



**International  
Standard**

**ISO 14813-1**

**Intelligent transport systems —  
Reference model architecture(s) for  
the ITS sector —**

**Part 1:  
ITS service domains, service groups  
and services**

*Systemes intelligents de transport (ITS) — Architecture(s) de  
modele de reference pour le secteur ITS —*

*Partie 1: Domaines de service, groupes de service et services ITS*

**Third edition  
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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

This third edition cancels and replaces the second edition (ISO 14813-1:2015), which has been technically revised.

The main changes are as follows:

- the list of services has been reorganized (to reduce redundancy) and updated;
- in [Clauses 7](#) to [16](#) some services have been added and others deleted, whilst others have been modified to reflect the continual evolution of ITS; this has been reflected in [Table 2](#);
- in [Clauses 7](#) to [16](#), the structure of the description of each service has been revised to create a more consistent representation of the services;
- as a result of the above changes, the Introduction and content of [Clauses 1](#) to [5](#) have been updated;
- a mapping of the services to the US ITS reference architecture reference [Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT)], has been provided in [Annex A](#);
- a mapping of the services to the European ITS Framework Architecture (FRAME), has been provided in [Annex B](#).

A list of all parts in the ISO 14813 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

Intelligent transport systems (ITS) service domains and groups reflect the evolution of technology-oriented transportation practices and applications. So far, this has been in the surface transport systems domain, but ITS is also beginning to appear in other domains, such as maritime and rail transport. This has become of increasing importance and interest as the scope of ITS expands beyond its original range of services in road traffic management, traveller information and electronic payment systems.

ITS addresses services in the following areas of the surface transport systems domain:

- transport network operations and maintenance activities;
- freight mobility and inter-modal connectivity;
- multi-modal travel, including both pre-trip and on-trip information and journey planning where the trip starts and/or finishes in the surface transport systems domain;
- variable road pricing strategies for freight and personal travel;
- response activities and coordination related to emergencies and natural disasters;
- national security needs related to transportation infrastructure;
- cooperative-ITS (sometimes referred to as “connected vehicles” or “connected vehicle/highway systems”).

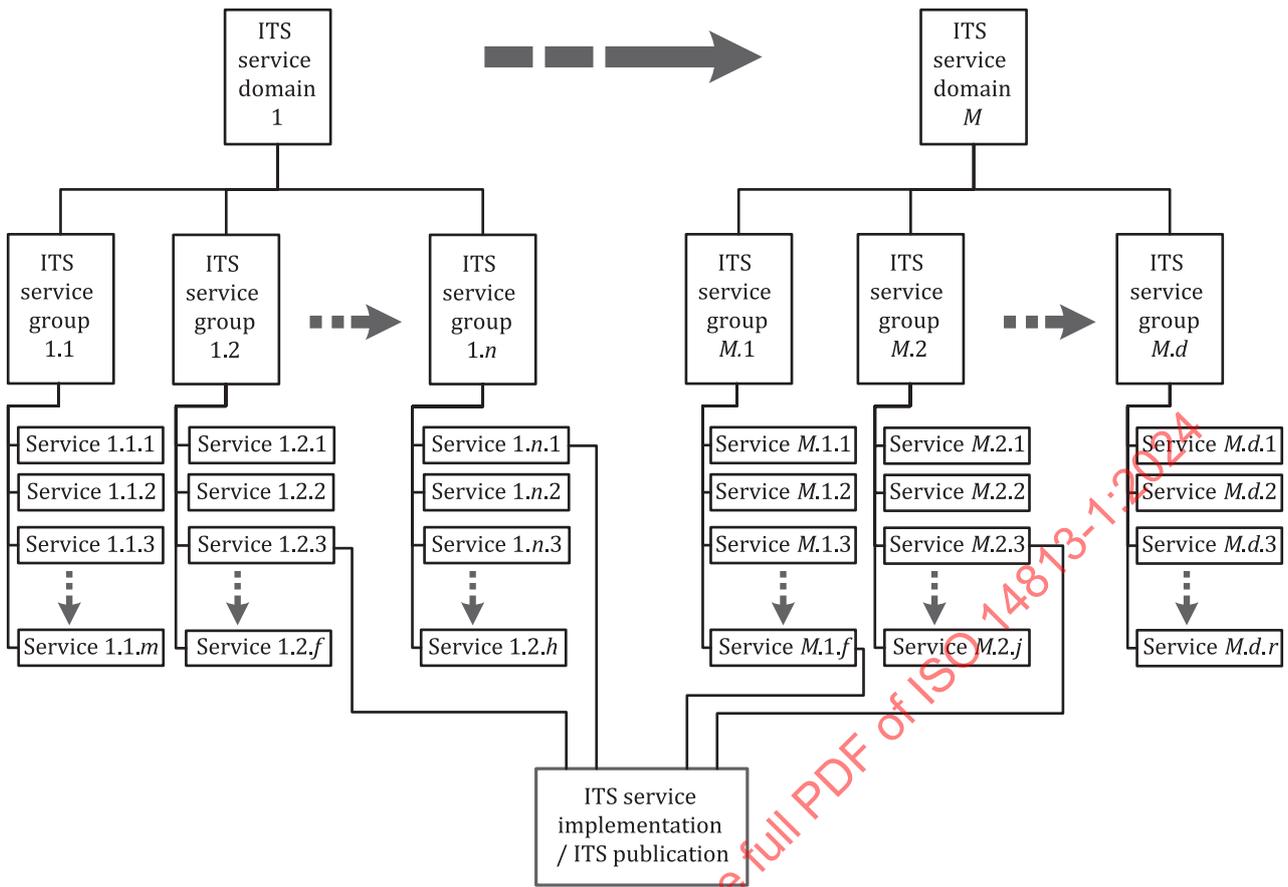
Services in some of these areas also interface with more generalized activities and environments outside the surface transport systems domain. For example, it is possible for road pricing and revenue systems activities to interface with electronic commerce (eCommerce) activities, and thus utilize standards and principles associated with the banking industry along with generally accepted accounting principles. The addressing of national security and coordination issues also requires that specific national standards related to civil defence, emergency communications, and other procedures be addressed. These interfaces, while largely outside the scope of ISO/TC 204, are nevertheless critical external influences on the functionality of the various services supported by ITS service domains and groups.

This document has been developed to define ITS service domains, service groups and services into which ISO/TC 204 documents can be mapped for a more structured context. This structure can then assist in the identification of areas that are not yet fully addressed by the documents created and managed by ISO/TC 204.

To this end, the ITS service domains, ITS service groups and ITS services presented in this document serve as a framework for developing ITS-related concepts of operation, which in turn lead to the definition of the appropriate requirements, ITS architectures and standards necessary to deploy specific ITS services. As the range of transportation activities that utilize ITS tools has broadened, the ITS service domains and ITS service groups included in previous editions of this document have been revised.

In order to establish the relationship and interdependencies of the various ITS services, it is beneficial to firstly determine the ITS service domains and the groups that reside within them in the current perception of the scope of the ITS sector. Although these ITS service domains and groups build upon those used in existing US, European Union, Japanese and other international ITS implementations, they can also provide a common descriptive basis for comparing these implementations, as well as others under development throughout the world. It is possible to use a sub-set of the ITS services described in this document as the basis for a particular ITS implementation. It is also possible to add specific ITS services not found in this document that are particular to an ITS implementation so that the stakeholders get the services that they want.

[Figure 1](#) illustrates the hierarchy of ITS service domains and ITS service groups and the ITS services that they include. The ITS service domains that apply to ITS are listed in [6.1](#) together with a definition of the nature of the activities provided. Each of these ITS service domains is then covered by separate clauses of this document, each of which includes the descriptions of its own ITS service groups and ITS services. The ITS service groups describe more specific activities that are part of the ITS service domain and the ITS services provide the more detailed description of what is provided within each ITS service group.



**Figure 1 — ITS services — Hierarchy of definitions for ITS reference architecture**

Currently there are many instantiations of ITS service implementations around the world, with some of them being used as the basis for several International Standards. This document embraces ITS services from the following sources:

- ITS service implementations from several parts of the world, including the US and the European Union;
- other ISO/TC 204 and CEN/TC 278 working groups.

Many ITS service implementations that are in use around the world are based on either the US National ITS Architecture or the European ITS Framework (FRAME) Architecture. Unfortunately, the terminology used by these two ITS architectures is similar but not identical. [Table 1](#) provides a high-level comparison between some of terms used in these two ITS architectures that are relevant to this document.

**Table 1 — High-level comparison of ITS architecture terms**

ISO 14813-1 (this document)	US Architecture	FRAME Architecture
Actor	Terminator	Terminator
ITS service domain	ITS Service Area	ITS Service Group
ITS service group	N/A	ITS Service Topic
ITS service	ITS Service Package	ITS Service

Full documentation of all possible approaches to ITS implementations is not feasible due to the high level of resources that would be necessary to carry this out. Indeed, full documentation and description of all possible approaches is undesirable as an item for standardization. Instead, a defined and consistent approach is required to facilitate reuse and interoperability.

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# Intelligent transport systems — Reference model architecture(s) for the ITS sector —

## Part 1: ITS service domains, service groups and services

### 1 Scope

This document provides a description of the primary services that have been internationally defined to promote consistency among implementations. Implementations can provide any of these services in combination with any other services that are appropriate. This document organizes ITS services by defining service groups, which are placed into one of several service domains. Each service group contains one or more individual services, each of which is described.

This document is intended for use by at least two groups of people involved in the ITS sector:

- a) those who are looking for ideas about the services that ITS implementations can provide, and
- b) those who are developing International Standards.

For the first group, this document provides service descriptions that can act as the catalyst for more detailed descriptions. The level of detail can differ from one ITS implementation to another, depending on whether or not a national ITS architecture is involved, and whether or not this architecture is based directly on services, or on groups of functions. The service descriptions in this document are pitched at a high-level as too much detail can be prescriptive and reduces flexibility.

For standards developers, this document is applicable to Technical Committees who are developing International Standards for the ITS sector. This document is designed to provide information and explanations of services that can form the basis and reason for developing standards.

Due to its nature, this document is largely advisory and informative with minimal requirements. It is designed to assist the integration of services into a cohesive reference architecture, thereby promoting interoperability and the use of common data definitions. Specifically, services defined within the service groups can be the basis for defining “use cases”, “user needs” or “user service requirements” depending on the methodology being used to develop the resultant ITS architecture functionality. They can also assist with defining applicable data within data dictionaries, and applicable communications and data exchange standards.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/TS 14812, *Intelligent transport systems — Vocabulary*

ISO 14817-3, *Intelligent transport systems — ITS data dictionaries — Part 3: Object identifier assignments for ITS data concepts*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14812 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

### 3.1

#### **actor**

entity that fulfils a role

### 3.2

#### **application**

mechanism for delivering some or all parts of an ITS service

### 3.3

#### **dangerous goods**

substances or articles which are potentially hazardous (for example, poisonous to humans, harmful to the environment, explosive, flammable or radioactive) that require regulatory control when transported

[SOURCE: ISO 15638-18:2017, 3.17, modified — permitted terms have been removed]

### 3.4

#### **dedicated transport network**

transport mechanism that is able to carry people in special vehicles through a purpose-built network, which is usually separate from, but can be part of an existing road network

### 3.5

#### **dispatch**

action that requests specific resources to perform particular services

EXAMPLE The emergency communications centre dispatches an ambulance in response to an incident where it is determined that the victim needs to be taken to a hospital.

### 3.6

#### **electric vehicle**

vehicle that is powered by its own on-board battery and does not use an internal combustion engine of any type

### 3.7

#### **ITS service group**

one or more similar or complementary ITS services provided to ITS users

### 3.8

#### **ITS service domain**

specific application area which comprises one or more ITS service groups

### 3.9

#### **ITS stakeholder**

individual or organization having a right, share, claim or interest in a system or in its possession of characteristics that meet their needs and expectations

Note 1 to entry: An ITS stakeholder's involvement can be through use, manufacture of products, provision of services, or regulation.

### 3.10

#### **ITS user**

individual who directly or indirectly receives output from and/or provides input to the transaction of an ITS service

Note 1 to entry: These individuals can be human, external systems or another source of data, e.g. detection equipment.

