive up-to-date information on those factors that will influence the demand management strategy, e.g. traffic levels, car park usage, other modes usage, fares, tolls, etc.	
	7.3.0.3	The system shall be able to recommend a strategy to reduce demand.	
	7.3.0.4	The system shall be able to simulate a demand management strategy on the road network.	2.1.2.4
	7.3.0.5	The system shall be able to simulate potential capacity reduction, e.g. due to road works.	2.1.2.5
7.3.1 Zoning	**7.3.1.1**	The system shall be able to create a "traffic collar" and limit the entry of all vehicles into a defined area according to (a set of) criteria.	
	7.3.1.2	The system shall be able to recommend alternative routes (e.g. that take into account the needs of heavy vehicles (and hazardous goods)) when required.	
	7.3.1.3	The system shall be able to control the access of vehicles into a zone using a form of identification, e.g. electronic tags, number plate readers, etc.	
	7.3.1.4	The system shall be able to use physical barriers to control the access of vehicles into a zone.	
7.3.2 Pricing Management	**7.3.2.1**	The system shall be able charge for the use of a section of road, or facility (e.g. bridge, tunnel etc.), based on given policy decisions, e.g. duration, distance, congestion etc.	
	7.3.2.2	The system shall be able to adjust toll fees according to a given pricing strategy.	
	7.3.2.3	The system shall be able to adjust parking fees according to a given pricing strategy.	
	7.3.2.4	The system shall be able to adjust public transport fares according to a given pricing strategy.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
7.3.3 Parking Management	**7.3.3.1**	The system shall be able to implement parking strategies in specific areas, including P+R strategies.	
7.3.4 Vulnerable Road Users	**7.3.4.1**	The system shall be able to provide information to promote the use of cycles and walking.	
7.3.5 Car Sharing	**7.3.5.1**	Deleted and moved to 6.1.0.7	
Cooperative Systems – Traffic Safety	**7.4**	*These are applications and services that enhance the safety of traffic by providing Road Hazard Warnings, Ghost Driver Management, advice on Lane Utilisation, Speed Management, Headway Management, Collision Warnings, VRU Warnings, and Warnings about Emergency Vehicles. These User Needs are associated with functions that are expected to use V2V and V2I technologies (Cooperative Systems).*	
Road Hazard Warning	**7.4.1**	*The activities associated with the collection of data, e.g. FCD and weather conditions, about the current situation, identification as to whether a hazardous condition exists, and then the provision of warnings to drivers that are appropriate to that hazard (motorcycle, traffic conditions, traffic queues, hazardous locations). In this set, each User Needs starts with a title that indicates its rôle in this scenario.*	
	7.4.1.1	*(X)FCD* – The system shall be able to maintain a database of the road network.	
	7.4.1.2	*(X)FCD* – The system shall be able to determine the intended route of the host vehicle.	6.4.0.1 7.5.1.2
	7.4.1.3	*(X)FCD* – The system shall be able to determine the relative position of the host vehicle on a road (e.g. lane, distance from a datum point) at all times (urban, inter-urban, tunnels etc.).	8.4.2.1

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.4.1.4	*(X)FCD* – The system shall be able to obtain information (values and status) from the host vehicle's systems (e.g. ABS, ESP, Longitudinal and Lateral Acceleration, Speed, Wipers) without affecting the safe functioning of those systems.	8.5.3.4
	7.4.1.5	*(X)FCD* – The system shall be able to determine the environmental conditions in the vicinity of the host vehicle.	
	7.4.1.6	*(X)FCD* – The system shall be able to determine the visibility in the vicinity of the host vehicle, and classify the cause of the reduction, e.g. fog, rain, darkness.	
	7.4.1.7	*(X)FCD* – The system shall be able to infer XFCD, i.e. the road conditions (e.g. reduced friction, aquaplaning) and traffic conditions (e.g. vehicle breakdown, traffic incident), from the state of the host vehicle systems' data (e.g. speed, acceleration, brakes, lights).	
	7.4.1.8	*(X)FCD* – The system shall be able to maintain a database of dynamic fused XFCD from the host vehicle's systems and sensors.	
	7.4.1.9	*(X)FCD* – The system shall be able to send XFCD from the host vehicle to a road-side device.	8.2.4.1
	7.4.1.10	*(X)FCD* – The system shall enable data received from vehicles by a road-side device to be integrated, analysed and fused.	8.2.4.1
	7.4.1.11	*(X)FCD* – The system shall enable a road-side device to send fused traffic data to the TCC.	
	7.4.1.12	*(X)FCD* – The system shall enable a road-side device to send weather and environmental conditions to the TCC road-side device.	
	7.4.1.13	*(X)FCD* – The system shall be able to fuse the XFCD data from a number of vehicles with the host vehicle data to create a more accurate view of the road and traffic conditions in that area.	
	7.4.1.14	*(X)FCD* – The system shall be able to send fused FCD to the TCC from an road-side device.	
	7.4.1.15	*(X)FCD* – The system shall be able to send XFCD to the TCC from the host vehicle.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.4.1.16	*(X)FCD* – The system shall be able to add traffic data from the infrastructure (e.g. induction loops, radar) to the fused XFCD data of the road-side device.	
	7.4.1.17	*(X)FCD* – The system shall be able to communicate with another vehicle either directly, or via an road-side device. (Communications).	8.2.4.1
	7.4.1.18	*(X)FCD* – The system shall be able to match a visual image of a vehicle with the (un-attributable – for privacy protection) identity of a vehicle that is providing FCD and/or XFCD.	
	7.4.1.19	*Hazard Detection* – The system shall be able to determine the existence of a sharp curve from the road network database.	
	7.4.1.20	*Hazard Detection* – The system shall be able to determine that the host vehicle is partially occupying an adjacent lane for a short time, e.g. due to manoeuvre round a sharp bend, or lane width reductions.	
	7.4.1.21	*Hazard Detection* – The system shall be able to detect the presence of fire or smoke on the host vehicle.	
	7.4.1.22	*Hazard Detection* – The system shall enable the host vehicle to send information about its own safety behaviour (i.e. whether or not the vehicle was being driven in an unsafe manner, e.g. excessive speeding, swapping of lanes, overtaking, driver inattention) to a road-side device.	
	7.4.1.23	*Hazard Detection* – The system shall be able to detect presence of other vehicles and traffic participants in the vicinity of the host vehicle, and determine its type, e.g. car, lorry, emergency, maintenance, cycle, pedestrian.	
	7.4.1.24	*Hazard Detection* – The system shall be able to determine the status of the traffic in the vicinity of the host vehicle, e.g. congestion, stationary vehicle(s).	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.4.1.25	*Hazard Detection* – The system shall be able to detect the presence of stationary objects (seen or deduced) in the carriageway ahead of the host vehicle, and to warn the driver via an in-vehicle device.	
	7.4.1.26	*Hazard Detection* – The system shall be able to detect the presence of stationary objects (seen or deduced) in the opposite carriageway to that of the host vehicle, and to send a warning to other vehicles.	
	7.4.1.27	*Hazard Detection* – The system shall enable the TCC to determine whether an incident has occurred.	
	7.4.1.28	*Hazard Detection* – The system shall enable an road-side device to determine whether an incident has occurred.	
	7.4.1.29	*Motorcycle Warning* – The system shall be able to detect that the host motorcycle has fallen onto the road pavement, and send this information to other vehicles.	
	7.4.1.30	*Motorcycle Warning* – The system shall be able to detect that the host motorcycle has fallen onto the road pavement, and send this information to a road-side device.	
	7.4.1.31	*Traffic Condition Warning* – The system shall be able to warn drivers in a timely manner of moving incidents (e.g. road/winter maintenance vehicles, long/wide loads) via an in-vehicle display.	7.2.5.1
	7.4.1.32	*Traffic Condition Warning* –The system shall be able to send to vehicles following the host vehicle information about the traffic conditions, or the traffic signs, near the host vehicle, that it may be useful to receive in advance.	7.4.1.49 7.4.2.6 7.4.3.10 7.4.4.18 8.5.5.2