### 3.11

#### **navigation**

ITS service which provides directional information to an individual during a trip

**3.12**

**mass**

mass of a given heavy vehicle as measured by equipment affixed to the regulated vehicle

[SOURCE: ISO 15638-12:2014, 4.33]

**3.13**

**route guidance**

service which utilizes directional information, destination or real-time data to select an appropriate route, either prior to or during a trip

**4 Abbreviated terms**

ANPR	automatic number plate recognition
AVL	automatic vehicle location
C-ITS	cooperative ITS
CN	communications network
EFC	electronic fee collection
EV	electric vehicle
ETC	electronic toll collection
GVW	gross vehicle weight
HAZMAT	hazardous materials
HOV	high occupancy vehicle
ITS	intelligent transport systems
LPN	licence plate number
MaaS	mobility as a service
MOD	mobility on demand
OBE	on-board equipment
PT	public transport
RUC	road user charging
TARV	telematics applications for regulated commercial freight vehicles
WIM	weigh-in-motion

**5 General requirements**

**5.1 ITS service domains, service groups and services**

**5.1.1 Characteristics of ITS service domains**

Regardless of any specific ITS implementation, ITS services and groups of services are usually combined into different (although often interrelated) application areas called "service domains". These service domains have as their focus one or more groups of ITS users, such as travellers, road network operators, drivers (both

of all vehicles and of selected types), or those who move freight. They are the highest level of abstraction in an ITS architecture.

ITS services do not represent the technology that will be required by any of the one or more ITS applications that are required to deliver them. In fact, it is possible for the technology and functionality used by the ITS applications to vary from one ITS implementations to another and for the content of the ITS applications to vary because of the variances in the organizational structures used in different geographical areas.

There is no prescribed relationship between ITS service domains and the areas of common functionality that are included in different ITS architectures. Sometimes a relationship can appear to exist, but this is often illusory and a reflection of the choice of names for the areas of common functionality. For example, both the US National ITS Architecture and the European ITS Framework (FRAME) Architecture include an area of functionality called "Manage Traffic", which in both cases supports ITS services other than those included in the "Traffic Management and Operations" ITS service domain described in this document.

### 5.1.2 Characteristics of ITS service groups

A service domain comprises one or more types of ITS service. It shall be possible for each type of ITS service to comprise several instances of related services. These collations of related ITS service instances are called "ITS service groups." An ITS service group consists of one or more similar or complementary services that can be provided to ITS users.

There are several characteristics of 'ITS service groups' and the services contained within.

- a) Each "ITS service group" is oriented to a specific activity related to management or information of the surface transport systems network that is divided into specific services that should address particular users or modes.
- b) The name of each service group should reflect the type of activities supported (e.g. "pre-trip information").
- c) Each service within the service group should reference both the service group activity and the nature of the users or modes supported by the service (e.g. "pre-trip information – public transport").
- d) Each level of the hierarchy should be at an equivalent level of granularity.

### 5.1.3 Characteristics of ITS services

Within this document, an ITS service consists of a product or activity that can be provided to an ITS user. Thus, ITS services are considered as the elemental building blocks of any ITS architecture and the ITS implementations based upon its contents. ITS services are described in a way that is independent of the technologies that will be needed to deliver them. In fact, it is entirely possible that the technologies needed by an ITS service do not exist and thus the ITS service can provide the motivation for future ITS-related research and development activities. The language used in ITS service descriptions is non-technical so that they can be understood by a wide variety of ITS users, including those without any knowledge of the capabilities that ITS can provide.

The level of detail in this document is focused at the level of domains and service groups, and specific services. It is noted that different countries partition their reference architectures in different ways – some through more granular service or needs definition, others at a higher level of abstraction. However, in order to provide a level of consistency and to avoid ambiguities arising from different definitions of services with the same name, high-level or outline definitions are provided for specific services. Nevertheless, users can add to or replace some of the specific services described in this document in order to reflect particular location and/or jurisdictional and/or societal requirements. Whenever this is done, the names of these new or replacement services are not permitted to conflict or replicate the names of services used in this document.

The elaboration of specific ITS services shall be undertaken in a consistent manner throughout any specific architecture. There are several methodologies that assist the development of this consistent elaboration.

ISO 14813-5 provides guidance as to the requirements for architecture description in ITS International Standards.

## 5.2 ITS users

The general definition of the ITS user is that it represents an entity that is external to the ITS implementation and has a need for a surface transport system benefit that can be met with the use of information, communication, sensor and/or control. The "need" is met through interaction of the ITS user with applications in the ITS implementation. ITS users have elsewhere also been described as one of the sets of "stakeholders" who are involved in requesting and promoting ITS implementations. By definition, all human interaction with ITS implementations involves ITS users interfacing with applications across the boundary of the system.

NOTE Humans interacting with applications in an ITS implementation are sometimes called "external ITS users."

## 6 The structure of ITS service domains

### 6.1 ITS service domains

Categorization of ITS activities is one of the first steps in defining the range of activities, some or all of which can be supported by any ITS implementation. It serves to delineate different sectors of the ITS industry.

The following lists and describes 10 "ITS service domains" covered by the services in this document.

- 1) Traveller Information – this service domain addresses the provision of both static and dynamic information about the surface transport systems network to users prior to and during their trips, including inter-modal options and transfers and the status of other transport modes.
- 2) Traffic Management and Operations – this service domain addresses the management of the movement of all types of vehicles, travellers and pedestrians throughout the road network, and includes both automated monitoring and control activities as well as decision-making processes (both automated and manual) that respond to the transport-related impacts of real-time incidents and other disturbances on the transportation network, as well as managing travel demand as needed to maintain overall mobility.
- 3) Vehicle Services – this service domain has as its focus the enhancement of safety, security and efficiency in vehicle operations, by warnings and assistance to users or input to the operation of the vehicle. These services use information from on-board sensing devices, and/or from wireless communications with other sources.
- 4) Freight Transport – this service domain addresses the management of the operation of commercial vehicle fleets and the movement of freight, including activities that expedite the authorization process for freight to move across national and jurisdictional boundaries, activities that expedite inter-modal transfers of freight and the operation of freight vehicles that use telematics applications to enhance their operation and management. The movement of freight within other transport modes, e.g. maritime and rail, is not generally considered a part of ITS but intermodal transfers, storage and road freight is considered an integral part of ITS.
- 5) Public Transport – this service domain addresses the management of public transport (i.e. publicly accessible transport whether publicly operated or privately operated) to enable the provision of services that operate in a more timely and efficient way and the provision of operational information to the operators and the public that are its users. This information for users also includes details of services provided by different operators and other transport modes.
- 6) Emergency Service – this service domain includes ITS services that assist emergency responders to provide their services in a quicker, safer, more informed and more efficient manner through the surface transport systems network.
- 7) Payment for Transport-Related Services – this service domain covers the payments that travellers make for using the transport network and mobility services and includes road user charging.

- 8) Weather and Environmental Conditions Monitoring – this service domain is responsible for activities that monitor and notify users and transport network managers of weather and environmental conditions that are likely to have an impact on the surface transport systems network and its users.
- 9) Disaster Response Management and Coordination – this service domain is concerned with surface transport systems-based activities that manage resources from multiple jurisdictions in their responses to natural disasters, civil disturbances or terror attacks.
- 10) Performance Management – this service domain is responsible for the on-line and off-line simulation, management and planning of surface transport systems network operation, using archived and/or live data that has been obtained from monitoring of the surface transport systems network.

The categorization of the services into 10 domains does not imply that all ITS architectures and the implementations deployed from them should be required to include one or more services from each and every one of these domains. The ITS services that ITS architectures include should be those that are best suited to the ultimate goals of the ITS deployment the ITS architectures are supporting.

ITS services are often dependent upon, or are key enablers of other services that can be external to ITS and/or within an ITS service group. In ITS implementations based on these services, it is important for the proposed classification schema included in the ITS architectures that supported the implementation to identify the entities that are responsible for the provision of the ITS service.

## 6.2 Cooperative-ITS

The advent of cooperative-ITS (C-ITS) is seen by many as providing the need for a completely new set of ITS services and ITS service groups. However, closer study reveals that much of what C-ITS provides is just a use of new technologies and methodologies to achieve the same service goals as traditional ITS. So, for example, providing travel information in a vehicle through communication with the roadside infrastructure and/or other vehicles, belongs in the "Traveller Information" group. The important attributes that C-ITS does provide are improved ways of communication, both for collecting surface transport systems data from which information can be derived, and for providing the information in real-time to the vehicle occupants. It also enables data to be shared between vehicles and with other entities within an ITS implementation. These points have been included in some of the new ITS service groups and services. The agreed definition of cooperative-ITS is provided in ISO/TS 14812.

## 6.3 Service domain structure

Table 2 shows the structure of each of the 10 service domains identified in 6.1. Within each domain are a number of groups, each of which can have one or more constituent ITS service(s). The domain and group structure provides an easy way to find individual services, which are the core of this document.

The following points apply when selecting services to be included in any ITS implementation.

- 1) Within many of the services there are attributes defined by "(a)", "(b)", "(c)", etc., at least one of which shall be selected for use in an application, or standard.
- 2) It is expected that any number of services can be selected and implemented in any combination depending on the goal(s) of the individual ITS implementations in which they are to be included. This particularly applies to the Traveller Information domain.

**Table 2 — Structure of ITS service domains and groups**

Service domain	Service group	Service	See sub-clause
Traveller Information	Real-time transport status information	Traffic information	<a href="#">7.2.2.1</a>
		Roadway information	<a href="#">7.2.2.2</a>
		Multi-modal transport information — available services	<a href="#">7.2.2.3</a>

Table 2 (continued)

Service domain	Service group	Service	See sub-clause
		Multi-modal transport information — current situation information	<a href="#">7.2.2.4</a>
		Multi-modal transport information — trip planning service	<a href="#">7.2.2.5</a>
		Multi-modal transport information — user access	<a href="#">7.2.2.6</a>
		Multi-modal transport information — modal transfer information	<a href="#">7.2.2.7</a>
		Dynamic parking information — external to facilities	<a href="#">7.2.2.8</a>
		Static parking information — external to facilities	<a href="#">7.2.2.9</a>
	Real-time in-vehicle display	In-vehicle signage — route guidance and regulatory	<a href="#">7.3.2.1</a>
		In-vehicle signage — parking information	<a href="#">7.3.2.2</a>
		In-vehicle signage — speed and lane control	<a href="#">7.3.2.3</a>
		In-vehicle signage — advance warning and advisory	<a href="#">7.3.2.4</a>
		Specific public transport vehicle related information	<a href="#">7.3.2.5</a>
	Real-time route guidance and information	Dynamic in-vehicle route guidance using real-time information	<a href="#">7.4.2.1</a>
		Dynamic personal route guidance using real-time information	<a href="#">7.4.2.2</a>
		Public transport-specific trip guidance	<a href="#">7.4.2.3</a>
	Guidance to EV charging facilities	Route guidance to nearest available appropriate EV charging station	<a href="#">7.5.2.1</a>
		Route guidance if no charging facility available	<a href="#">7.5.2.2</a>
	Multi-modal trip planning	Multi-modal comparative trip guidance	<a href="#">7.6.2.1</a>
		Centralized trip planning using real-time and policy inputs	<a href="#">7.6.2.2</a>
	Travel services information	Travel services information — destination	<a href="#">7.7.2.1</a>
		Travel services information — current location	<a href="#">7.7.2.2</a>
	Traffic Management and Operations	Traffic management and control	Traffic monitoring
Surface street traffic management			<a href="#">8.2.2.2</a>
Freeway traffic control — ramp management			<a href="#">8.2.2.3</a>
Freeway traffic control — mainline speed and lane management			<a href="#">8.2.2.4</a>
Preferential treatment for specific vehicle types (signal priority and pre-emption)			<a href="#">8.2.2.5</a>
Reversible lane management			<a href="#">8.2.2.6</a>
Coordination of surface street and freeway management			<a href="#">8.2.2.7</a>
Multi-modal highway junction management			<a href="#">8.2.2.8</a>
Parking management			<a href="#">8.2.2.9</a>
Work zone traffic management			<a href="#">8.2.2.10</a>
Traffic advisory and warning information			<a href="#">8.2.2.11</a>
Vehicle oversize/overweight warning and re-routing			<a href="#">8.2.2.12</a>
Queue detection and information management			<a href="#">8.2.2.13</a>
Tunnel access management and re-routing			<a href="#">8.2.2.14</a>
Bridge access management and re-routing		<a href="#">8.2.2.15</a>	
Transport related incident management	Incident monitoring and confirmation	<a href="#">8.3.2.1</a>	
	Incident on-site driver assistance	<a href="#">8.3.2.2</a>	
	Incident on-site traveller assistance	<a href="#">8.3.2.3</a>	

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Table 2 (continued)

Service domain	Service group	Service	See sub-clause
		Incident co-ordination and clearance	<a href="#">8.3.2.4</a>
		Hazardous materials monitoring and management	<a href="#">8.3.2.5</a>
		Collection of incident details from other transport modes	<a href="#">8.3.2.6</a>
	Demand management	Variable road pricing – dedicated lane	<a href="#">8.4.2.1</a>
		Variable road pricing – entire facility	<a href="#">8.4.2.2</a>
		Cordon and zone-based congestion pricing	<a href="#">8.4.2.3</a>
		Access management	<a href="#">8.4.2.4</a>
		High-occupancy lane management	<a href="#">8.4.2.5</a>
		Air quality and pollution-based surface transport systems management	<a href="#">8.4.2.6</a>
		Surface transport systems infrastructure maintenance management	Winter maintenance
	Roadway maintenance management		<a href="#">8.5.2.2</a>
	Work zone safety management		<a href="#">8.5.2.3</a>
	Maintenance fleet and equipment management		<a href="#">8.5.2.4</a>
	Policing/enforcing traffic regulations	Restricted zone access enforcement	<a href="#">8.6.2.1</a>
		Vehicle overweight enforcement	<a href="#">8.6.2.2</a>
		High-occupancy vehicle facility usage	<a href="#">8.6.2.3</a>
		Parking regulation enforcement	<a href="#">8.6.2.4</a>
		Speed limit enforcement	<a href="#">8.6.2.5</a>
		Signal enforcement	<a href="#">8.6.2.6</a>
	Safety enhancements for vulnerable road users	Non-motorized vehicle and pedestrian monitoring	<a href="#">8.7.2.1</a>
		Systems to monitor specialized vehicles	<a href="#">8.7.2.2</a>
		Access to roadway crossings for vulnerable road users	<a href="#">8.7.2.3</a>
	Safety provisions for pedestrians using intelligent junctions and links	Provide pedestrian access at intelligent junctions	<a href="#">8.8.2.1</a>
		Monitor pedestrians using intelligent links	<a href="#">8.8.2.2</a>
	Advanced warnings provided by intelligent junctions	Signal display advance warning	<a href="#">8.9.2.1</a>
		Non-signalized advance warning	<a href="#">8.9.2.2</a>
	Monitoring and management of suspicious vehicles	Detection and identification of suspicious vehicles	<a href="#">8.10.2.1</a>
		Road traffic management for suspicious vehicles	<a href="#">8.10.2.2</a>
		Emergency notification to key agencies of suspicious vehicles	<a href="#">8.10.2.3</a>
		Management of the impact of suspicious vehicles on their surroundings	<a href="#">8.10.2.4</a>
Vehicle Services	Automated vehicle operation	Automated highway operation	<a href="#">9.2.2.1</a>
		Automated low-speed vehicle operations assistance	<a href="#">9.2.2.2</a>
		Automated parking	<a href="#">9.2.2.3</a>
		Adaptive cruise control	<a href="#">9.2.2.4</a>
		Cooperative adaptive cruise control	<a href="#">9.2.2.5</a>
		Vehicle platooning	<a href="#">9.2.2.6</a>
		Automated lane keeping	<a href="#">9.2.2.7</a>
		Automated road departure prevention	<a href="#">9.2.2.8</a>

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Table 2 (continued)

Service domain	Service group	Service	See sub-clause
		Automated lane change systems	<a href="#">9.2.2.9</a>
		Automatic weigh-in-motion (WIM)	<a href="#">9.2.2.10</a>
	Collision mitigation / avoidance	Roadway collision mitigation/avoidance	<a href="#">9.3.2.1</a>
		Intersection collision mitigation/avoidance	<a href="#">9.3.2.2</a>
		Automatic vulnerable road user mitigation systems	<a href="#">9.3.2.3</a>
	Driver warning or advisory	Lane departure warning system	<a href="#">9.4.2.1</a>
		Emergency breaking assistance	<a href="#">9.4.2.2</a>
		External hazard detection and notification	<a href="#">9.4.2.3</a>
		Driver advisory	<a href="#">9.4.2.4</a>
	Safety warning	Special vehicle alert	<a href="#">9.5.2.1</a>
	Management of suspicious vehicles	Identification of suspicious vehicles	<a href="#">9.6.2.1</a>
		Disablement of vehicles believed to be suspicious	<a href="#">9.6.2.2</a>
	Freight Transport	Commercial vehicle pre-clearance	Weigh-in-motion
Non-stop pre-clearance			<a href="#">10.2.2.2</a>
Vehicle safety records monitoring			<a href="#">10.2.2.3</a>
Commercial vehicle administrative processes		Freight movement information exchange	<a href="#">10.3.2.1</a>
		Automatically identify, monitor and exchange emergency response information for dangerous goods	<a href="#">10.3.2.2</a>
		Automated credential filing	<a href="#">10.3.2.3</a>
		Automated commercial vehicle administration	<a href="#">10.3.2.3</a>
Automated roadside safety inspection		Automated border crossings	<a href="#">10.3.2.5</a>
		Remote access to commercial vehicle safety data	<a href="#">10.4.2.1</a>
Commercial vehicle on-board safety monitoring		Remote access to commercial vehicle driver data	<a href="#">10.4.2.2</a>
		Commercial vehicle internal systems monitoring	<a href="#">10.5.2.2</a>
		Commercial vehicle driver alertness monitoring	<a href="#">10.5.2.2</a>
Intercity freight transport fleet management		Commercial vehicle cargo state monitoring	<a href="#">10.5.2.3</a>
		Intercity commercial vehicle fleet tracking	<a href="#">10.6.2.1</a>
Intermodal information management		Intercity commercial vehicle fleet dispatching	<a href="#">10.6.2.2</a>
		Vehicle and container arrival information exchange	<a href="#">10.7.2.3</a>
		Customer freight information access	10.7.2.4
Management and control of intermodal centres		Freight container tracking	10.7.2.5
		Intermodal centre facility management	<a href="#">10.8.2.1</a>
Management of dangerous freight		Intermodal vehicle and container control	<a href="#">10.8.2.2</a>
		Dangerous goods movement data collection and sharing	<a href="#">10.9.2.1</a>
		Dangerous goods movement data registry	<a href="#">10.9.2.2</a>
		Dangerous goods movement fleet coordination	<a href="#">10.9.2.3</a>
		Dangerous goods movement police/safety coordination	<a href="#">10.9.2.4</a>
Management of heavy goods vehicles		Dangerous goods movement location monitoring	<a href="#">10.9.2.5</a>
		Heavy goods vehicle data collection and sharing	<a href="#">10.10.2.1</a>
		Heavy goods vehicle registration and route planning	<a href="#">10.10.2.2</a>
	Heavy goods vehicle location monitoring	<a href="#">10.10.2.3</a>	

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Table 2 (continued)

Service domain	Service group	Service	See sub-clause	
	Management of local delivery vehicles	Delivery vehicle fleet tracking	<a href="#">10.11.2.1</a>	
		Delivery vehicle fleet dispatching	<a href="#">10.11.2.2</a>	
		Delivery zone and parking information services	<a href="#">10.11.2.3</a>	
	Telematics applications for regulated commercial freight vehicles (TARV)	Procedures, and enforcement provisions for the providers of regulated services	Procedures, and enforcement provisions for the providers of regulated services	<a href="#">10.12.2.2</a>
			Provision of system security	<a href="#">10.12.2.2</a>
			Provision of vehicle information	<a href="#">10.12.2.3</a>
			Provision of vehicle access management	<a href="#">10.12.2.4</a>
			Provision of remote tachograph monitoring	<a href="#">10.12.2.5</a>
			Provision of emergency messaging system/eCall	<a href="#">10.12.2.6</a>
			Provision of driver work records	<a href="#">10.12.2.7</a>
			Provision of vehicle "mass" monitoring	<a href="#">10.12.2.8</a>
			Provision of vehicle location, speed and consignment data	<a href="#">10.12.2.9</a>
			Provision of vehicle parking facilities	<a href="#">10.12.2.10</a>
	Freight transport content management	Collection of freight transport content data	Collection of freight transport content data	<a href="#">10.13.2.1</a>
			Communication of freight transport content data	<a href="#">10.13.2.2</a>
Monitoring of freight for tampering and security			<a href="#">10.13.2.3</a>	
Public Transport	Public transport management	Public transport operational management	<a href="#">11.2.2.1</a>	
		Public transport fleet management	<a href="#">11.2.2.2</a>	
		Public transport vehicle monitoring	<a href="#">11.2.2.3</a>	
		Public transport service monitoring and scheduling	<a href="#">11.2.2.4</a>	
		Public transport operational strategies	<a href="#">11.2.2.5</a>	
		Public transport wayside status	<a href="#">11.2.2.6</a>	
	Demand responsive and shared transport	On-demand public transport fleet management	On-demand public transport fleet management	<a href="#">11.3.2.1</a>
			On-demand ridesharing management	<a href="#">11.3.2.2</a>
			On-demand movement of freight by public transport	<a href="#">11.3.2.3</a>
	Automated vehicle operation	Precision docking for public transport vehicles	<a href="#">11.4.2.1</a>	
	Public travel security	Silent alarm	<a href="#">11.5.2.1</a>	
		Emergency call/mayday alert for public transport	<a href="#">11.5.2.2</a>	
	Emergency Services	Transport related emergency notification and personal security	User-initiated distress calls	<a href="#">12.2.2.1</a>
			Automated emergency call and mayday (eCall) dispatch	<a href="#">12.2.2.2</a>
		After-theft vehicle recovery	Stolen vehicle tracking	<a href="#">12.3.2.1</a>
Remote vehicle immobilization			<a href="#">12.3.2.2</a>	
Emergency vehicle management		Emergency vehicle fleet tracking	<a href="#">12.4.2.1</a>	
		Emergency vehicle fleet management	<a href="#">12.4.2.2</a>	
		Emergency vehicle traffic management coordination	<a href="#">12.4.2.3</a>	
Hazardous materials and incident notification		HAZMAT vehicle tracking and monitoring	<a href="#">12.5.2.1</a>	
		HAZMAT vehicle route management	<a href="#">12.5.2.2</a>	
		Automated HAZMAT emergency call/mayday notification	<a href="#">12.5.2.3</a>	
		HAZMAT preclearance services	<a href="#">12.5.2.4</a>	

Table 2 (continued)

Service domain	Service group	Service	See sub-clause
Payment for Transport Related Services	Transport Infrastructure usage	Electronic fee collection (EFC) and electronic toll collection – (ETC)	<a href="#">13.2.2.2</a>
		Road user charging (RUC)	<a href="#">13.2.2.2</a>
	Mobility service usage	Fee and fare collection for mobility services	<a href="#">13.3.2.1</a>
		Parking payment	<a href="#">13.3.2.2</a>
	Transport related services	Payment for transport-related services	<a href="#">13.4.2.1</a>
Payment for additional non-transport related services		<a href="#">13.4.2.2</a>	
Weather and Environmental Conditions Monitoring	Weather monitoring	Road weather information monitoring	<a href="#">14.2.2.1</a>
		Road weather prediction	<a href="#">14.2.2.2</a>
	Environmental conditions monitoring	Water level/tidal monitoring and prediction	<a href="#">14.3.2.1</a>
		Seismic monitoring	<a href="#">14.3.2.2</a>
		Pollution monitoring	<a href="#">14.3.2.3</a>
Avalanche, mud slide and fallen rock monitoring	<a href="#">14.3.2.4</a>		
Disaster Response Management and Coordination	Disaster data management	Disaster and emergency data collection	<a href="#">15.2.2.1</a>
		Disaster and emergency data sharing	<a href="#">15.2.2.2</a>
	Disaster response and evacuation management	Disaster response planning for the transport network	<a href="#">15.3.2.1</a>
		Evacuation planning for the transport network	<a href="#">15.3.2.2</a>
		Disaster response implementation	<a href="#">15.3.2.3</a>
	Evacuation and re-entry management	<a href="#">15.3.2.4</a>	
Coordination with emergency agencies	Disaster response coordination	<a href="#">15.4.2.1</a>	
Traffic Management Performance	Data storage	Data archiving warehousing	<a href="#">16.2.2.1</a>
		Provide access to data archive and warehouse to interested organizations	<a href="#">16.2.2.2</a>
	Simulation	System performance simulation (online)	<a href="#">16.3.2.1</a>
		System performance simulation (offline)	<a href="#">16.3.2.2</a>

#### 6.4 ITS service groups for each domain

ITS service groups represent a further delineation of the various sectors of ITS activity represented by the domains described in 6.1. The delineation specifically addresses different types of activities carried out within the domain. The service groups as described by domain in the following subclauses do not necessarily address specific users, modes or audiences for these activities. That level of detail is provided by the specific services, which are defined under each service group. This permits the transport operator (state, municipality or authority) to select which specific services within each service group are relevant to their needs and to add extra location and/or jurisdictional specific services if and when required.