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.4.1.33	*Traffic Queue Detection* – The system shall be able to locate the tail end of a traffic queue and estimate its speed of propagation.	
	7.4.1.34	*Traffic Queue Detection* – The system shall be able to inform drivers, via in-vehicle and road-side devices, of slow moving obstacles (e.g. person, animal, slow vehicle) and advise on the appropriate action (e.g. speed and lane).	
	7.4.1.35	*Hazardous Location Notification* – The system shall be able to warn drivers in a timely manner of incidents ahead (e.g. road works, accident, traffic queue) via an in-vehicle display. Where available and relevant this information shall include lane(s)/road section(s) affected and expected delay.	7.2.2.3 7.2.4.1
	7.4.1.36	*Hazardous Location Notification* – The system shall be able to warn the driver in a timely manner, via an in-vehicle display, of adverse road surfaces and weather conditions along the planned route.	7.2.5.1
	7.4.1.37	*Hazardous Location Notification* – The system shall be able to warn driver, via an in-vehicle device, of adverse driving conditions ahead (e.g. slippery road, low visibility, queuing traffic) and advise on the appropriate action (e.g. speed).	6.2.2.4 7.1.1.6 7.1.2.6 7.2.5.1
	7.4.1.38	*Hazardous Location Notification* – The system shall be able to warn drivers, via a road-side device, of adverse driving conditions ahead (e.g. slippery road, low visibility, queuing traffic) and advise on the appropriate action (e.g. speed).	6.2.2.4 7.1.1.6 7.1.2.6 7.2.5.1
	7.4.1.39	*Hazardous Location Notification* – The system shall be able to warn the driver, via an in-vehicle device, that the host vehicle is about to enter a curve that has been classified as a black spot for that category of vehicle, and recommend a suitable speed and trajectory.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.4.1.40	*Hazardous Location Notification* – The system shall be able to warn the driver, via an in-vehicle device, that the host vehicle is about to enter a section of road whose surface has less grip than normal (low μ).	
	7.4.1.41	*Hazardous Location Notification* – The system shall be able to inform drivers, via an in-vehicle device, of obstacles in the carriageway and advise on the appropriate action (e.g. speed and lane).	7.4.6.14
	7.4.1.42	*Hazardous Location Notification* – The system shall be able to inform drivers, via road-side devices, of obstacles in the carriageway and advise on the appropriate action (e.g. speed and lane).	7.4.6.14
	7.4.1.43	*Hazardous Location Notification* – The system shall enable a road-side device to select and activate a traffic management strategy in the event of an incident (including poor driving conditions).	
	7.4.1.44	*Hazardous Location Notification* – The system shall be able to send information about incidents ahead in the next section from a road-side device to drivers via an in-vehicle device.	
	7.4.1.45	*Hazardous Location Notification* – The system shall be able to estimate the condition of the road surface in the vicinity of the host vehicle and send warnings to other vehicles.	8.2.4.1
	7.4.1.46	*Hazardous Location Notification* – The system shall be able to estimate the condition of the road surface in the vicinity of the host vehicle and send warnings to a road-side device.	8.2.4.1
	7.4.1.47	*Hazardous Location Notification* – The system shall be able to send information about incidents on the road network ahead from the TCC to drivers via an in-vehicle device.	
	7.4.1.48	*Hazardous Location Notification* – The system shall provide "copies" of the traffic signs that are relevant to the current section of the road (e.g. speed limit, road hazards, junctions) to the driver at all times via an in-vehicle display.	7.4.2.5 7.4.3.9 7.4.4.17 8.5.5.1

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.4.1.49	*Hazardous Location Notification* – The system shall be able to send to following vehicles "copies" of the traffic signs, or information about the local traffic (e.g. sudden congestion), that it may be useful to receive in advance.	7.4.1.32 7.4.2.6 7.4.3.10 7.4.4.18 8.5.5.2
Ghost Driver Management	**7.4.2**	*The activities associated with the management of the situation when a vehicle is being driven the wrong way along a road or carriageway.*	
	7.4.2.1	The system shall be able to detect that a (non-self-reporting) vehicle is travelling in the wrong direction along a “one-way” road (i.e. a ghost driver), and warn other vehicles “ahead” of that vehicle.	
	7.4.2.2	The system shall be able to warn drivers in a timely manner of self-reporting ghost drivers via an in-vehicle display.	7.2.5.1
	7.4.2.3	The system shall be able to detect that the host vehicle is travelling in the wrong direction along a “one-way” road (i.e. a ghost driver), and warn/advise that driver to correct the situation.	
	7.4.2.4	The system shall be able to detect that a vehicle is overtaking (i.e. in the wrong lane) on a two-lane road and that there is another vehicle approaching in that lane, and provide a warning to the drivers of both vehicles via their in-vehicle devices.	
	7.4.2.5	The system shall provide "copies" of the traffic signs that are relevant to the current section of the road (e.g. speed limit, road hazards, junctions) to the driver at all times via an in-vehicle display.	7.4.1.48 7.4.3.9 7.4.4.17 8.5.5.1

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.4.2.6	The system shall be able to send to following vehicles "copies" of the traffic signs, or information about the local traffic (e.g. sudden congestion), that it may be useful to receive in advance.	7.4.1.32 7.4.1.49 7.4.3.10 7.4.4.18 8.5.5.2
Lane Utilization	**7.4.3**	*The activities associated with the management of the use of lanes on a multi-lane road, including providing restrictions, the management of obstacles and of hard shoulder running.*	
	7.4.3.1	The system shall be able to provide lane usage information to the driver via an in-vehicle display.	
	7.4.3.2	The system shall be able to provide lane restriction information (e.g. HGV, HOV) from outside the vehicle, and to confirm that it is consistent with the information that has been sent directly to that vehicle.	7.1.10.1
	7.4.3.3	The system shall be able to provide instructions not to change lanes to the driver via an in-vehicle device in order to stabilise the total traffic flow. These instructions may either apply to all types of vehicle, or to sub-sets.	
	7.4.3.4	The system shall provide information to the driver via an in-vehicle display when auxiliary lanes are now available for use by that type of vehicle (e.g. hard shoulder running).	
	7.4.3.5	The system shall ensure that the auxiliary lane is free from obstacles before it is released for use.	
	7.4.3.6	The system shall be able to provide lane usage information to the driver via an in-vehicle display when there are temporary restrictions to lane usage (e.g. at road works).	7.1.5.2
	7.4.3.7	The system shall be able to advise a driver, via an in-vehicle device, which lane to use when passing an incident/accident.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.4.3.8	The system shall be able to advise a driver, via an in-vehicle device, where to stop safely (e.g. an appropriate exit lane, hard shoulder)	
	7.4.3.9	The system shall provide "copies" of the traffic signs that are relevant to the current section of the road (e.g. speed limit, road hazards, junctions) to the driver at all times via an in-vehicle display.	7.4.1.48 7.4.2.5 7.4.4.17 8.5.5.1
	7.4.3.10	The system shall be able to send to following vehicles "copies" of the traffic signs, or information about the local traffic (e.g. sudden congestion), that it may be useful to receive in advance.	7.4.1.32 7.4.1.49 7.4.2.6 7.4.4.18 8.5.5.2
Speed Management	**7.4.4**	*The activities associated with providing warning to drivers on the current legal speed limit and/or the current recommended speed limit.*	7.1.7.n
	7.4.4.1	The system shall be able to recommend a safe speed limit according to the prevailing traffic, weather and road conditions based on the current legal speed limit.	8.2.5.1 8.2.5.4
	7.4.4.2	The system shall be able to warn drivers, via an in-vehicle display, of different legal speed limits as a result of particular weather conditions.	7.1.7.3
	7.4.4.3	The system shall provide legal speed limits continuously to the driver, via an in-vehicle display, according to the type of the host vehicle and the lane in which it is travelling (Intelligent Speed Adaptation – ISA). A suitable message should be provided if the service provision cannot be guaranteed.	8.2.5.1 8.2.5.4
	7.4.4.4	The system shall be able to provide recommended speed limits continuously to the driver, via an in-vehicle display, according to the type of the host vehicle and the lane in which it is travelling (Intelligent Speed Adaptation – ISA). A suitable message should be provided if the service provision cannot be guaranteed.	8.2.5.1 8.2.5.4