ITS International Standards prepared by ISO/TC 204 are focused on the surface transport systems sector and the interfaces with other transport modes. Other committees define standards and practices for rail, air and waterways. However, there are many "grey" areas where ITS standards embrace aspects that affect both road and other transport modes. Conversely, there are also standards for other transport modes that affect the ITS sector. This particularly applies in the area of traveller information, scheduling and traffic control.

#### 6.5 Use of ITS services to provide Object Identifiers for data concepts

A unique Object Identifier (OID) for data concepts shall be used in other ITS International Standards prepared by ISO/TC 204. The format of this OID shall be defined through the use of the ITS domain and

service number in which the data concept shall be used and the format shall be defined according to the procedures for OIDs that are described in ISO 14817-3.

## 7 Traveller Information service domain

### 7.1 Overview

The scope of this domain shall include the provision of both static and dynamic information about the surface transport systems network to its users both prior to and during their trips. It includes information about inter-modal options and transfers and the status of other transport modes for use by some users.

Within this scope, the domain shall include the following groups of services:

- a) Real-time transport status information — see [7.2](#);
- b) Real-time in-vehicle display — see [7.3](#);
- c) Real-time route guidance and information — see [7.4](#);
- d) Guidance to EV charging facilities — see [7.5](#);
- e) Multi-modal trip planning — see [7.6](#);
- f) Travel services information — see [7.7](#).

### 7.2 Real-time transport status information

#### 7.2.1 Overview

This service group has the following characteristics.

- It shall encompass travel information received at home, work, hotels, major public locations, such as shopping centres, and on portable terminals prior to travel.
- It shall be possible for pre-trip information services to target road facilities, public transport, freight and intermodal users, and non-motorized travel.
- Depending on the service provided, pre-trip information shall include current information on traffic conditions, schedule adherence and location of public transport vehicles relative to the user's location, road and weather information, prevailing traffic regulations and tolls.
- In geographic terms, it shall relate to those parts of the travel network that are near to the current location of the traveller and shall not be dependent on the route and modes of a trip that the traveller is currently undertaking.

#### 7.2.2 Constituent ITS services

##### 7.2.2.1 Traffic information

The scope of this service shall include the provision of information to the traveller about the current state of traffic and shall comprise the following:

- a) the current real-time state of traffic flows, including such things as speed, headway and congestion state;
- b) queues at toll stations, bridges and road ferry terminals.

#### 7.2.2.2 Roadway information

The scope of this service shall include the provision of information to the traveller about the current state of the roadway and comprise the following:

- a) the presence of ice, snow or surface water;
- b) any other conditions that have the possibility to affect the freedom of movement for road vehicles.

#### 7.2.2.3 Multi-modal transport information — available services

The scope of this service shall include the provision of available services information including:

- a) types and modes of transport services available at each stop;
- b) location of stops;
- c) schedules for all transport services available at each stop;
- d) historical performance (schedule adherence and “vertical” mode performance) for each service at each stop;
- e) fares for each transport service at each stop.

#### 7.2.2.4 Multi-modal transport information — current situation information

The scope of this service shall include the provision of the current situation information including:

- a) the current status (arrivals and departures) of the transport services provided;
- b) temporary and special services that are in operation;
- c) current known and expected delays (current and near-term situational status) and cancellations;
- d) currently available parking nearby.

#### 7.2.2.5 Multi-modal transport information — trip planning service

The scope of this service shall include the provision of trip planning for current or upcoming passenger trips including calculating itinerary and end-to-end navigation from origin to destination (including walking directions).

#### 7.2.2.6 Multi-modal transport information — user access

The scope of this service shall include the provision of information about user channels for accessing planning and real-time information on available services, current situational status and trip planning.

#### 7.2.2.7 Multi-modal transport information — modal transfer information

The scope of this service shall include the provision of information about the facilities that are available for a traveller to transfer their mode of travel between different transport modes and shall include the following:

- a) modal transfer options available;
- b) recommended transfer locations between transport modes;
- c) be based on static information, which shall be provided by those who own, operate and manage the transport infrastructure and include:
  - 1) location of inter-modal transfer points,
  - 2) hours of operation,
  - 3) modes between which transfers can be made,

- 4) transfer facilities, e.g. lifts, stairs and escalators;
- d) be based on real-time dynamic information, which shall be provided by those who own, operate and manage the transport infrastructure and include:
  - 1) current service availability,
  - 2) next scheduled departure times for available services,
  - 3) current transfer time.

The types of information shown in c) and d) shall be available through a variety of mechanisms, such as local information outputs, the Internet, in-vehicle displays and personal devices.

#### 7.2.2.8 Dynamic parking information — external to facilities

The scope of this service shall include the provision of real-time dynamic information at one or more locations outside of the facility itself that comprises:

- a) current number of available spaces;
- b) predicted number of available spaces.

This information shall be provided for each type of parking, e.g. long stay, short stay and valet parking. It shall be available through a variety of mechanisms, including the Internet at locations that are remote from the parking facilities.

#### 7.2.2.9 Static parking information — external to facilities

The scope of this service shall include the provision of static information at one or more locations outside of the facility itself that comprises:

- a) directions to the parking facility;
- b) type of parking available, e.g. long stay, short stay and valet parking;
- c) allowable length of stay;
- d) restrictions, e.g. no camping or overnight parking;
- e) parking charges.

This information shall be provided for each type of parking, e.g. long stay, short stay and valet parking. It shall be available through a variety of mechanisms, including the Internet at locations that are remote from the parking facilities.

### 7.3 Real-time in-vehicle display

#### 7.3.1 Overview

This service group has the following characteristics.

- It shall encompass information provided to travellers in the vehicle, either for a mass audience or tailored to the specific vehicle or traveller location, or along the travel route.
- It shall be possible for the scopes of the services to enable information to be provided as advisories and for it to comprise:
  - real-time travel information, including estimated time to a destination based on current conditions;
  - work zones;
  - incidents;

- weather;
- tolls;
- parking availability;
- other information of use to the traveller.

### 7.3.2 Constituent ITS services

#### 7.3.2.1 In-vehicle signage — route guidance and regulatory

The scope of this service shall include the provision of the facility for the following information to be displayed to drivers in their vehicles:

- a) route guidance: this information shall be based on some or all of the following data that are provided by drivers before the start of their trips:
  - 1) trip origin and destination,
  - 2) route preferences,
  - 3) requested arrival time,
  - 4) vehicle characteristics;
- b) regulatory: this information shall include weight, height and entry restrictions.

It shall be possible within the scope of this service for some of these data to be automatically provided by the vehicle, and other items such as origin, destination and route preferences can be sourced from a pre-defined list of those used most often by the driver.

#### 7.3.2.2 In-vehicle signage — parking information

The scope of this service shall include the provision of the facility for parking information to be displayed to drivers in their vehicles and shall include some or all of the following:

- a) location of available parking spaces, either as the location of a parking area, or spaces within a parking area;
- b) cost of parking;
- c) maximum allowable duration of stay and any other limitations, e.g. no camping, or maximum size of vehicle;
- d) level of security and its type, e.g. entry/exit detection, car parking attendant and video monitoring.

It shall be possible within the scope of this service for this information to be displayed for:

- 1) one or more parking area(s) in the vicinity of the vehicle or at a location that is defined by the driver, e.g. the trip destination;
- 2) as part of booking facilities that must be used before a space can be occupied.

#### 7.3.2.3 In-vehicle signage — speed and lane control

The scope of this service shall include the provision of the facility for speed and lane control information to be displayed to drivers in their vehicles and shall comprise some or all of the following:

- a) current speed limit;
- b) speed limit in the road ahead of the vehicle when different from the current speed limit;
- c) vehicle staying out of lane;

- d) vehicle in a lane not appropriate for its type and/or number of occupants;
- e) vehicle headway is unsafe for current speed, vehicle and road conditions.

It shall be possible within the scope of this service for the content of this information to be influenced by:

- f) the type of vehicle;
- g) the size of the vehicle;
- h) the current condition of the vehicle;
- i) the current state of the driver that has been detected by sensors in the vehicle.

#### 7.3.2.4 In-vehicle signage — advance warning and advisory

The scope of this service shall include the provision of the facility for advance warning and advisory information not included in other services in this group to be displayed to drivers in their vehicles and for this information to comprise warnings and advisories about:

- a) adverse road conditions on the planned route, or in the predicted vehicle trajectory;
- b) changes in speed limits;
- c) changes in weather conditions;
- d) entry into a tolled section and/or imminent arrival at a toll plaza/charging zone;
- e) restricted access to the road ahead;
- f) erratic driving, e.g. due to tiredness;
- g) problems with the condition of the vehicle.

It shall be possible within the scope of this service for the content of this information to be influenced by:

- 1) the type of vehicle;
- 2) its size;
- 3) its current condition.

#### 7.3.2.5 Specific public transport vehicle related information

The scope of this service shall include the provision of travellers with real-time public transport vehicle information integrating information from different transport modes and presenting it to travellers for decision making. It shall consist of the following functions;

- a) information distribution: this provides real-time situational information to travellers based on their needs, for example “in the right place, at the right time, for a reasonable ‘cost’”, including providing through signs or announcements current and next stop information on-board public transport vehicles;
- b) information receipt: this includes provision of the following:
  - 1) information on mobile devices, equipment at a fixed location where passengers board or alight from a public transport vehicle, or on a public transport conveyance,
  - 2) interactive or static on-trip information dissemination via visual or audio media channels,
  - 3) current situational status and/or predictive information about current public transport services;
- c) information processing: this provides services to reserve, confirm and pay for public transport services, including connection protection, rideshare, fixed route deviation, parking and other public transport services (or multimodal services connected with public transport trips).

## 7.4 Real-time route guidance and information

### 7.4.1 Overview

This service group has the following characteristics.

- It shall be categorized as a planning service and includes services provided during a trip to enable the traveller to complete the trip as planned.
- It shall be possible for the scopes of the services in this group to enable the best route options to be calculated taking account of network and public transport information and to incorporate multi-modal options such as "Park and Ride".

### 7.4.2 Constituent ITS services

#### 7.4.2.1 Dynamic in-vehicle route guidance using real-time information

The scope of this service shall include providing drivers of vehicles with route guidance information in their vehicles that shall have the following characteristics:

- a) dynamically updated as the trip progresses;
- b) based on some or all of the following data that is to be provided by drivers before the start of their trips:
  - 1) the trip origin and destination,
  - 2) route preferences,
  - 3) requested arrival time,
  - 4) vehicle characteristics;
- c) some of the previous data may be automatically provided by the vehicle;
- d) other items of data such as origin, destination and route preferences may be sourced from a pre-defined list of those used most often by the driver;
- e) modified as the trip progresses from that originally produced to take account of real-time changes to one or more of the following:
  - 1) road conditions, e.g. ice and snow,
  - 2) traffic conditions, e.g. congestion and incidents,
  - 3) the condition of the vehicle, e.g. brakes becoming worn down,
  - 4) the driver's state, e.g. tiredness causing lack of concentration that has been detected by sensors in the vehicle.

The changes to the route guidance shall enable the driver to avoid and/or compensate for the above.

- f) possibility for the route guidance to provide direction to a nearby rest area if the state of the driver is such that to continue to drive the vehicle is likely to present a danger to other road users.

#### 7.4.2.2 Dynamic personal route guidance using real-time information

The scope of this service shall include providing travellers with route guidance information for any surface transport mode. It shall be:

- a) available through a portable device that is dynamically updated as the trip progresses;

- b) based on some or all of the following data that is to be provided by drivers before the start of their trips:
- 1) trip origin and destination,
  - 2) route preferences,
  - 3) requested arrival time,
  - 4) requested preferences for transport modes to be used,
  - 5) the traveller's state, e.g. disabled, elderly,
  - 6) characteristics of the traveller's own transport means, e.g. car, bicycle and motor cycle.
- c) possible for some of the content to be automatically provided from a pre-defined list of those used most often by the driver, e.g. origin and destination plus route and mode preferences;
- d) modified as the trip progresses from that originally produced to take account of real-time changes to one or more of the following:
- 1) travel conditions, e.g. ice, snow, congestion, availability of other transport modes,
  - 2) the condition of the traveller's own transport means,
  - 3) the traveller's state, e.g. tiredness causing lack of concentration that has been detected by sensors in the vehicle.

The changes to the route guidance shall enable the traveller to avoid and/or compensate for the above.

- e) possible for the content to include:
- 1) unexpected changes to the availability of transport modes;
  - 2) guidance to a place where rest can be taken be it from driving, cycling, walking or the use of public transport.

#### 7.4.2.3 Public transport-specific trip guidance

The scope of this service shall include the provision of travellers with route guidance information through information displays that are available on public transport vehicles or at other public transport-related facilities. The route guidance information shall:

- a) be generic in the sense that it does not necessarily relate to the trip being made by each traveller;
- b) have the possibility of including some or all of the following information:
  - 1) expected time of arrival of the next service and subsequent services,
  - 2) current service performance, e.g. running late or early,
  - 3) other services available at the next stop and their time(s) of departure,
  - 4) other transport modes available at the next stop.

The availability of this information and the display mechanism that is used shall depend on the physical location where it is being displayed.

## 7.5 Guidance to EV charging facilities

### 7.5.1 Overview

This service group has the following characteristics.

- It shall enable drivers to plan trips so that they can make use of the appropriate electric vehicle charging facilities along their route.
- It shall take account of the vehicle type, make and model so that the most appropriate charging facilities can be found.
- It shall provide guidance to safety if charging is not possible.

### 7.5.2 Constituent ITS services

#### 7.5.2.1 Route guidance to nearest available appropriate EV charging station

The scope of this service shall include the provision of dynamic route guidance information to drivers in their vehicles to guide them to the nearest most appropriate charging facilities to be utilized when required. The content of the information shall take account of the following:

- a) type of vehicle;
- b) make and model of vehicle, so that a facility with the appropriate connections can be found;
- c) current state of charge of the battery that is used for the movement of the vehicle, from which the distance the vehicle can travel before running out of power can be determined;
- d) the availability of the charging facility, e.g. is it operational and are there any available charging points.

The route guidance information shall give the driver the option to choose and be guided to any of the available charging facilities that are within range of the vehicle given the current state of its battery, even if one or more of these facilities is not on the route that is being followed by the driver.

#### 7.5.2.2 Route guidance if no charging facility available

The scope of this service shall enable the provision of dynamic route guidance information that is provided to drivers in their vehicles to guide them to a place of safety if no suitable charging facilities are available within range of the vehicle given the current state of its battery.

## 7.6 Multi-modal trip planning

### 7.6.1 Overview

This service group has the following characteristics.

- It shall enable travellers to plan trips that involve the use of two or more modes of transport.
- It shall be possible for scopes of the services in this group to enable the best route options to be calculated taking account of network and public transport information and to incorporate multi-modal options such as Park and Ride.

## 7.6.2 Constituent ITS services

### 7.6.2.1 Multi-modal comparative trip guidance

The scope of this service shall enable travellers to plan different trips and then compare them in the following ways.

- a) The trips shall involve the use of two or more modes of transport, at least one of which shall involve the use of the managed road network, either for walking, cycling, motor cycling, car driving or using public transport.
- b) The comparison shall be made by the traveller selecting one or more of the following parameters:
  - 1) cost;
  - 2) total trip time, i.e. including waiting time at modal transfers;
  - 3) number of modes used;
  - 4) number of mode changes.
- c) As a result of the comparison, the traveller shall be able to refine the details of some or all of the trips and re-run the comparison. Once the traveller is satisfied, the trip can be retained for immediate or future use.

### 7.6.2.2 Centralized trip planning using real-time and policy inputs

The scope of this service shall include the provision of trip planning that takes place using a "centralized" system belonging to an organization that has access to the following:

Real-time travel data that shall include some or all of the following:

- a) traffic data, to include speeds and congestion;
- b) public transport service data, to include current and expected schedule deviations;
- c) weather data, to include both current conditions and forecast changes that have the potential to adversely affect road travel;
- d) policy inputs that are either obtained from other organizations, or created by the organization that provides the service and include such things as the requirement for trips to use particular transport modes in preference to others or for the use of some transport modes to be prohibited.

Where the modes chosen by the traveller are not those used in the trip plan because of policy restrictions, the traveller shall be informed of the changes.

## 7.7 Travel services information

### 7.7.1 Introduction

This service group has the following characteristics.

- It shall include the provision of services other than actual travel that have the potential to be of use to a traveller before or during a trip.
- The information made available from services in this group shall relate to the proposed destination of the trip, to the trip origin, or to the current location of the traveller.

## 7.7.2 Constituent ITS services

### 7.7.2.1 Travel services information — destination

The scope of this service shall include the provision of information about the services that are available to the traveller at the destination of a trip, either before the trip is made, or whilst the trip is in progress. It shall be possible within the scope of this service for the information to be both static and real-time dynamic, the traveller being provided with a suitable indication for each piece of information.

- a) static information shall include any of the following:
  - 1) hotels,
  - 2) restaurants and fast or take-away food outlets,
  - 3) places of entertainment,
  - 4) medical facilities,
  - 5) points of Interest, e.g. land marks and places of historical interest,
  - 6) places offering other services, e.g. banking and currency exchange;
- b) real-time dynamic information shall include any of the following:
  - 1) hotel availability and costs,
  - 2) restaurant availability and costs,
  - 3) current and predicted state of the weather and other phenomena such as tides, canal lock operating times, etc.

The availability of this information and the display mechanism that is used shall depend on the physical location from where it is being displayed, which could be:

- c) a static device;
- d) computer equipment;
- e) vehicles;
- f) personal devices.

Where the information is available from computers and personal devices, the scope of this service shall enable the traveller to pre-book hotels and restaurants and to place orders in advance.

### 7.7.2.2 Travel services information — current location

The scope of this service shall include the provision of information about the services that are available to the traveller at the place where they are currently located, which may be the trip origin or a place that is en-route in the trip. If this information is being provided before a trip commences then it shall be about the trip origin. It shall be possible within the scope of this service for the information to be both static and real-time dynamic, the traveller being provided with a suitable indication for each piece of information.

- a) Static information shall include any of the following:
  - 1) restaurants and take-away food outlets,
  - 2) places of entertainment,
  - 3) medical facilities,

- 4) places offering other services, e.g. banking and currency exchange.
- b) Real-time dynamic information shall include any of the following:
  - 1) current and predicted arrivals and departures of available public transport modes,
  - 2) current and predicted state of the weather and other phenomena such as tides, canal lock operating times, etc.

The availability of this information and the display mechanism that is used shall depend on the physical location from where it is being displayed, which could be:

- c) a static device;
- d) computer equipment;
- e) vehicles;
- f) personal devices.

Where the information is available from computers and personal devices, the scope of this service shall enable the traveller to pre-book restaurants and place orders in advance at take-away food outlets.

## 8 Traffic management and operations service domain

### 8.1 Overview

The scope of this domain shall include the management of the movement of all types of vehicles, travellers and pedestrians throughout the surface transport systems network, and includes both automated monitoring and control activities, decision-making processes (both automated and manual) that address real-time incidents and other disturbances on the transportation network, plus managing travel demand as needed to maintain overall mobility, safety enhancements for vulnerable and disabled road users, managing the use of intelligent junctions and dealing with suspicious vehicles.

Within this scope, the domain shall include the following groups of services:

- a) traffic management and control — see [8.2](#);
- b) transport-related incident management — see [8.3](#);
- c) demand management — see [8.4](#);
- d) surface transport systems infrastructure maintenance management — see [8.5](#);
- e) policing/enforcing traffic regulations — see [8.6](#);
- f) safety enhancements for vulnerable road users — see [8.7](#);
- g) safety enhancements for disabled road users — see [8.8](#);
- h) safety provisions for pedestrians using intelligent junctions and links — see [8.9](#);
- i) monitoring and management of suspicious vehicles — see [8.10](#).

### 8.2 Traffic management and control

#### 8.2.1 Overview

The service group has the following characteristics.

- It shall address the management of traffic flows through the managed road network.

- It shall include the use of various mechanisms to monitor and manage traffic using the managed road network, including facilities to give preference to the movement of specific types of vehicles such as buses and taxis, plus vehicles belonging to the emergency services.
- It shall include the management of the physical road network, modal interfaces and parking.

## 8.2.2 Constituent ITS services

### 8.2.2.1 Traffic monitoring

The scope of this service shall enable the monitoring of the traffic conditions that currently exist in the road network being managed by ITS. The data to be monitored shall include some or all of the following:

- a) traffic flow rate (a measure that shows the numbers of vehicles passing particular points);
- b) traffic speed (for vehicles passing particular points);
- c) headway between vehicles (at particular points and in particular lanes at those points);
- d) congestion (defined as the location of stationary traffic at particular points).

It shall be possible within the scope of this service for the above data items to be:

- 1) measured at one or more points in the managed road network;
- 2) classified by type of road vehicle, e.g. car, bus, freight vehicle and bicycle;
- 3) made available for use by other services.

### 8.2.2.2 Surface street traffic management

The scope of this service shall enable the flow of traffic in surface streets to be managed in one or more of the following ways:

- a) local control, using traffic signal controllers that only take account of local conditions;
- b) vehicle-actuated control, using traffic signal controllers that use their own detection of vehicle presence;
- c) fixed time control, using pre-programmed traffic signal controllers;
- d) pedestrian control using:
  - 1) traffic signal controllers that can respond to demands from pedestrians to be allowed to cross the roadway,
  - 2) without input from pedestrians in conjunction with other traffic management measures;
- e) adaptive control, using traffic signal controllers subject to one or more different methodologies;
- f) no control – traffic is allowed to flow without being managed.

It shall be possible for each of these methods of management to be applied to some parts or the entire managed road network at different times or the day and days of the year.

### 8.2.2.3 Freeway traffic control — ramp management

The scope of this service shall enable the control of ramps that give access for vehicles to freeways to be applied in the following ways:

- a) to restrict the access of vehicles to freeways to limit the impact of joining traffic on the flow of vehicles that are already using the freeways;

- b) to decide whether or not vehicles shall have access to the freeway based on the current traffic slow conditions, e.g. vehicle density and speed, on the freeway in the vicinity of the ramp entrance onto the freeway;
- c) to decide whether or not vehicles shall have access to the freeway based on the current traffic slow conditions, e.g. vehicle density and speed, in the surface street networks adjacent to the freeway ramps;
- d) to apply the first two of these criteria by freeway lane and/or vehicle type;
- e) to apply all access restrictions by time of day, day of week, and/or day or year;
- f) to be able to modify an existing access restriction or impose a new access restriction without any reference to the current freeway traffic conditions, e.g. in the event of some kind of incident, or emergency.

Any changes in control shall be applied in a safe manner that does not lead to a reduction in the safety of vehicles using the surface street network.

#### 8.2.2.4 Freeway traffic control — mainline speed and lane management

The scope of this service shall enable the flow of traffic using freeways to be managed in a way that is based on one or both of the following:

- a) mainline speed, i.e. the average speed of vehicles using the freeway;
- b) lane management, i.e. the use that is made of each lane of the freeway.

It shall be possible within the scope of this service for either of these control methods to be applied;

- c) to one or more of the lanes provided by the freeway;
- d) to vary from one location to another;
- e) to be applied in different ways to different types of vehicles.

Any changes in control shall be applied in a safe manner that does not lead to a diminution in the safety of vehicles using the freeway network.

#### 8.2.2.5 Preferential treatment for specific vehicle types (signal priority and pre-emption)

The scope of this service shall enable priority to be given to the way in which particular types of vehicles are able to move through the managed road network. It shall mainly be applied to the surface street part of the managed road network as this is where the most beneficial effects are able to be produced.

The types of vehicles for which priority shall be available shall include some or all of the following:

- a) bicycles;
- b) public transport vehicles, including buses and trams plus light rail vehicles where their routes interact with the managed road network;
- c) emergency vehicles, i.e. police, fire and ambulance;
- d) freight vehicles;
- e) special vehicles, e.g. military vehicles or those carrying “hazardous goods”.

It shall be possible within the scope of this service for priority to be given to each vehicle type at the same location and to different types of vehicles at specific locations throughout the managed road network.

### 8.2.2.6 Reversible lane management

The scope of this service shall enable the direction of the flow of traffic in a lane of the managed road network to be changed and for it to be applied:

- a) on a very selective basis;
- b) made in such a way that:
  - 1) it does not lead to a diminution in the safety of vehicles using the road network,
  - 2) it causes the minimum of disruption to the current flow of traffic,
  - 3) the lanes for which the direction of traffic flow is to be changed are clearly identified in a way that can be understood by all drivers.

These changes to the direction of traffic shall apply to all drivers using the part(s) of the managed road network in which the affected lane exists and drivers joining the affected lane from other parts of the road network, e.g. from side roads.