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.4.4.5	The system shall enable the driver of the host vehicle, via an in-vehicle device, to receive safety-related information (e.g. legal speed limit, recommended speed limit) from other vehicles in the vicinity.	8.2.5.1 8.2.5.4
	7.4.4.6	The system shall enable the driver of the host vehicle, via an in-vehicle device, to receive safety-related information (e.g. legal speed limit, recommended speed limit) from a road-side device.	8.2.5.1 8.2.5.4
	7.4.4.7	The system shall enable the driver of the host vehicle, via an in-vehicle device, to receive safety-related information (e.g. legal speed limit, recommended speed limit) from the TCC.	8.2.5.1 8.2.5.4
	7.4.4.8	The system shall be able provide recommended speed limits from outside the vehicle, and to confirm that they are consistent with the limits that have been sent directly to that vehicle.	8.2.5.2
	7.4.4.9	The system shall enable a road-side device to display safety-related information (e.g. legal speed limit, recommended speed limit) to drivers via a road–side device.	8.2.5.2
	7.4.4.10	The system shall enable the TCC to display safety-related information (e.g. legal speed limit, recommended speed limit) to drivers via a road-side device.	8.2.5.2
	7.4.4.11	The system shall be able to compare the reported speed of a vehicle with the current legal speed limit and send a warning to that vehicle for display to the driver, via an in-vehicle device, if its current speed is greater than the legal speed limit.	
	7.4.4.12	The system shall be able to compare the reported speed of a vehicle with the current legal speed limit and display a warning to the driver, via a road-side device, if its current speed is greater than the legal speed limit.	
	7.4.4.13	The system shall be able to compare the reported speed of a vehicle with the current recommended speed limit and send a warning to that vehicle for display to the driver, via an in-vehicle device, if its current speed is greater than the recommended speed limit.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.4.4.14	The system shall be able to compare the reported speed of a vehicle with the current recommended speed limit and display a warning to the driver, via a road-side device, if its current speed is greater than the recommended speed limit.	
	7.4.4.15	The system shall be able to warn the driver, via an in-vehicle device, that the host vehicle is exceeding the maximum speed limit.	
	7.4.4.16	The system shall inform the driver, via an in-vehicle display, that there is a modification to the speed limit ahead, and the reason for it.	
	7.4.4.17	The system shall provide "copies" of the traffic signs that are relevant to the current section of the road (e.g. speed limit, road hazards, junctions) to the driver at all times via an in-vehicle display.	7.4.1.48 7.4.2.5 7.4.3.9 8.5.5.1
	7.4.4.18	The system shall be able to send to following vehicles "copies" of the traffic signs, or information about the local traffic (e.g. sudden congestion), that it may be useful to receive in advance.	7.4.1.32 7.4.1.49 7.4.2.6 7.4.3.10 8.5.5.2
Headway Management	**7.4.5**	*The activities associated with providing a driver with a safe recommended headway from the vehicle in front.*	
	7.4.5.1	The system shall enable the TCC to calculate recommended headways for the current traffic and environment conditions.	
	7.4.5.2	The system shall provide the current minimum headway for the current speed limit to the driver via an in-vehicle device.	
	7.4.5.3	The system shall be able to recommend a safe minimum headway according to the current speed limit, traffic, weather and road conditions to the driver via an in-vehicle device.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.4.5.4	The system shall inform the driver, via an in-vehicle display, that there is a modification to the recommended headway ahead, and the reason for it.	
	7.4.5.5	The system shall be able to warn the driver, via an in-vehicle device, that the host vehicle is violating the minimum headway.	
Collision Warning	**7.4.6**	*The activities associated with identifying the possibility of collision with another vehicle in various circumstances and sending a consequential warning to the driver.*	
	7.4.6.1	The system shall be able to determine the type and current position of other vehicle(s) in the vicinity of the host vehicle, and to predict their future path(s).	
	7.4.6.2	The system shall be able to determine that there is a high probability of a collision between the host vehicle and another vehicle.	
	7.4.6.3	The system shall be able to warn the driver approaching a junction, via an in-vehicle device, of other equipped vehicles approaching that junction.	
	7.4.6.4	The system shall be able to warn the driver approaching a junction, via an in-vehicle device, of an equipped emergency vehicle that is approaching that junction.	
	7.4.6.5	The system shall be able to determine that the host vehicle is (about to) change lanes and warns the driver, via and in-vehicle device, if there are other equipped vehicles on potential collision path (e.g. motor-cycle in a blind spot).	
	7.4.6.6	The system shall be able to determine that the host vehicle is (about to) overtake, or turn across the road, and warns the driver, via and in-vehicle device, if there are other equipped vehicles on potential collision path (e.g. motor-cycle in a blind spot).	
	7.4.6.7	The system shall be able to compare the current trajectory of a vehicle with the road geometry and send a warning to that vehicle for display to the driver, via an in-vehicle device, that it is about to depart its lane.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.4.6.8	The system shall be able to compare the current trajectory of a vehicle with the road geometry and send a warning to the driver, via a road-side device, that it is about to depart its lane.	
	7.4.6.9	The system shall be able to compare the current trajectory of a vehicle with the road geometry and send a warning to the drivers of other vehicles that might be affected, via an in-vehicle device, that an oncoming vehicle lane departure into their lane is imminent.	
	7.4.6.10	The system shall be able to compare the current trajectory of a vehicle with the road geometry and send a warning to the drivers of other vehicles that might be affected, via a road-side device, that an oncoming vehicle lane departure into their lane is imminent.	
	7.4.6.11	The system shall be able to warn the driver, via an in-vehicle device, that another equipped vehicle is approaching the host vehicle from the front and in the same (partial) lane.	
	7.4.6.12	The system shall be able to warn the driver, via an in-vehicle device, that another equipped vehicle is approaching the host vehicle from the rear in the same (partial) lane and, when possible, provide advice, e.g. change to a safe adjacent lane, accelerate.	
	7.4.6.13	The system shall be able to warn the driver, via an in-vehicle device, that a slower equipped vehicle is ahead of the host vehicle and in the same (partial) lane and, when possible, provide advice, e.g. change to a safe adjacent lane, decelerate, brake.	
	7.4.6.14	The system shall be able to warn the driver, via an in-vehicle device, that there is a stationary object ahead of the host vehicle and in the same (partial) lane and, when possible, provide advice, e.g. change to a safe adjacent lane, brake.	7.4.1.41 7.4.1.42
	7.4.6.15	The system shall be able to advise the driver, via an in-vehicle device, of a recommended speed and distance from the vehicle ahead, based on the speed and characteristics (e.g. mass, load being carried) of the host vehicle and of the vehicle ahead.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.4.6.16	The system shall be able to calculate the current and future trajectories of each vehicle and VRU approaching the host vehicle at an urban intersection and assess the potential for collisions with the host vehicle.	
	7.4.6.17	The system shall be able to warn the driver of the host vehicle, via an in-vehicle device, of any collisions that could occur with other vehicles and/or VRU that are approaching an urban intersection.	
	7.4.6.18	The system shall be able to use a road-side device to warn drivers of any collisions that could occur with other vehicles and/or VRU that are approaching an urban intersection.	
	7.4.6.19	The system shall be able to calculate the trajectory of each vehicles and VRU approaching a T-junction, predict their future trajectories, assess potential conflicts and advise the driver on the minor road when to exit and join the main road.	
	7.4.6.20	The system shall be able to receive the status of traffic signals/signs that the host vehicle is approaching.	
	7.4.6.21	The system shall be able to provide advice to the driver approaching a junction, via an in-vehicle device, recommendations in terms of lane, speed, when traffic signal will change.	
	7.4.6.22	The system shall be able to advise a driver, via an in-vehicle device, how to approach a complex urban junction, e.g. speed required to go through green phase, imminent red phase warning, reduce speed to avoid queuing traffic, another vehicle or VRU, recommended lane choice.	
	7.4.6.23	The system shall be able to provide a warning to the driver, via an in-vehicle display, that other drivers ahead are performing an emergency brake manoeuvre.	
	7.4.6.24	The system shall be able to inform vehicles behind the host vehicle that it is performing an emergency brake manoeuvre.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.4.6.25	The system shall be able to provide a warning to the driver, via an in-vehicle display, that other vehicles behind are behaving in a dangerous manner (e.g. over speed limit, below minimum headway).	
Vulnerable Road User Warning	**7.4.7**	*The activities associated with warning a driver that a VRU is in a dangerous location.*	
	7.4.7.1	The system shall be able to warn the driver, via an in-vehicle device, that a VRU has been detected in a dangerous location by a system at the road side.	
	7.4.7.2	The system shall be able to warn the driver, via an in-vehicle device, that a VRU has been detected in a dangerous location by a system on the host vehicle.	
Emergency Vehicle Warning	**7.4.8**	*The activities associated with facilitating a smooth journey (blue wave) for emergency vehicles.*	
	7.4.8.1	The system shall enable drivers to be warned, via an in-vehicle device, that there are one, or more, stationary assistance/emergency vehicles ahead of them.	
	7.4.8.2	The system shall enable drivers to be warned, via a road-side device, that there are one, or more, stationary assistance/emergency vehicles ahead of them.	
	7.4.8.3	The system shall enable an emergency vehicle to request a “blue wave” from those other vehicles that are in its path.	
	7.4.8.4	The system shall enable an emergency vehicle to request a green signal for when that vehicle passes a controlled intersection.	
	7.4.8.5	The system shall enable the trajectory of an emergency vehicle to be predicted and compared with the trajectories of other vehicles in the vicinity, and to warn the drivers of those other vehicles with a potential conflict, via an in-vehicle device.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.4.8.6	The system shall be able to inform the driver of the host vehicle, via an in-vehicle device, that an emergency vehicle is approaching, and in sufficient time to enable a “blue corridor” to be created by all equipped vehicles.	
	7.4.8.7	The system shall be able to advise the driver, via an in-vehicle device, of an appropriate lane to use to create a “blue corridor”.	
	7.4.8.8	The system shall enable the host emergency vehicle to “place” virtual cones around the site of an accident.	
	7.4.8.9	The system shall enable the driver of the host vehicle to be advised, via an in-vehicle device, not to enter a zone defined by virtual cones.	
Cooperative Systems – Traffic Efficiency	**7.5**	*These are applications and services that enhance the efficiency of traffic by providing Traffic Flow Optimisation, Advanced Adaptive Traffic Signals and Flexible Lane Allocation. These User Needs are associated with functions that are expected to use V2V and V2I technologies (Cooperative Systems).*	
Traffic Flow Optimisation	**7.5.1**	*The activities associated with optimising the traffic flow by providing routes suitable for the vehicle, and alternatives when there is congestion.*	
	7.5.1.1	The system shall enable a traveller to request and receive journey plans in advance, assess different plans according to certain criteria (e.g. vehicle type, travel time, cost, expected traffic density, planned events, facilities en route, parking), and to save one for future use.	6.1.0.4 6.1.0.5 6.1.0.6 7.6.2.3
	7.5.1.2	*(X)FCD* – The system shall be able to send the intended route of the host vehicle (e.g. from a navigation system) to a road-side device.	7.4.1.2 8.2.4.1
	7.5.1.3	The system shall be able to monitor the current inter-urban traffic and weather/environmental conditions, identify incidents, assess their impact, make short term predictions, and select and initiate an appropriate mitigation strategy.	7.1.1.3 7.1.3.5