Any change in the direction of traffic flow shall:

- c) be preceded by a closure of the use of the lane to ensure that the traffic that is currently using it has been cleared;
- d) not be made at frequent intervals, i.e. at intervals of less than one hour.

### 8.2.2.7 Coordination of surface street and freeway traffic management

The scope of this service shall make it possible for the management of traffic using the surface streets in the managed road network to be co-ordinated with the management of traffic using the freeway part of the managed road network in any of the following ways:

- a) switching of traffic between surface streets and freeway parts of the network to enable traffic use to be balanced;
- b) switching of traffic between surface streets and freeway parts of the network to reduce congestion in one part of the network if there is spare capacity in the other;
- c) switching of traffic between surface streets and freeway parts of the network when some or all of one part of the network has been closed;
- d) temporary restriction of access for one or more types of vehicles to either the surface streets or freeway parts of the network.

It shall be possible within the scope of this service for any of these activities to be applied:

- e) to some or all of either the surface streets or freeway parts of the managed road network;
- f) where the some or all of the surface streets and freeway parts of the managed road network are managed and/or operated by different authorities and/or jurisdictions.

### 8.2.2.8 Multi-modal highway junction management

The scope of this service shall enable the management of inter-modal highway junctions using either of the following measures:

- a) the stoppage of one of the modes of travel to give priority to one or more other modes (e.g. stopping road traffic to permit heavy or light rail vehicles to move through the junction) or the closure of part of the managed road network to permit a bridge over a river or canal to open to water borne traffic;
- b) the application of a temporary speed restriction to one or more modes so that they are not brought to a physical stop by the passage of vehicles using one or more of the other modes.

These measures shall be applied so that any temporary restriction on the operation of one mode is managed in such a way that the disruption to the other mode is minimized.

It shall be possible within the scope of this service for each of these activities;

- 1) to be applied to one, some or all of the modes that use a particular inter-modal junction;
- 2) to be accompanied by the provision of appropriate and adequate warning to drivers of all effective modes well in advance of the inter-modal crossing that either of the activities is in progress.

For the managed road network, where possible and appropriate, the warning that the activity is in progress shall include advice about the temporary use of one or more alternative routes.

### 8.2.2.9 Parking management

The scope of this service shall enable the use of parking facilities within the managed road network to be managed using one or more of the following measures:

NOTE The service for the collection of payment for parking is described in [13.2.2](#).

- a) the opening and/or closing of some or all of a parking facility, either permanently or for a temporary period;
- b) the provision of real-time and static information to drivers at a parking facility about the number of vacant spaces, the cost to use them and the maximum time for which they can be used;
- c) the real-time monitoring of the usage of a parking facility to establish how many vacant spaces exist at any point in time;
- d) the real-time monitoring of a parking facility in total and/or some or all of the individual spaces within a parking facility to identify vehicles that have stayed longer than the time for which they have paid and/or the maximum time allowed.

It shall be possible within the scope of this service for one or some of these measures to be applied:

- 1) to some or all of the parking facilities in some or the entire managed road network;
- 2) at each parking facility;
- 3) to one or more different types of vehicles at each parking facility.

### 8.2.2.10 Work zone traffic management

The scope of this service shall enable the flow of traffic passing work zones (road works) to be managed using one or more of the following measures:

- a) application of speed restrictions for some or all of the part of the managed road network where the work zone (road works) is (are) active;
- b) application of different speed restrictions for some or all of the part of the managed road network where the work zone (road works) is (are) active;
- c) provision of appropriate lane management to ensure the safety of both the road workers and the passing traffic;
- d) where possible and appropriate, the provision of physical barriers to ensure the safety of both the road workers and the passing traffic;
- e) the temporary closure of the part of the managed road network in which the work zone (road works) is (area) present;
- f) the provision of appropriate and safe access for road workers and equipment and construction materials to the work zone (road works);

- g) the provision of the appropriate advanced warning to drivers that any of the above measures have been implemented on the managed road network ahead in the direction of travel.

It shall be possible within the scope of this service for:

- h) each of these measures to be implemented at some or all of the work zones (road works) present in the managed road network;
- i) different measures to be implemented at each work zone (road works).

#### 8.2.2.11 Traffic advisory and warning information

The scope of this service shall enable the provision of traffic advisory and warning information to drivers comprising one or more of the following.

- a) Advisory messages which shall include advice about:
  - 1) the onset of adverse traffic conditions that are causing delays,
  - 2) alternative routes for any of the previously defined advisories and warnings,
  - 3) the likely effects of congestion and/or adverse weather on speeds and/or journey times.
- b) Warning messages which shall include warning of:
  - 1) impending adverse weather and in the current location and/or in the direction of travel,
  - 2) a work zone (road works) ahead, including any temporary speed limits,
  - 3) highway restrictions ahead, such as narrow lanes, bridges, severe curves, weight restrictions,
  - 4) road closure in the direction of travel.

The advisory and warning information shall:

- 1) be provided in a form that is easily readable in all expected types of lighting conditions, whether due to the natural progression of day and night or due to bad weather;
- 2) be at the prevailing average vehicle speeds;
- 3) take into consideration any local regulations that are in force;
- 4) be presented in a timely manner and at locations where drivers are able to make decisions about what alternative route choices to make, depending on what is available.

#### 8.2.2.12 Vehicle oversize/overweight warning and re-routing

The scope of this service shall enable the use of sensors to detect a vehicle with the following characteristics:

- a) one or more of its dimensions, i.e. length, width or height, exceed those that are defined for “normal” vehicles by the authority responsible for managing the operation of the road network;
- b) its weight exceeds that defined for “normal” vehicles by the authority responsible for managing the operation of the road network.

If either, or both, of a) and b) are detected, then the driver of the vehicle shall be provided with one or both of the following mechanisms:

- 1) a visible and audible warning that the vehicle is oversize and/or overweight;
- 2) instructions for an alternative route for the driver to follow so that the current journey can continue.

These warnings and instructions may be provided through one or both of the following mechanisms:

- in-vehicle displays and audio devices;
- devices located at the roadside.

#### 8.2.2.13 Queue detection and information management

The scope of this service shall enable the presence of queues to be detected and for information about the queues to be provided to drivers. The detection of the presence of queues can be provided by one or both of the following mechanisms:

- a) sensors located in the carriageway that detect the presence and passage of vehicles;
- b) sensors located at the roadside that detect the presence and passage of vehicles;
- c) data about vehicle movement provided by in-vehicle systems and/or sensors provided through C-ITS.

When a queue is detected, drivers located upstream of where the queue has formed, i.e. approaching the back of the queue, shall be informed of the presence of the queue using one or more of the following mechanisms:

- 1) in-vehicle displays;
- 2) displays on devices located at the roadside and/or above the carriageway.

#### 8.2.2.14 Tunnel access management and re-routing

The scope of this service shall enable the conditions inside road tunnels that form part of the road network to be detected and monitored and for information about any closures or restricted access to be provided to drivers. The monitoring can be achieved using a variety of mechanisms including but not limited to:

- a) inputs provided by tunnel monitoring systems;
- b) sensors that are able to monitor conditions in the tunnels, e.g. air quality, smoke and excessive heat;
- c) traffic flow sensors that can detect queues of vehicles at tunnel entrances and/or lack of vehicles at tunnel exits.

If any of these sensors detect problems, i.e. interruptions to the flow of traffic through a tunnel, drivers of all vehicles approaching the tunnel shall be provided with one or both of the following mechanisms:

- 1) a visible and audible warning that the tunnel is closed for use by road traffic;
- 2) instructions for an alternative route for the driver to follow so that the current journey can continue but avoiding the tunnel for which problems have been detected.

These warnings and instructions may be provided through one or both of the following mechanisms:

- in-vehicle displays and audio devices;
- displays on devices located at the roadside and/or above the carriageway.

#### 8.2.2.15 Bridge access management and re-routing

The scope of this service shall enable the conditions on bridges that form part of the road network to be detected and monitored and for information about any closures or restricted access to be provided to drivers, pedestrians and cyclists. The monitoring can be achieved using a variety of mechanisms including but not limited to:

- a) inputs provided by bridge monitoring systems;
- b) sensors that are able to monitor travel conditions on the bridges, e.g. wind speed and direction and temperature;

- c) traffic flow sensors that can detect queues of vehicles at the on-ramps for bridges and/or lack of vehicles at off-ramps for bridges.

If any of these sensors detect problems, i.e. interruptions to the flow of traffic across a bridge, drivers of all vehicles approaching the bridge shall be provided with one or both of the following mechanisms:

- 1) a visible and audible warning that the bridge is closed for use by road traffic;
- 2) instructions for an alternative route for the driver to follow so that the current journey can continue but avoiding the bridge for which problems have been detected.

These warnings and instructions may be provided through one or both of the following mechanisms:

- in-vehicle displays and audio devices;
- displays on devices located at the roadside and/or above the carriageway.

In addition to the above, the service may also provide similar warnings and alternative route instructions to other travellers such as pedestrians and cyclists using one or both of the following mechanisms:

- displays adjacent to the walkways used by pedestrians and cyclists;
- messages that can be displayed by mobile devices.

### 8.3 Transport-related incident management

#### 8.3.1 Overview

This service group provides the capability for the detection of possible incidents, the confirmation that an incident has occurred, and response to various incidents in the transport network, which specifically involve conditions initiated in the network itself rather than purely from external sources (e.g. natural disasters, terrorist attacks).

The scope of the services in this group shall enable the detection of some incidents to be provided by systems responsible for the management of other transport modes, e.g. rail and air.

#### 8.3.2 Constituent ITS services

##### 8.3.2.1 Incident monitoring and confirmation

The scope of this service shall enable the monitoring of data and its use to detect and confirm that an incident has occurred that affects the movement of vehicles in the managed road network.

It shall be possible within the scope of this service for the detection of incidents to be by one or more of the following mechanisms:

- a) traffic flow monitoring;
- b) congestion monitoring;
- c) changes in public transport service running times away from the expected times;
- d) failure of roadside equipment;
- e) reports from police or other emergency services;
- f) reports from travellers and persons who have sight of the managed road network but are not actually travelling;
- g) reports from drivers, e.g. using eCall, OnStar or similar public or proprietary services;
- h) automatic reports from ITS stations, whether on-board vehicles or at the roadside.

It shall be possible within the scope of this service for:

- 1) any number of these mechanisms to be used to provide an indication of the possibility that an incident has occurred;
- 2) a "degree of confidence" to be assigned to each indication which shall depend on:
  - the mechanism providing the incident indication,
  - the number of mechanisms reporting each incident;
- 3) confirmation that an incident has occurred to be provided by either:
  - a single source with a high "degree of confidence", or
  - many sources the sum of whose "degrees of confidence" is high.

#### 8.3.2.2 Incident on-site driver assistance

The scope of this service shall enable incident response resources to be deployed to the location of the incident to provide assistance to a driver as needed. It shall be possible within the scope of this service for this assistance to include some or all of the following types:

- a) removal of a vehicle involved in an incident or broken down to a safe place where it is not a hazard to other road users and there is little or no hazard to the occupants of the vehicle;
- b) towing of a vehicle involved in an incident or broken down to a place of repair;
- c) repair of a vehicle involved in an incident or broken down when and where it is safe to do so;
- d) removal by emergency vehicle (road vehicle, or airborne, e.g. helicopter or aeroplane) of any person in a vehicle that has been involved in an incident, including the driver to a place where the appropriate medical treatment can be provided;
- e) removal of some or all of the cargo of a freight vehicle that has been involved in an incident or has broken down, particularly when the continued presence of that cargo is causing a hazard to other road users, despite the cargo not being classed as a hazardous material.

The scope of the service shall enable coordination between emergency services responding to the incident including either pre- or post-arrival of the emergency services at the incident scene.

#### 8.3.2.3 Incident on-site traveller assistance

The scope of this service shall enable incident response resources to be deployed to the location of the incident to provide assistance to travellers needed. It shall be possible within the scope of this service for this assistance to be one or more of the following types:

- a) medical assistance to assist the traveller with the completion of their journey;
- b) removal of the traveller to a place where continuous medical treatment can be provided in the event that they are unable to continue their journey;
- c) advice on what changes need to be made to the traveller's itinerary to enable a journey to be completed;
- d) advice on the location of nearby facilities such as hotels, restaurants, hospitals and other forms of medical aid providers, banks, etc.;
- e) advice on the location of modal interchange points and the modes of travel available from them.