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.5.1.4	The system shall be able to monitor the current inter-urban traffic and weather/environmental conditions for the road network and recommend and/or set an appropriate traffic management strategy.	7.1.1.3 7.1.3.5
	7.5.1.5	The system shall be able to manage the traffic in an area using a number of local semi-autonomous traffic management units, whose rules can be modified when required.	
	7.5.1.6	The system shall enable the TCC to receive information about emergencies, e.g. eCall, ghost drivers.	
	7.5.1.7	The system shall enable the TCC to obtain travel times from cellular telephone service providers.	
	7.5.1.8	The system shall enable the TCC to inform drivers, via an in-vehicle device, about (foreseen and unexpected) incidents on the driver's planned route.	7.1.7.6
	7.5.1.9	The system shall be able to warn the driver, via an in-vehicle device, of incidents in the urban road network as they are detected.	
	7.5.1.10	The system shall enable the service provided to the traveller to be passed from one TCC to another as the traveller moves from one area of coverage to another.	
	7.5.1.11	The system shall be able to provide the driver, via an in-vehicle device, and on request, details of the (predicted) traffic situation in a defined area of interest, and for a time horizon, that has been selected by the driver. This information shall be updated at (selected) intervals.	
	7.5.1.12	The system shall enable the driver to store data relating to the characteristics of the host vehicle for that trip (e.g. loaded weight, hazardous goods, (trailer) dimensions).	9.5.7.1
	7.5.1.13	The system shall be able to determine the characteristics of the host vehicle (e.g. Type, (Total) weight, Width, Length (including trailer)).	9.5.7.2
	7.5.1.14	The system shall enable the host vehicle to receive information from other vehicles about the goods being carried by those vehicles.	9.5.7.3

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.5.1.15	The system shall be able to provide the driver via an in-vehicle device with a route to a selected destination that takes account of the vehicle type, the state of the traffic on the road network and any incidents/congestion (route options may be offered and one selected by the driver).	7.2.2.3
	7.5.1.16	The system shall be able to calculate an optimal speed for each type of vehicle through designated sections of the road network and provide that information to drivers via an in-vehicle device.	
	7.5.1.17	The system shall be able to compute an alternative local route for vehicles approaching a location to be avoided (e.g. one where there is a traffic incident or congestion above a given severity), and does not create congestion downstream. The alternative route computed may depend upon the vehicle type, and may need to be changed as the incident or congestion to be avoided evolves over time.	7.1.0.5 7.1.5.7 7.2.0.1
	7.5.1.18	The system shall be able to inform the driver, via an in-vehicle device, that an incident has been detected ahead on the selected route and provide a revised route.	6.2.1.1
	7.5.1.19	The system shall be able to present an alternative route that avoids an incident or congestion to the driver via an in-vehicle device, and to update that route if necessary.	
	7.5.1.20	The system shall enable the TCC to instruct drivers, via an in-vehicle device, of an alternative route that should be followed (to avoid an incident).	
	7.5.1.21	The system shall be able to “follow” those vehicles that have been provide with individual routes and to prove the effectiveness of those suggested routes, making changes to the algorithms that will be used in the future if necessary.	7.1.1.1
	7.5.1.22	The system shall be able to inform the driver via an in-vehicle device that part(s) of the selected route include one or more Flexible Lane Allocation sections.	
	7.5.1.23	The system shall inform the driver via an in-vehicle device that the vehicle has departed from the selected route and a revised route has been requested.	6.4.0.4

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.5.1.24	The system shall be able to calculate a predicted time for a total journey made up from separate links. The predicted time shall be updated regularly as the time for each link changes.	6.4.1.3 7.1.6.1
	7.5.1.25	The system shall enable the TCC to recommend the use of alternative routes for different types of vehicle.	6.4.0.4 7.1.5.6 7.3.1.2 9.5.2.12
	7.5.1.26	The system shall enable the TCC to command the use of alternative routes for different types of vehicle.	6.4.0.4 7.1.5.6 7.3.1.2 9.5.2.12
	7.5.1.27	The system shall be able to provide current and predicted journey times to another navigation device via an open interface (to enable dynamic navigation on the other device).	
	7.5.1.28	The system shall enable the TCC to inform traveller information service providers of the current traffic management strategy.	7.1.0.9
	7.5.1.29	The system shall be able to analyse traffic data using an off-line simulation tool.	
	7.5.1.30	The system shall be able to use a simulation model for predicting the effects of implementing a given cooperative traffic management scenario.	7.3.0.4 7.3.0.5
Advanced Adaptive Traffic Signals	**7.5.2**	*The activities associated with improving the flow of traffic through a signalised junction.*	
	7.5.2.1	The system shall enable a road-side device to receive information on the status of traffic signals.	
	7.5.2.2	The system shall enable the driver of a host vehicle to request a series of green phases from traffic signals (i.e. a green wave) for the route that is about to be taken.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.5.2.3	The system shall enable a traffic signal controller to receive a request for a green phase from an approaching vehicle; in the event that more than one conflicting request is received at the same time they shall be prioritised (e.g. emergency vehicles before private vehicles), possibly by the TCC operator.	7.1.9.1
	7.5.2.4	The system shall be able to determine the queue length in front of traffic signals in urban areas.	
	7.5.2.5	The system shall enable the traffic signal controller to determine the expected arrival time of a vehicle at the junction using data received from that vehicle (e.g. current location and speed profile, estimated time of arrival).	
	7.5.2.6	The system shall enable the traffic signal controller to inform the driver, via an in-vehicle display, that a green phase will be available when the host vehicle arrives at that junction at a recommended speed; this includes the ability to warn that a green phase is not possible.	
	7.5.2.7	The system shall be able to calculate an optimal speed for each vehicle through a section of road.	
	7.5.2.8	The system shall enable a traffic signal controller that has received a green phase request to inform downstream controllers that a green wave vehicle is approaching.	
	7.5.2.9	The system shall be able to keep track of the speed profiles of green wave vehicles between signalised junctions.	
	7.5.2.10	The system shall be able to warn other vehicles that a green wave is in operation.	
	7.5.2.11	The system shall be able to determine that the host vehicle is about to go through a red traffic signal, and to broadcast a warning to vehicles in the vicinity.	
	7.5.2.12	The system shall enable the host vehicle to receive a message that another vehicle is about to go through a red traffic signal, and to provide a warning to the driver, via an in-vehicle device.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
Flexible Lane Allocation	**7.5.3**	*The activities associated with the temporary use of PT lanes by other authorised vehicles.*	
	7.5.3.1	The system shall permit approved vehicles to use a section of a bus lane when it is not being used by PT or other specific vehicles (e.g. taxis and emergency services).	
	7.5.3.2	The system shall be able to predict the usage of a particular section of a bus lane for a short time into the future (e.g.15 minutes).	
	7.5.3.3	The system shall enable an approved vehicle that wishes to use a section of bus lane to provide its characteristics, destination and speed for lane use management.	
	7.5.3.4	The system shall enable the driver to set the destination of the host vehicle that wishes to use a bus lane, if this cannot be provided by the navigation system for lane use management.	
	7.5.3.5	The system shall be able to determine whether there is congestion on the normal road and, if so, whether a temporary licence should be given to the approved vehicle that is making a request to use a corresponding section of a bus lane without causing delays to scheduled PT vehicles.	
	7.5.3.6	The system shall inform the driver whether a licence has been granted to become an approved vehicle and, if so, for how long it will remain valid.	
	7.5.3.7	The system shall monitor the approved vehicles on the bus lanes and, if its licence has expired, that vehicle will be ordered to leave the bus lane at the end of that section.	
	7.5.3.8	The system shall monitor the usage of the bus lanes, and if a green wave cannot be sustained for a PT vehicle, then approved vehicles shall be ordered to leave the bus lane at the end of that section, and no further licences will be granted until suitable conditions are resumed.	
	7.5.3.9	The system shall monitor the congestion in each section of a bus lane and if a “critical/emergency” situation arises then approved vehicles shall be ordered to leave that section and the up-stream section(s) of bus lanes.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.5.3.10	The system shall monitor the usage of the bus lanes and record the identification, time and location of any vehicle that does not have permission to use it, for further processing by an enforcement agency.	
	7.5.3.11	The system shall collect traffic information (e.g. number of vehicles, speeds, queue lengths, violation details) on the roads covered by flexible bus lane allocation for statistical purposes, and to improve the algorithms used to decide when non-PT vehicles can use the bus lane.	
Cooperative Systems – Value-Added and Other Services	**7.6**	*These are applications and services that provide eCall, Enhanced Route Guidance and Navigation, Access Control and Service Continuity. These User Needs are associated with functions that are expected to use V2V and V2I technologies (Cooperative Systems).*	
eCall	**7.6.1**	*These activities are associated with providing emergency support after a traffic/vehicle/driver incident.*	5.1.0.n 7.2.0.n 7.2.1.n
	7.6.1.1	The system shall be able to detect that the host vehicle has been involved in an incident/accident and to call the emergency services either automatically or on command of the driver/passenger (eCall).	
	7.6.1.2	The system shall be able to send a request for assistance (eCall) message to the emergency services from a road-side device.	8.5.1.1
Enhanced Route Guidance and Navigation	**7.6.2**	*The activities are associated with providing personalised and up-to-date route guidance.*	6.4.n.n
	7.6.2.1	The system shall be able to provide data to add to, or to replace, that used to form a digital map.	
	7.6.2.2	The system shall enable the driver of the host vehicle to provide the destination and personal settings for the journey (e.g. desired route, way points, special needs).	6.4.1.4

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.6.2.3	The system shall enable a traveller to request and receive personalised journey plans in advance, assess different plans according to certain criteria (e.g. vehicle type, travel time, cost, expected traffic density, planned events, facilities en route, parking), and to save one for future use.	6.1.0.4 6.1.0.5 6.1.0.6 7.5.1.1
	7.6.2.4	The system shall enable the traveller information service provider to receive current inter-urban traffic management, and weather, conditions and planned events.	
	7.6.2.5	The system shall enable the traveller information service provider to be provided with current an predicted inter-urban traffic conditions.	
	7.6.2.6	The system shall enable the traveller to request and receive (anticipated) weather/environmental conditions on, or before, a planned trip.	
	7.6.2.7	The system shall be able to calculate the expected time of arrival at a destination or way point based on the driver's profile and the anticipated traffic conditions.	6.4.1.3
	7.6.2.8	The system shall be able to provide the driver, via an in-vehicle device, with a personalised route.	
	7.6.2.9	The system shall be able to provide the driver, via an in-vehicle device, with an estimated time of arrival which is updated at regular intervals.	
	7.6.2.10	The system shall enable the driver to (request and) receive, via an in-vehicle device, personalised on-trip information about incidents that may affect the planned journey.	
	7.6.2.11	The system shall enable a traveller to request and receive, via an in-vehicle device, personalised on-trip alternative journey plans (to avoid an incident) and to accept/reject the proposal(s).	
	7.6.2.12	The system shall be able to provide the pre-trip driver, via an in-vehicle device, with suggested alternative routes.	
	7.6.2.13	The system shall enable a traveller to request and receive, via an in-vehicle device, on-trip information about facilities on, or near, the planned route (e.g. fuel stations, refreshment areas).	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.6.2.14	The system shall be able to send O-D data, from the navigation system, and current location data from the host vehicle to the TCC to enable geo-referenced travel times to be produced.	
	7.6.2.15	The system shall enable the service provided to the traveller to be passed from one Service Provider to another as the traveller changes areas of coverage.	
Access Control	**7.6.3**	*These activities are associated with controlling access to a specific area into which only designated vehicles can go.*	7.3.1
	7.6.3.1	The system shall enable the host vehicle to receive the information from a road-side device that it is about to enter a “sensitive are”, and then to contact the relevant Access Control Centre.	
	7.6.3.2	The system shall enable the host vehicle to detect (e.g. using map matching) that it is about to enter a “sensitive area” and to contact the relevant Access Control Centre.	
	7.6.3.3	The system shall enable the Access Control Centre to give, or deny, permission for an equipped vehicle to enter a “sensitive area”.	
	7.6.3.4	The system shall enable the Access Control Centre to monitor all equipped vehicles, and the traffic, within a “sensitive area” and to send instructions to the drivers of the equipped vehicles.	
	7.6.3.5	The system shall enable the Access Control Centre to store information about each equipped vehicle.	
	7.6.3.6	The system shall enable the host vehicle to close the contact with the Access Control Centre when it leaves the “sensitive area” and to create a report for the freight vehicle driver.	
Service Continuity	**7.6.4**	*These activities are associated with ensuring that applications and services are provided throughout a journey.*	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	7.6.4.1	The system shall be able to exchange relevant information between adjacent TCCs and TICs to ensure the continuity of services for travellers.	2.1.0.1
8 Intelligent Vehicle Systems		*This group contains the functions found within a vehicle, including vision enhancement, longitudinal and lateral collision avoidance, lane keeping, platooning, speed control, driver alertness, 'eCall' initiation, etc.*	
8.1 Vision Enhancement		*This service does not require communications with any other vehicle or infrastructure and is therefore outside the scope of the European ITS Framework Architecture.*	
8.1.0 Basic Services	**8.1.0.1**	Deleted - outside new system boundary	
	8.1.0.2	Deleted - outside new system boundary	
	8.1.0.3	Deleted - outside new system boundary	
	8.1.0.4	Deleted - outside new system boundary	
8.2 Automated Vehicle Operation			
8.2.0 Objectives	**8.2.0.1**	The system shall provide support for direct or indirect assistance for the driving task.	
8.2.1 Collision Avoidance	**8.2.1.1**	The system shall be able to inform another vehicle when the host vehicle has detected that a collision is imminent.	
	8.2.1.2	Deleted - outside new system boundary	
	8.2.1.3	Deleted - outside new system boundary	
8.2.2 Lane Keeping	**8.2.2.1**	The system shall be able to provide support to control the lateral dynamic behaviour of the vehicle automatically, and keep the vehicle within its current lane of the carriageway.	8.4.2.1

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	8.2.2.2	The system shall be able to provide support to provide the driver with information, or active steering support, to assist him/her to keep within the current lane of the carriageway.	8.4.2.2
8.2.3 Platooning	**8.2.3.1**	The system shall provide support to create a platoon of vehicles, in particular trucks ("Electronic Towbar" or "Road Train").	
	8.2.3.2	Deleted - outside new system boundary	
	8.2.3.3	Deleted - outside new system boundary	
	8.2.3.4	Deleted - outside new system boundary	
	8.2.3.5	Deleted - outside new system boundary	
	8.2.3.6	Deleted - outside new system boundary	
	8.2.3.7	Deleted - outside new system boundary	
8.2.4 Short Range Communications	**8.2.4.1**	The system shall be able to communicate with other equipped vehicles, and/or the infrastructure, to exchange data for automatic vehicle control.	
8.2.5 Speed Control	**8.2.5.1**	The system shall be able to provide support to limit the speed of a vehicle automatically to the a given, but variable, maximum (intelligent speed adaptation)	
	8.2.5.2	The system shall be able to receive (variable) mandatory speed limits from outside the vehicle.	7.1.7.4
	8.2.5.3	Moved to 8.5.5.1	
	8.2.5.4	The system shall be able to display continuously to the driver the current mandatory speed limit.	
	8.2.5.5	Deleted - outside new system boundary	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	8.2.5.6	Deleted - identical to 8.2.5.2	
8.2.6 Supporting Tasks	**8.2.6.1**	Deleted - outside new system boundary	
	8.2.6.2	Deleted - outside new system boundary	
	8.2.6.3	Deleted - outside new system boundary	
	8.2.6.4	Deleted - outside new system boundary	
	8.2.6.5	Deleted - outside new system boundary	
	8.2.6.6	Deleted - outside new system boundary	
	8.2.6.7	Deleted - outside new system boundary	
8.3 Longitudinal Collision Avoidance			
8.3.0 Objectives	**8.3.0.1**	The system shall be able to provide the driver with assistance in longitudinal separation from other vehicles in, or entering, the host vehicle's lane.	
	8.3.0.2	Deleted - outside new system boundary	
	8.3.0.3	Deleted - outside new system boundary	
8.3.1 Collision Avoidance	**8.3.1.1**	Deleted - outside new system boundary	
	8.3.1.2	The system shall be able to provide support to warn the driver when the vehicle in front is too close.	
	8.3.1.3	The system shall be able to provide support to determine a safe vehicle trajectory relative to the lane/road boundaries.	8.4.1.3
	8.3.1.4	Deleted - outside new system boundary	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	8.3.1.5	Deleted - outside new system boundary	
	8.3.1.6	Deleted - outside new system boundary	
	8.3.1.7	Deleted - outside new system boundary	
8.3.2 Supporting Tasks	**8.3.2.1**	Deleted - outside new system boundary	
	8.3.2.2	Deleted - outside new system boundary	
	8.3.2.3	Deleted - outside new system boundary	
	8.3.2.4	Deleted - outside new system boundary	
	8.3.2.5	Deleted - outside new system boundary	
8.4 Lateral Collision Avoidance			
8.4.0 Objectives	**8.4.0.1**	The system shall provide support to monitor for hazards involved in lane keeping, lane changing, entering and leaving high speed roads, and overtaking.	
	8.4.0.2	Deleted - outside new system boundary	
8.4.1 Collision Avoidance	**8.4.1.1**	The system shall be able to provide support to warn the driver if the host vehicle moves towards a volume of road space that is about to be occupied, or already occupied, by another road user.	
	8.4.1.2	Deleted - outside new system boundary	
	8.4.1.3	The system shall be able to provide support to determine a safe vehicle trajectory relative to the lane/road boundaries.	8.3.1.3
	8.4.1.4	Deleted - outside new system boundary	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
8.4.2 Lane Keeping	**8.4.2.1**	The system shall be able to provide support to detect the position of the vehicle relative to lane boundaries and/or roadway shoulders.	8.2.2.1
	8.4.2.2	The system shall be able to provide support to to warn the driver when the vehicle approaches or exceeds the lane boundaries.	8.2.2.2
8.4.3 Supporting Tasks	**8.4.3.1**	Deleted - outside new system boundary	
	8.4.3.2	Deleted - outside new system boundary	
	8.4.3.3	Deleted - outside new system boundary	
	8.4.3.4	Deleted - outside new system boundary	
	8.4.3.5	Deleted - outside new system boundary	
8.5 Safety Readiness			
8.5.0 Basic Services	**8.5.0.1**	The system shall minimise the risk of an accident due to the impaired alertness of the driver.	
	8.5.0.2	The system shall be able to detect impairment of the driver, e.g. alcohol/drug abuse, drowsiness, sudden health problems, prolonged inattention, etc.	
	8.5.0.3	The system shall be able to warn the driver when a lack of alertness is detected.	
	8.5.0.4	The system shall be able to warn surrounding drivers that this driver has a problem.	
8.5.1 eCall	**8.5.1.1**	The system shall be able to make an 'eCall'.	5.1.0.7 5.1.0.1
	8.5.1.2	The system shall be able to detect that the vehicle has been involved in an accident, identify its location, and initiate an 'eCall' automatically.	5.1.0.2 9.4.0.3