The scope of the service shall enable coordination between emergency services responding to the incident including either pre- or post-arrival of the emergency services at the incident scene.

#### 8.3.2.4 Incident co-ordination and clearance

The scope of this service shall enable the following:

- a) the co-ordination of the response to an incident;
- b) the clearance of any results from the incidents that have the potential to affect road users.

It shall be possible within the scope of this service for the "co-ordination and clearance" to involve assistance from:

- 1) any combination of the emergency services ((fire, police and medical));
- 2) other forms of assistance such as tow trucks;
- 3) other mechanisms for removing people, vehicles and freight from the incident location.

#### 8.3.2.5 Hazardous materials monitoring and management

The scope of this service shall enable the movement of vehicles carrying hazardous materials through the managed road network to be monitored:

- a) throughout all types of managed road network, e.g. surface streets, freeways, toll roads plus privately operated and maintained roads;
- b) at places and occasions when a hazardous load is stationary, e.g. awaiting a clear path through the managed road network.

The management of the movement of the hazardous materials shall enable:

- 1) the route it is to follow through the managed road network to be planned and monitored;
- 2) the emergency services to be alerted if the state of the hazardous materials becomes a danger to other road users, or people and objects adjacent to the managed road network.

#### 8.3.2.6 Collection of incident details from other transport modes

The scope of this service shall enable the collection of details about incidents that have occurred on other transport modes and for the collected details to include some or all of the following:

- a) transport mode;
- b) location;
- c) impact on the operation of the transport mode involved in the incident;
- d) details of any involvement of the emergency services.

It shall be possible within the scope of this service to use these details:

- 1) as the source of warning and advisory messages to be provided to drivers and travellers;
- 2) to assess the impact of the incident on the movement of vehicles through the managed road network.

### 8.4 Demand management

#### 8.4.1 Overview

This service group covers the development and implementation of management and control strategies designed to influence the demand for travel. The collection of any payments required by these services is included in the services described in [13.3](#) and [13.4](#).

It shall be possible within the scope of this service for the strategies included in this service group to influence the overall level of demand for travel at different times of the day and the relative demand for different modes of transport, through the management of:

- pricing structures;
- area access control or zone entry regulations;
- facilities specifically dedicated to high-occupancy vehicles.

It shall also be possible for the strategies to take account of air quality and pollution levels so that their impact on the health of travellers can be minimized.

## 8.4.2 Constituent ITS services

### 8.4.2.1 Variable road pricing — dedicated lane

The scope of this service shall enable the price for the use of a particular lane within the managed road network to be fixed and varied from time to time and for the variation to apply to the following:

- a) the total length of a lane;
- b) one or more parts of the total length of a lane;
- c) a lane which is in either the surface streets and/or freeway part of the managed road network.

It shall be possible within the scope of this service for variations in price:

- 1) to be made by time of day and day of the year;
- 2) to be changed several times during the day.

Indications shall be provided to all drivers in a manner that is clear and easily read to show:

- the actual price for using the lane;
- any changes in price which should also appear before they occur, so that drivers are able to decide to use an alternative and cheaper lane.

### 8.4.2.2 Variable road pricing — entire facility

The scope of this service shall enable the price for using a particular part of the managed road network to be varied and applied:

- a) to all lanes in the selected part of the managed road network;
- b) for any period of time;
- c) by time of day and day of the year.

It shall be possible within the scope of this service for:

- 1) several different prices to be applied and varied for some or the entirety the managed road network during the day;
- 2) the prices to be applied to different parts of the managed road network to be varied independently of one another.

Indications shall be provided to all drivers in a manner that is clear and easily read to show:

- the actual price for using the lane;

- any changes, which should also appear before they occur, so that drivers are able to decide to use an alternative and cheaper part of the managed road network.

#### 8.4.2.3 Cordon and zone-based congestion pricing

The scope of this service shall enable the price for the use of parts of the managed road network to be applied in such a way that either:

- a) a cordon is created around a particular location;
- b) a zone is created where a particular price applies.

It shall be possible within the scope of this service for:

- 1) one or more of these cordons and/or zones to be created in a single managed road network;
- 2) the part(s) of the managed road network to which they apply to be varied;
- 3) variations to be made by time of day and day of the year;
- 4) several variations to be made during the day.

Indications shall be provided to all drivers in a manner that is clear and easily read to show:

- the actual price for using the roads within the cordon or zone;
- any changes, which should also appear before they occur, so that drivers are able to decide to use an alternative and cheaper part of the managed road network.

#### 8.4.2.4 Access management

The scope of this service shall enable access to some parts or the entire managed road network to be managed using any combination of the following ways:

- a) vehicle type;
- b) vehicle cargo;
- c) time of day;
- d) day of year;
- e) traffic conditions within the part of the managed road network for which access is being managed.

When management is applied, the information about it shall be:

- 1) clearly indicated in a form that is easily read by drivers without having to stop their vehicles;
- 2) displayed at locations where it is possible for drivers to be able to decide to use a different "access free" part of the managed road network.

#### 8.4.2.5 High-occupancy lane management

The scope of this service shall enable the management of those lanes within the road network that are for use by vehicles with more than one occupant using any of the following criteria:

- a) number of vehicle occupants;
- b) type of vehicle;
- c) time of day;
- d) day of year;

e) direction of travel.

It shall be possible within the scope of this service for any combination of these criteria to be applied to individual high occupancy lanes.

Any restrictions that are applied to the use of high occupancy vehicle lanes shall be clearly indicated and displayed:

- f) in a way that is easily read by drivers regardless of the type of vehicle they are driving and the expected speed of the vehicle;
- g) at locations where it is possible for drivers to change their use of the high occupancy vehicle lanes so that they shall not infringe the criteria.

#### 8.4.2.6 Air quality-and pollution-based surface transport systems management

The scope of this service shall enable the use of the road network to be managed according to the air quality being experienced by road users and for vehicles to be excluded from using areas of the managed road network with low air quality according to the following criteria:

- a) type and level of air quality;
- b) levels of pollution arising from:
  - 1) the air emitted from vehicle exhausts, including CO, CO<sub>2</sub>, NO<sub>x</sub> etc.,
  - 2) background (general non-transport-related) pollution levels,
  - 3) the level of ozone,
  - 4) noise levels;
- c) prevailing and/or forecast weather conditions;
- d) type of vehicle.

It shall be possible within the scope of this service for any combination of these criteria to be applied to some or the entire managed road network so that the use of the road network can be managed to reduce the impact on travellers regardless of the mode of transport they are using.

Any restrictions that are applied shall be clearly indicated and displayed:

- 1) in a way that is easily read by travellers regardless of the type of vehicle or mode of transport they are using and their expected speed through the managed road network;
- 2) at locations where travellers can change their routes and/or mode of transport so as not to infringe the access requirements.

### 8.5 Surface transport systems infrastructure maintenance management

#### 8.5.1 Overview

This service group covers the management of the road network maintenance and shall include:

- the maintenance of the physical managed road network (including those parts used by cyclists and pedestrians);
- maintenance activities particular to winter weather conditions;
- activities related to roadway construction;
- management of the safety of those carrying out road maintenance work;

— management of the fleet and equipment used for maintenance activities.

This service group shall also include the maintenance of the communication and computer infrastructures used to support travellers using the managed road network.

## 8.5.2 Constituent ITS services

### 8.5.2.1 Winter maintenance

The scope of this service shall enable winter maintenance activities to take place on some or the entire managed road network and shall comprise:

- a) snow ploughing operations;
- b) roadway treatments (e.g. gritting and salt spraying);
- c) anti-icing material applications, including automatic applications on bridges or other road surfaces;
- d) scheduling of winter maintenance activities as well as determination of the appropriate snow and ice control response.

It shall be possible within the scope of this service for some or several of these activities to be applied to different parts of the managed road network and for more than one of them to be applied to the same part of the managed road network.

The purpose behind implementing this service shall be to:

- 1) minimize the disruption to road users caused by winter conditions;
- 2) maintain a safe working environment for road workers.

### 8.5.2.2 Roadway maintenance management

The scope of this service shall enable the management of scheduled and unscheduled maintenance on a roadway system or right-of-way in a way that keeps the roadway system in a condition that is appropriate for its continued use at the expected levels of traffic, without causing any hazard to road users.

The roadway maintenance activities may comprise some or all of the following:

- a) maintenance or repair to the physical structure of the roadway system, from filling “pot holes” to complete replacement of structures;
- b) routine maintenance activities such as road cleaning, grass cutting, etc.;
- c) the repair and maintenance of both ITS and non-ITS equipment on the roadway (e.g. signs, traffic controllers, traffic detectors, dynamic message signs, traffic signals, CCTV, etc.);
- d) monitoring the condition of pavement, bridges, tunnels, and other transportation-related infrastructure (e.g. culverts);
- e) the prohibition of certain types of vehicles from using certain parts or an entire section of road pavement.

Any of the above pavement management activities shall be carried out at times and in ways that cause the minimum of disruption to road users.

### 8.5.2.3 Work zone safety management

The scope of this service shall enable work zone (road works) areas to be managed using activities that are expected to include:

- a) application of speed restrictions;

- b) application of restrictions on vehicle size, weight and type;
- c) application of some or all of these restrictions to one or more of the traffic lanes in the vicinity of the work zone (road works);
- d) segregation of the work zone (road works) from passing traffic that takes as its first priority the provision of a safe working environment, but also minimizes the impact on passing traffic;
- e) the provision of adequate warning of the position of the work zone (road works) and the restrictions that are in force to approaching traffic.

Warnings of restrictions other than speed shall be provided at locations from which vehicles are able to use alternative parts of the managed road network and thus avoid the work zone.

It shall be possible for any of the activities in the previous list to be:

- 1) applied to parts of, or the entire managed road network;
- 2) in place for any required length of time;
- 3) managed in a way that is safe for both road workers and road users.

#### 8.5.2.4 Maintenance fleet and equipment management

The scope of this service shall enable the management of the fleet of vehicles involved in roadway maintenance (e.g. snow ploughs) and the management of equipment used for maintenance activities and shall comprise:

- a) tracking the location of maintenance vehicles and other equipment to ascertain the progress of their activities;
- b) scheduling of maintenance activities relating to vehicles and maintenance equipment;
- c) monitoring diagnostics relating to the operation of maintenance vehicles;
- d) tracking of maintenance assets to maintain accurate inventory status that includes asset locations.

## 8.6 Policing/enforcing traffic regulations

### 8.6.1 Overview

This service group covers the enforcement of laws and regulations governing the way in which the managed road network is to be used and shall include:

- the monitoring and detection of violations of laws and regulations;
- the collection of information that is of sufficient quality and content to enable its use in any subsequent legal action(s).

However, the implementation of any legal action(s) is not included as it is considered to be outside the ITS domain.

It shall be possible within the scope of this service for information to be obtained comprising:

- the identity of the driver in charge of the vehicle when the infringement of the laws and/or regulations occurs;
- the identity of the vehicle itself.

Both sets of information are crucially needed because many transport vehicles have the ability to be used by drivers who are not their owners. The two sets of information shall be used in the actual processing of the enforcement and in creating a default history archive for any of the constituent ITS services. Such a default history archive shall be capable of being used by enforcement agencies for infringement history for regular offenders.

## 8.6.2 Constituent ITS services

### 8.6.2.1 Restricted zone access enforcement

The scope of this service shall enable the management, monitoring and enforcement of the access for vehicles to certain parts of a managed road network (zones) or road sections depending on traffic management policies and special official regulations. It shall take into account factors such as:

- a) time of the day/day of week;
- b) special access rights of the drivers (e.g. residents);
- c) vehicle types (e.g. private cars, trucks);
- d) vehicle properties (e.g. weight, height);
- e) purpose of the journey (e.g. deliveries, ambulances, tourist buses);
- f) payment of access fees or road toll.

It shall be possible within the scope of this service for the actual processing of the enforcement, i.e. prosecution and imposition of penalties, to be carried out by an external agency, or within the road management organization for which the control, monitoring and enforcement is being carried out.

### 8.6.2.2 Vehicle overweight enforcement

The scope of this service shall enable the enforcement of vehicle weight restrictions across some or the entire road network. The weight per axle and total weight (sometimes called "gross vehicle weight") can be determined in one of the following ways:

- a) through sensors that measure the weight per axle and gross vehicle weight (GVW) as it passes over them, often called "weigh-in-motion" (WIM);
- b) static weighing scales located at specific points at or near the roadside, e.g. in specially designated areas;
- c) using sensors on-board a vehicle that determine the weight of the cargo it is carrying that can be added to the un-laden (empty) weight of the vehicle to provide its GVW.