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	8.5.1.3	The system shall be able to identify the vehicle's location, and make an 'eCall' on the command of a vehicle occupant.	5.1.0.3 9.4.0.4
	8.5.1.4	The system shall be able to detect that the driver is impared, identify its position, and initiate an 'eCall' automatically.	5.1.0.7 9.4.0.4
8.5.2 Automatic Parking	**8.5.2.1**	The system shall be able to manoeuvre the vehicle to the roadside automatically, when the driver does not respond.	
	8.5.2.2	Deleted - outside new system boundary	
8.5.3 Environmental Monitoring	**8.5.3.1**	Deleted - outside new system boundary	
	8.5.3.2	Deleted - outside new system boundary	
	8.5.3.3	Deleted - outside new system boundary	
	8.5.3.4	The system shall be able to collect information about the vehicle and its environment for other organisations to use, i.e. probe or floating car data.	
8.5.4 Accident Data Recording	**8.5.4.1**	The system shall be able to record data about an accident and the journey immediately before (black box).	
	8.5.4.2	The system shall be able to provide data about an accident or a journey to an authorised person, e.g. the police.	
8.5.5 Traffic Information & Signs	**8.5.5.1**	The system shall provide "copies" of the traffic signs that are relevant to the current section of the road (e.g. speed limit, road hazards, junctions) to the driver at all times.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	8.5.5.2	The system shall be able to send to following vehicles "copies" of the traffic signs, or information about the local traffic (e.g. sudden congestion), that it may be usefull to receive in advance	
8.5.6 Vehicle Information	**8.5.6.1**	The system shall be able to provide a unique ID to an authorised authority on request (i.e. electronic vehicle identification EVI)).	
8.5.7 Improper Use	**8.5.7.1**	The system shall be able to provide support for detecting that the vehicle is not being used properly, e.g. being stolen.	
8.6 Pre-crash Restraint Deployment		*This service does not require communications with any other vehicle or infrastructure and is therefore outside the scope of the European ITS Framework Architecture.*	
8.6.0 Basic Services	**8.6.0.1**	Deleted - outside new system boundary	
	8.6.0.2	Deleted - outside new system boundary	
9 Freight and Fleet Management		*This group contains all the activities associated with FFM, including statutory data collection and reporting; orders and document mgt; planning, scheduling, monitoring, reporting & operations mgt; vehicle and cargo safety; mgt of inter-modal interfaces.*	
9.1 Commercial Vehicle Pre-Clearance			
9.1.0 Basic Services	**9.1.0.1**	The system shall enable the device storing the information recorded by the tachograph to be physically removed from the vehicle.	
	9.1.0.2	The system shall enable all electronically recorded information stored on-board the vehicle to be interrogated whenever required.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	9.1.0.3	The system shall be able to communicate with road-side equipment whilst the vehicle is travelling.	
	9.1.0.4	The system shall protect the tachograph against fraud, and from being accessed by unauthorised persons.	
9.2 Commercial Vehicle Administrative Processes			
9.2.0 Basic Services	**9.2.0.1**	The system shall be able to store all necessary statutory (i.e. required by law) information on-board the vehicle.	9.5.3.2
	9.2.0.2	The system shall be able to provide communications between fleet operators and the relevant authorities for the transfer of registration data (e.g. vehicle identity, load, etc.) plus payments.	
9.3 Automated Roadside Safety Inspection			
9.3.0 Basic Services	**9.3.0.1**	The system shall be able to transfer safety-related information (e.g. brakes status, driving time etc.) from the vehicle to the road-side whilst the vehicle is travelling.	
	9.3.0.2	The system shall enable the weight of a commercial vehicle to be measured whilst the vehicle is travelling (weigh-in-motion).	3.1.1.3
	9.3.0.3	The system shall be able to collect evidence automatically about a vehicle that has violated the regulations.	4.1.4.1

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
9.4 Commercial Vehicle On-Board Safety Monitoring			
9.4.0 Basic Services	**9.4.0.1**	The system shall be able to monitor the vehicle and cargo safety status, and the behaviour of the driver (e.g. duration of driving time, excess speed).	9.5.3.10
	9.4.0.2	The system shall issue a warning to the driver whenever a threshold for a vehicle or cargo safety status, or driver behaviour, has been exceeded, and the relevant data shall be recorded.	
	9.4.0.3	The system shall be able to identify the vehicle's location, and make an 'eCall' to the emergency services on the command of a vehicle occupant.	8.5.1.3
	9.4.0.4	The system shall be able to detect that the vehicle has been involved in an incident, identify its location, and initiate an 'eCall' to the emergency services automatically.	8.5.1.2 8.5.1.4
	9.4.0.5	The system shall be able to report to the home base when incorrect driver behaviour persists (e.g. driver is ill, or an unskilled driver is in control).	
9.5 Commercial Fleet Management			
9.5.0 Objectives	**9.5.0.1**	The system shall support fleet and freight operations for all sizes of operator, including single vehicle companies.	
	9.5.0.2	The system shall be able to incorporate additional regulations as and when required, and provide an indication of compliance.	
9.5.1 Road Freight Management	**9.5.1.1**	The system shall enable the exchange of information, e.g. market enquiries, offer and supplier evaluation data, contracts, invoices, payments etc. between parties, e.g. consignors, consignees etc.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	9.5.1.2	The system shall be able to provide information about a cargo, (e.g. loading status, contents, delays, delivery status, disputes etc.) to the fleet management centre in real time.	
	9.5.1.3	The system shall be able to prepare and update official documents, e.g. transport orders, customs declarations, hazardous goods declarations, notices of dispatch etc. in a controlled manner, and assist the process of checking them.	9.5.3.8
	9.5.1.4	The system shall be able to exchange official documents (e.g. transport orders, customs declarations, hazardous goods declarations, notices of dispatch etc.) between vehicles, the fleet management centre and the relevant authorities in a controlled manner	9.5.3.4
	9.5.1.5	The system shall be able to transfer any information about a journey (e.g. route, (hazardous or oversize) cargo, etc.) to the relevant authorities (e.g. TCCs, TICs etc.) when required.	5.3.0.3
	9.5.1.6	The system shall be able to track the physical (e.g. temperature) and administrative status (e.g. shipment status, delivery status, etc.) of a cargo throughout its journey.	9.5.3.16
	9.5.1.7	The system shall enable the consignee to receive information, (e.g. delivery note, invoice etc.) directly from the vehicle.	
	9.5.1.8	The system shall enable the shipper to receive information (e.g. destination, contractual data etc.) directly from the vehicle.	
	9.5.1.9	The system shall be able to confirm electronic documents with electronic signatures.	
	9.5.1.10	The system shall be able to reconstitute the route taken by any item, and the contracts that have been fulfilled (tracing function).	9.5.3.12
	9.5.1.11	The system shall be able to analyse the costs and performance of the FFM operations.	9.5.2.16 9.5.3.21
	9.5.1.12	The system shall be able to transfer any data that has been recorded on a vehicle to the home base and/or any other authorised third party.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
9.5.2 Road Freight Fleet Management	**9.5.2.1**	The system shall be able to support some aspects of the planning, monitoring, controlling and evaluation of vehicle fleet operations (see below).	
	9.5.2.2	The system shall be able to assign tasks to vehicles and drivers, e.g. pick-up and delivery instructions.	
	9.5.2.3	The system shall be to optimise the scheduling of vehicles.	
	9.5.2.4	The system shall be to optimise the scheduling of drivers.	
	9.5.2.5	The system shall be able to optimise the assignment of loads.	
	9.5.2.6	The system shall be able to weigh the vehicle, compare it with the expected weight and report on any discrepancies or overweight.	
	9.5.2.7	The system shall be able to transfer all information relating to a cargo (e.g. task assignment, load planning etc.) to the vehicle.	9.5.3.3
	9.5.2.8	The system shall be able to provide an optimal route for each 'normal' vehicle.	6.4 9.5.3.22
	9.5.2.9	The system shall be able to provide suitable routes for 'abnormal' vehicles (e.g. oversized, overweight, hazardous cargo etc.) when requested.	5.3.2.1 7.1.4.9
	9.5.2.10	The system shall be able to predict a time of arrival.	6.4.1.3 7.1.6.1 10.2.1.3
	9.5.2.11	The system shall be able to communicate with other systems, e.g. workshop, customs, road operator, police, etc.	
	9.5.2.12	The system shall be able to provide a driver with a suitable alternative route, when the original planned route becomes unavailable.	7.1.5.6 9.5.3.11
	9.5.2.13	The system shall be able to locate, identify and monitor the status of a vehicle, equipment or cargo at any time.	6.4.0.3 10.1.2.1

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	9.5.2.14	The system shall be able to inform the driver about a change of task, e.g. change of pick-up, delivery, route etc.	9.5.3.11
	9.5.2.15	The system shall be able to schedule the maintenance of vehicles, equipment and cargo units.	
	9.5.2.16	The system shall be able to monitor and analyse the vehicle fleet and drivers' staff costs and performance.	9.5.1.11
9.5.3 Road Vehicle, Driver, Equipment and Cargo Management	**9.5.3.1**	The system shall support the activities associated with the management of individual vehicles, i.e. not related to the vehicle fleet as a whole.	
	9.5.3.2	The system shall be able to store all necessary commercial and statutory vehicle, driver, trip and freight information on-board the vehicle.	9.2.0.1
	9.5.3.3	The system shall be able to receive all necessary commercial and statutory vehicle, driver, trip and freight information from the fleet management centre at any time.	9.5.2.7
	9.5.3.4	The system shall be able to transfer official documents (e.g. transport orders, customs declarations, hazardous goods declarations, notices of dispatch etc.) between vehicles and relevant parties in a controlled manner.	9.5.1.4
	9.5.3.5	The system shall enable the driver to receive traffic information.	
	9.5.3.6	The system shall enable the driver to receive weather information.	
	9.5.3.7	The system shall enable voice communication between the vehicle and the fleet management centre.	
	9.5.3.8	The system shall be able to assist the process of checking the vehicle, equipment and cargo documents.	9.5.1.3
	9.5.3.9	The system shall be able to record data (e.g. from vehicle, equipment, cargo unit sensors, and driver input etc.) for later processing.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	9.5.3.10	The system shall be able to record driver's hours, and report on available hours, deviations and disturbances.	9.4.0.1
	9.5.3.11	The system shall enable the driver to receive a change (e.g. to the route, task, etc.) at any time.	7.1.5.6 9.5.2.12 9.5.2.14
	9.5.3.12	The system shall be able to record the actual route taken.	9.5.1.10
	9.5.3.13	The system shall be able to report when a substantial deviation from the intended route has been used (e.g. to detect a possible theft of the vehicle).	
	9.5.3.14	The system shall be able to determine a delay in the planned time of arrival, and communicate this to the fleet management centre.	
	9.5.3.15	The system shall enable automatic payment, e.g. of tolls etc.	4.1.3.1
	9.5.3.16	The system shall be able to detect when the status of the cargo (e.g. changes in temperature or humidity) exceeds a given limit during the transport cycle, and trigger an alarm.	9.5.1.6
	9.5.3.17	The system shall be able to adjust the temperature and humidity of a freight unit remotely, during the transport cycle.	
	9.5.3.18	The system shall be able to monitor the vehicle and cargo unit for erroneous procedures (e.g. doors being opened incorrectly) and trigger an anti-theft alarm message to the home base and/or any relevant body.	
	9.5.3.19	The system shall be able to provide communications between the vehicle and local breakdown support, e.g. for repair of punctured tyres.	
	9.5.3.20	The system shall enable automatic remote vehicle diagnostics.	
	9.5.3.21	The system shall be able to monitor and analyse the vehicle and driver's staff costs and performance.	9.5.1.11

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	9.5.3.22	The system shall be able to provide the driver with a route to a destination	6.4 9.5.2.8
	9.5.3.23	The system shall be able to record the payment of tolls.	
	9.5.3.24	The system shall be able to monitor the weight of the cargo, check conformance with the documentation and report any variations.	
	9.5.3.25	The system shall be able to record the details of any relevant legal offence committed by the driver, vehicle or cargo, that has been registered with the authorities, and provide them to authorised personnel.	
	9.5.3.26	The system shall be able to record supplementary information about events recorded by the tachograph, e.g. reason for waiting time.	
	9.5.3.27	The system shall be able to provide the driver with relevant information about client sites (consignors & consignees), e.g. location, pick-up/delivery times, average waiting time.	
	9.5.3.28	The system shall be able to collect and record information about collection/delivery operations, e.g. arrival & waiting times, additional work, incidents.	
	9.5.3.29	The system shall be able to time-stamp data recorded during a trip, e.g. current location.	
	9.5.3.30	The system shall be able to produce a message about a new collection of cargo that has been made.	
	9.5.3.31	The system shall be able to provide a list of all the servicing and repair actions that have been done, and any special accessories that have been installed, for confirmation by the driver prior to departure.	
	9.5.3.32	The system shall be able to identify cargo, e.g. during loading and unloading, compare it for compliance with a manifest, and issue a warning in case of non-compliance.	
	9.5.3.33	The system shall be able to identify the vehicle and/or equipment, e.g. to gain access to a controlled site.	
	9.5.3.34	The system shall be able to locate an item of cargo within the vehicle and/or equipment.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	9.5.3.35	The system shall be able to record the location of operational points, e.g. pick up, delivery, home base.	
	9.5.3.36	The system shall be able to transfer site access details to the driver from the home base.	
	9.5.3.37	The system shall be able to record guidance details of regular and/or frequent trips so that they do not have to be re-calculated.	
	9.5.3.38	The system shall be able to report automatically the receipt and/or reading of incoming messages to the sender.	
	9.5.3.39	The system shall be able to add a time stamp and/or vehicle position to any message sent from the vehicle; this data to be added at the time the message was formulated and/or the time it was sent.	
	9.5.3.40	The system shall be able to record details about pallets, and provide this information to the home base when required.	
	9.5.3.41	The system shall be able to assist the process of confirming that the driver is suitable qualified to take a given cargo, e.g. dangerous goods.	
	9.5.3.42	The system shall provide information in the native language of the driver.	
9.5.4 Freight Distribution	**9.5.4.1**	The system shall manage freight and fleets in such a way that the impact of commercial vehicles on the urban environment is minimised.	7.1.0.4
	9.5.4.2	The system shall be able to manage freight and fleets in such a way that the distribution of goods in an urban area will be made in the most efficient manner.	
	9.5.4.3	The system shall be able to manage the use of (un-)loading zones to aid the distribution of goods in an urban area.	
	9.5.4.4	The system shall be able to book places in an equipment/container storage area.	
	9.5.4.5	The system shall be able to forecast the use of an equipment/container storage area	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
9.5.5 Inter-Modal Interface	**9.5.5.1**	The system shall be able to manage the use of the interface between freight transport modes in an effective manner.	
	9.5.5.2	The system shall be able to support a combined transport interface management function.	
	9.5.5.3	The system shall be able to support a freight transport order processing function that is common to all modes of transport.	
	9.5.5.4	The system shall ensure that the information associated with a vehicle, equipment or container is available when that vehicle, equipment or container arrives at a modal interchange.	
	9.5.5.5	The system shall enable the matching of demand for, and supply of, (multi-modal) freight transport resources.	
Hazardous Goods Vehicle Management	**9.5.6**	*The activities associated with managing the transit of hazard goods through an area.*	
	9.5.6.1	The system shall enable the relevant authority to plan and manage routes that are suitable for use by vehicles carrying hazards goods.	
	9.5.6.2	The system shall enable a driver of a vehicle carrying hazardous goods to request from the relevant authority, via an on-board device, an approved route from the current position of the host vehicle to a stated destination.	5.3.2.1 7.3.1.2 9.5.2.9
	9.5.6.3	The system shall enable the driver of a vehicle carrying hazardous goods to be guided, via an in-vehicle device, along an approved route by the relevant authority.	
	9.5.6.4	The system shall enable a vehicle carrying hazardous goods to be monitored, via an in-vehicle device, by the relevant authority.	5.3.0.n 9.5.1.5
	9.5.6.5	The system shall enable the relevant authority to detect incidents within its area and to re-route any vehicle carrying hazardous goods that will be affected by the consequences of that incident	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	9.5.6.6	The system shall enable the relevant authority to monitor all vehicles carrying hazardous goods within its area of responsibility, to confirm that they are proceeding as planned, and to contact the driver of any vehicle that is not behaving correctly.	
	9.5.6.7	The system shall enable vehicles carrying hazardous goods to be transferred from one authority to another as they pass from one area of responsibility to another.	
	9.5.6.8	The system shall enable a vehicle carrying hazardous goods to request appropriate assistance in the case of an incident or accident (eCall).	5.1.0.n 5.3.1.3 5.3.1.4 7.2.6.1
Driver Rest Areas	**9.5.7**	*The activities associated with booking and managing freight driver rest areas.*	
	9.5.7.1	The system shall enable the driver to store data relating to the characteristics of the host vehicle for that trip (e.g. loaded weight, hazardous goods, (trailer) dimensions).	7.5.1.12
	9.5.7.2	The system shall be able to determine the characteristics of the host vehicle (e.g. Type, (Total) weight, Width, Length (including trailer)).	7.5.1.13
	9.5.7.3	The system shall enable the host vehicle to receive information from other vehicles about the goods being carried by those vehicles.	7.5.1.14
	9.5.7.4	The system shall enable the freight vehicle driver, to request a reservation for a rest area parking place. The request will include the planned route, estimated time, required duration, potential flexibility, possible hazardous goods and vehicle type.	
	9.5.7.5	The system shall enable a rest area parking reservation to be made based on the request that has been received, or to state that one is not available and/or propose and alternative booking, and to send the details to the freight vehicle driver and the fleet operator.	
	9.5.7.6	The system shall enable the driver to accept or reject alternative proposals for a rest area parking place.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	9.5.7.7	The system shall be able to receive an ETA from a vehicle that is approaching a rest area, based on current traffic conditions, and to send confirmation to the driver that the reserved parking place is still available together with information about the other services that are available.	
	9.5.7.8	The system shall enable the driver to determine the ETA to the booked rest area parking place, based on current traffic information, and to confirm/modify/cancel details of the booking.	
	9.5.7.9	The system shall be able to identify the vehicle that arrives at a rest area, and to inform the driver which parking slot to use and how to get there.	
	9.5.7.10	The system shall be able to receive a message that a vehicle is leaving the rest area.	
Loading Zone Management	**9.5.8**	*The activities associated with booking urban (un)loading places*	
	9.5.8.1	The system shall enable the freight vehicle driver, to request a reservation for an urban parking place to enable un/loading. The request will include the desired location, time, duration, potential flexibility, possible hazardous goods and vehicle type.	
	9.5.8.2	The system shall enable an un/loading zone parking allocation to be made based on the request that has been received, or to state that one is not available and/or propose an alternative booking, and to send the details to the freight vehicle driver and the fleet operator.	
	9.5.8.3	The system shall enable the driver to accept or reject alternative proposals for an urban parking place.	
	9.5.8.4	The system shall be able to receive an ETA from a vehicle that is approaching an urban parking place, and to receive confirmation that the urban parking place (or holding zone) is still/now available and/or receive updates to the booking.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	9.5.8.5	The system shall be able to inform the driver, via an in-vehicle device, of a holding zone that may be used in the event that a suitable urban parking place is not available, or the booked urban parking place is no long available, at the desired time.	
	9.5.8.6	The system shall enable the urban parking zone to be monitored for any vehicle that is parked with or without permission, including overstaying.	
	9.5.8.7	The system shall be able to provide up-to-date micro-routing information to a booked parking place (or holding zone).	
	9.5.8.8	The system shall be able to receive a message that a vehicle is leaving the urban parking place.	
10 Public Transport Management		*This group contains the activities associated with public transport (PT), demand responsive PT, Shared PT, on-trip PT Information and Traveller Security. It includes management, scheduling, monitoring, information handling, communications and PT priority.*	
10.1 Public Transport Management			
10.1.0 Objectives	**10.1.0.1**	The system shall provide effective and attractive PT.	
	10.1.0.2	The system shall be able to manage one or more modes of PT.	
	10.1.0.3	The system shall be able to assist PT operators in planning for the optimum use of existing resources to meet the demand.	
	10.1.0.4	The system shall be able to analyse records of usage and operational data, and passenger surveys, to assist in the planning process.	
10.1.1 Scheduling	**10.1.1.1**	The system shall be able to produce optimum vehicle schedules that consider many issues, e.g. links, points, day types, vehicle types, demand types, time bands, limits based on demand etc.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	10.1.1.2	The system shall be able to produce optimum driver schedules.	
10.1.2 Monitoring	**10.1.2.1**	The system shall be able to receive information about the identity, location, status and occupancy all vehicles in the fleet in real time.	6.4.0.3 9.5.1.13
	10.1.2.2	The system shall be able to monitor the number of travellers waiting at a pick-up point, e.g. Park and Ride site.	
10.1.3 Incident Management	**10.1.3.1**	The system shall be able to identify an incident and to revise its services so that passengers may complete their journeys.	
	10.1.3.2	The system shall be able to schedule PT operations dynamically so that incidents or unexpected events can be handled with the minimum disruption.	7.2
10.1.4 Information Handling	**10.1.4.1**	The system shall be able to inform travellers about PT operations for a mode of transport, e.g. travel times, delays, fares etc.	10.4.0.1
	10.1.4.2	The system shall be able to provide information about a PT service to the travellers before and during the journey.	6.1.1.4 10.4.0.1
	10.1.4.3	The system shall be able to provide an update of arrival/departure information in real-time and present it to travellers of that mode before and during the jouney.	10.4.1.1 10.4.1.2
	10.1.4.4	The system shall be able to provide information that is relevant to travellers with special needs, e.g. obstacles, manually operated doors, manual payment systems, restrictions for guide dogs, etc.	
10.1.5 Communications	**10.1.5.1**	The system shall be able to provide two-way data and voice communication between PT vehicles and a central location.	10.5.0.2

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
10.1.6 Priority	**10.1.6.1**	The system shall be able to select those vehicles that need to be given priority and communicate the requests to the TCC.	7.1.9.3
10.2 Demand Responsive Public Transport			
10.2.0 Objectives	**10.2.0.1**	The system shall be able to provide both planned and spontaneous trips.	
	10.2.0.2	The system shall be able to satisfy a variety of booking types, e.g. last minute, return trip (including weeks/months ahead), being able to take advantage of late opening hours, special facilities etc.	
	10.2.0.3	The system shall be able to provide access to a wide variety of destinations over a large geographic area.	
	10.2.0.4	The system shall be able to obtain service information so that other journeys may include other modes of transport.	
	10.2.0.5	The system shall provide the traveller with an easy to use user interface that minimises the amount of data to be provided by the traveller.	
10.2.1 Information Handling	**10.2.1.1**	The system shall provide all the information necessary to prepare a journey.	
	10.2.1.2	The system shall enable the user to book a trip from a variety of access points, e.g. internet, "on-street" terminals, etc.	
	10.2.1.3	The system shall be able to predict the time that will be taken to make a particular trip.	6.4.1.3 7.1.6.1 9.5.2.10
	10.2.1.4	The system shall be able to provide a service in which travellers wait a minimum period of time for a Demand Responsive PT vehicle to arrive.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	10.2.1.5	Deleted and moved to 10.2.4.2 with changes	
	10.2.1.6	The system shall be able to locate and identify the Demand Responsive PT vehicles.	
	10.2.1.7	The system shall be able to schedule the Demand Responsive PT vehicles in real-time.	
	10.2.1.8	The system shall be able to plan the Demand Responsive PT vehicle trips in the most efficient manner.	
	10.2.1.9	The system shall enable the traveller to specify any special needs that he or she may have, e.g. disability, young children, etc.	
10.2.2 Communications	**10.2.2.1**	The system shall be able to provide two-way data communications between the Demand Responsive PT vehicles and a control centre.	
	10.2.2.2	The system shall be able to provide two-way voice communications between the Demand Responsive PT vehicles and a control centre for non-routine use.	10.5.0.2
10.2.3 Route Guidance	**10.2.3.1**	The system shall be able to inform the driver about the optimum route, according to specified criteria, that he or she should take for one or more trips.	6.4.1.4
10.2.4 Reporting	**10.2.4.1**	The system shall be able to provide statistics of usage for reporting to managers, and use in day-to-day operations.	
	10.2.4.2	The system shall be able to provide statistics on how well it actually satisfies its customers, e.g. response times, for reporting to its users.	
10.3 Shared Transport Management			
10.3.0 Basic Services	**10.3.0.1**	The system shall support car pooling, i.e. the sharing of a small number of cars between a larger set of people; normally the cars are the property of the system owner.	

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	10.3.0.2	The system shall support car sharing, i.e. the allocation of a single car to a number of people for a single journey; normally one of them owns the car.	6.1.0.7
	10.3.0.3	The system shall be able to register people either as a driver and/or a (paying) passenger.	
	10.3.0.4	The system shall enable drivers and passengers to input pooling or sharing requests from a variety of access points, using the minimum amount of data	
	10.3.0.5	The system shall support an interactive database of car sharers that will permit them to find suitable partners.	
	10.3.0.6	The system shall be able to record each trip made, both for statistical purposes and to levy a possible charge.	
	10.3.0.7	The system shall provide the cost of the journey to the traveller before he or she accepts the service that is being offered, unless the service is free.	
	10.3.0.8	The system shall support a database containing the prices being charged by drivers for carrying passengers; this shall be available to drivers and passengers before they accept the service being offered.	
	10.3.0.9	The system must provide a positive indication to the drivers if the service being offered is free, and what additional charges (if any) they can levy on the passengers.	
10.4 On-Trip Public Transport Information			
10.4.0 Objectives	**10.4.0.1**	The system shall be able to inform travellers about all PT operations, e.g. bus, rail, metro, air, taxi, car pooling etc.	10.1.4.1 10.1.4.2
10.4.1 Information Handling	**10.4.1.1**	The system shall be able to provide in-vehicle general (dynamic) PT information, as well as the arrival time at, and name of, the next stop for this vehicle.	10.1.4.3

FRAME User Needs V4.1			
Group	**No**	**Description**	**Similar**
	10.4.1.2	The system shall be able to provide general (dynamic) PT information, personal safety information, as well as the arrival times of next vehicles, delays, etc. at mode interchanges, e.g. bus stops, in metro, railway or bus stations, etc.	10.1.4.3
	10.4.1.3	The system shall be able to provide information that is relevant to travellers with special needs, e.g. obstacles, manually operated doors, restrictions for guide dogs and/or push chairs, etc.	
10.4.2 Traveller Interaction	**10.4.2.1**	The system shall provide service information which is legible, understandable and capable of being assimilated very quickly by all travellers, including those with special needs.	
	10.4.2.2	The system shall provide information in the native language at the output location, and/or from a user selected choice of other appropriate foreign languages, when applicable.	6.1.2.8 6.2.3.3
10.5 Public Travel Security			
10.5.0 Basic Services	**10.5.0.1**	The system shall monitor for, and collect evidence on, illegal activities in various locations, e.g. car parks, PT facilities, PT vehicles, etc.	
	10.5.0.2	The system shall be able to provide two-way data and voice communication between PT vehicles and a central location.	10.1.5.1 10.2.2.2
	10.5.0.3	The system shall summon assistance when requested by drivers, or other travellers, e.g. after disorderly behaviour amongst certain passengers.	