The results of whichever of these methods provides the GVW and/or weight per axle shall be used to determine if the vehicle is too heavy to continue using a particular part of the road network, e.g. a bridge, or the entire road network.

If the vehicle is too heavy then the scope of this service shall permit the enforcement authority to serve an enforcement notice preventing the vehicle from moving until such time as its GVW has been reduced to the maximum permitted for the part(s) of the road network that the vehicle needs to use.

### 8.6.2.3 High occupancy vehicle facility usage

The scope of this service shall enable the management, monitoring and enforcement of the use of dedicated lanes (sometimes called "HOV lanes") for vehicles which are occupied with a certain minimal number of passengers (more than one).

It shall be possible within the scope of this service for:

- a) the numbers of vehicle occupants to be determined;
- b) enforcement action to be initiated where this is below the minimum required for the lane that the vehicle is using;
- c) the minimum numbers of vehicle occupants to be the same across all lanes in the highway, or to be specific to particular lanes;

- d) the service to be applied over specific lengths of the roadway;
- e) lanes in the highway to be made “HOV” temporarily at particular times of the day and/or days of the week.

The scope of this service shall enable the collection of sufficient parameters to enable the enforcement to be processed including but not limited to:

- 1) time of the day/day of week;
- 2) location;
- 3) vehicle types (e.g. private cars, trucks);
- 4) vehicle identity;
- 5) direction of travel.

It shall be possible within the scope of this service for the actual processing of the enforcement, i.e. prosecution and imposition of penalties, to be carried out by an external agency, or within the road management organization for which the control, monitoring and enforcement is being carried out.

#### 8.6.2.4 Parking regulation enforcement

The scope of this service shall enable the enforcement of parking regulations for both on-street and off-street parking facilities and shall take into account factors such as:

- a) permanent or temporary parking bans and restrictions;
- b) parking fees and ticketing;
- c) licences for special road users (e.g. residents, people with disabilities).

To enable the enforcement to be processed, the service shall collect parameters, including but not limited to:

- 1) time of the day/day of week;
- 2) location of parking space;
- 3) vehicle types (e.g. private cars, trucks);
- 4) vehicle identity.

It shall be possible within the scope of this service for the actual processing of the enforcement, i.e. prosecution and imposition of penalties, to be carried out by an external agency, or within the road management organization for which the control, monitoring and enforcement is being carried out.

#### 8.6.2.5 Speed limit enforcement

The scope of this service shall enable the speed limits set for each segment of the managed road network to be enforced. It shall be possible within the scope of this service for:

- a) both maximum and minimum speed limits to be enforced;
- b) different speed limits to be applied for:
  - 1) particular vehicle types, so that those groups of vehicles with a lower speed limit (often commercial vehicles) can be distinguished from other vehicles with a higher speed limit (usually private cars),
  - 2) particular types of weather, such as rain, fog, ice and snow, plus other conditions for which limiting vehicle speeds can improve safety;
- c) compliance with speed limits to be ignored for emergency vehicles responding to incidents, or in other special circumstances, e.g. VIP convoys.

The scope of this service shall enable the collection of sufficient parameters to enable the enforcement to be processed, including but not limited to:

- 1) time of the day/day of week;
- 2) location;
- 3) vehicle types (e.g. private cars, trucks);
- 4) vehicle identity;
- 5) direction of travel.

It shall be possible within the scope of this service for the actual processing of the enforcement, i.e. prosecution and imposition of penalties, to be carried out by an external agency, or within the road management organization for which the control, monitoring and enforcement is being carried out.

#### 8.6.2.6 Signal enforcement

The scope of this service shall enable compliance with operation of traffic signals to be enforced. It shall be possible within the scope of this service for the enforcement to be applied through the detection of:

- a) compliance with individual signal phases, i.e. red light running;
- b) non-compliant use of a signal phase for a particular vehicle type, e.g. a private car using the green phase for a public transport vehicle.

The scope of this service shall enable the collection of sufficient parameters to enable the enforcement to be processed including but not limited to:

- 1) time of the day/day of week;
- 2) location;
- 3) vehicle types (e.g. private cars, trucks);
- 4) vehicle identity;
- 5) signal phase that is relevant to the vehicle's movement.

It shall be possible within the scope of this service for the actual processing of the enforcement, i.e. prosecution and imposition of penalties, to be carried out by an external agency, or within the road management organization for which the control, monitoring and enforcement is being carried out.

### 8.7 Safety enhancements for vulnerable road users

#### 8.7.1 Overview

The service group covers the provision of services that enhance the safety of vulnerable road users, who shall be defined as pedestrians that are using streets, roads and highways without the benefit of the protection offered by an automobile or truck and:

- have impaired vision, e.g. colour blindness;
- are blind and are potentially supported by a guide dog;
- are deaf;
- have restricted mobility and use one of the following:
  - a walking frame,
  - a wheelchair,

- a motorized device, sometimes called a “mobility scooter”.

The services in this group shall enable persons with any of the above disabilities to be able to cross the managed road network at specific designated locations.

## 8.7.2 Constituent ITS services:

### 8.7.2.1 Non-motorized vehicle and pedestrian monitoring

The scope of this service shall enable the movement of vulnerable road users through the road network, including places where they are able to cross the normal flow of road traffic. It shall enable some or all of the following to be provided:

- warnings to drivers of motorized vehicles of the imminent arrival or presence vulnerable road users at road crossings, to enable them to take the most appropriate action to ensure the safety of everybody;
- warnings to vulnerable road users of the imminent arrival or presence of the motorized vehicles at road crossings, to enable them to take the most appropriate action to ensure the safety of everybody;
- the ability for changes to be made to the priority of vulnerable road users at road crossings so that they take precedence over motorized vehicles;
- the ability for changes to be made (both increase and decrease if not needed) to the time period during which vulnerable road users can cross the carriageway used by motorized vehicles.

### 8.7.2.2 Systems to monitor specialized vehicles

The scope of this service shall enable the speeds and presence of specialized vehicles that are moving through the road network to be monitored. The term “specialized vehicle” shall be applied to any vehicle that is used by road maintenance organizations, or carries special loads, and may also include vehicles belonging to any of the emergency services. The data collected by the monitoring process shall be used to:

- aid the use of pedestrian crossings by vulnerable road users so that they can be alerted to the presence of a specialized vehicle, which may delay their future use of the crossing;
- give advanced warning to road maintenance workers that specialized vehicles are approaching their working environment;
- provide warnings to the drivers of specialized vehicles about the presence of road maintenance workers in the part of the road network that is in the predicted forward trajectory of the vehicle.

### 8.7.2.3 Access to roadway crossings for vulnerable road users

The scope of this service shall enable vulnerable road users to cross the managed road network in order to move from one geographic location to another. It shall provide some of all of the following facilities for disabled persons:

- clearly audible signals to indicate that it is, or is not safe to cross the roadway;
- clearly visible indications that it is, or is not safe to cross that can be recognized by those who are colour blind;
- mechanisms to indicate their presence to the device(s) managing the crossing that do not require movement of a body part such as an arm or hand;
- adjacent pavement with a unique surface texture not used elsewhere.

When the crossing is operating and indicating that persons may cross the roadway, sufficient time shall be provided for vulnerable road users to completely move from one side of the roadway to another before road traffic is able to start moving over the crossing.

## 8.8 Safety provisions for pedestrians using intelligent junctions and links

### 8.8.1 Overview

The service group covers the provision of safety facilities for pedestrians that are using or about to use the pedestrian facilities provided by intelligent junctions and links. These are defined as junctions and links whose operation is determined by their own mechanisms, which can be local to the junction or link, or can be remote, e.g. where the mechanism in one junction controls the operation of other local junctions.

### 8.8.2 Constituent ITS services

#### 8.8.2.1 Provide pedestrian access at intelligent junctions

The scope of this service shall enable intelligent junctions to provide access to the pedestrian road crossing at intelligent junctions. It shall enable the presence of pedestrians to be detected and for this to be included as input to the intelligent junction control facility.

The intelligent junction control facility shall:

- a) treat the presence of pedestrians waiting to cross the road as of equal or greater importance to the presence of other types of road user, e.g. vehicles, horses and cycles;
- b) enable pedestrians to completely cross the road in safety and without encountering other road users in an unsafe manner.

#### 8.8.2.2 Monitor pedestrians using intelligent links

The scope of this service shall enable intelligent links to provide warnings about the presence of pedestrians to all types of road user. The warning shall be produced when a pedestrian is detected and is found to:

- a) have a trajectory that will lead them into the road part of the link;
- b) be present in the road part of the link.

Both audible and visual warning shall be provided using roadside, in-vehicle and personal devices to:

- 1) the pedestrians that have been detected;
- 2) other pedestrians in the immediate vicinity;
- 3) other road users.

If the capability is available from the intelligence in the link, it shall display stop audible and visual indications to all vehicles, using both roadside and in-vehicle equipment.

## 8.9 Advanced warnings provided by intelligent junctions

### 8.9.1 Overview

This service group covers the warnings that are provided to vehicle drivers, pedestrians and vulnerable road users by intelligent junctions. The characteristics of intelligent junctions are defined as either:

- junctions whose operation is determined by their own mechanisms, which may be local to the junction, or may be remote, e.g. where the mechanism in one junction controls the operation of other local junctions;
- junctions that do not have any signals other than a right of way indication provided through the detection of approaching vehicles, pedestrians, cyclists and vulnerable road users.

## 8.9.2 Constituent ITS services

### 8.9.2.1 Signal display advance warning

The scope of this service shall enable the provision of advance warning of changes to the traffic signal indication about to be encountered by vehicle drivers, cyclists, pedestrians and vulnerable road users at various parts of the managed road network. The warnings may include indications about the presence of other road users and may be provided in one or more of the following ways:

- a) via devices located at the roadside;
- b) directly to the drivers of any type of vehicle through some type of in-vehicle indication;
- c) to cyclists, pedestrians and vulnerable road users through their mobile devices.

The warnings shall be provided by audible and/or visual indications that are easily understood by all types of vehicle drivers, including cyclists, pedestrians and vulnerable road users. These may include one or more of the following:

- 1) flashing signals, e.g. flashing green to show that a signal is about to change to red;
- 2) countdown indicators that show the time remaining before a signal changes from green to red;
- 3) changes in audible indications, e.g. frequency and/or tone.

### 8.9.2.2 Non-signalized advance warnings

The scope of this service shall concisely provide warnings that clarify the right-of-way rules for non-signalized junctions in the managed road network so that vehicle drivers, cyclists, pedestrians and vulnerable road users are able to determine whether they are expected to give way or stop to enable others to use the junction. The warnings may include indications about the presence of other road users and may be provided in one or more of the following ways:

- a) via devices located at the roadside;
- b) directly to the drivers of any type of motorized vehicle through some type of in-vehicle indication;
- c) to cyclists, pedestrians and vulnerable road users through their mobile devices.

The warnings shall be provided by audible and/or visual indications that are easily understood by all types of vehicle drivers, including cyclists, pedestrians and vulnerable road users. These may include one or more of the following:

- 1) static displays using text and/or symbols;
- 2) dynamic text strings using electronic displays;
- 3) changes in type of road surface, e.g. ridges or bumps;
- 4) changes in audible indications, e.g. frequency and/or tone.

## 8.10 Monitoring and management of suspicious vehicles

### 8.10.1 Overview

The service group covers the monitoring and management of suspicious vehicles that are present in the managed road network. A suspicious vehicle is defined as one that is exhibiting behaviour that is inconsistent with that expected from a vehicle of its type. Such behaviour shall include:

- stopping in unauthorized places within the managed road network;
- being driven in a way that is creating a hazard for other road users.

## 8.10.2 Constituent ITS services

### 8.10.2.1 Detection and identification of suspicious vehicles

The scope of this service shall enable the detection and monitoring of vehicles using the managed road network to determine if they need to be classed as being suspicious. The determination that a vehicle is suspicious shall be based on the following criteria.

- a) Is the vehicle stationary in a part of the managed road network where vehicles do not do this, e.g. on a bend in the road, or at a junction?
- b) Has the vehicle been parked in the same location for time that is longer than normal, e.g. overstaying the maximum time allowed in a parking space?
- c) Is the vehicle being driven in an erratic manner, e.g. speeding, going slower than other traffic, or making unexpected manoeuvres?
- d) Does the vehicle look overloaded, or is it carrying a load that is too big for its size?

The service shall use inputs and sensors provided for other traffic management services to enable the existence of the above conditions to be monitored.

### 8.10.2.2 Road traffic management for suspicious vehicles

The scope of this service shall enable any particular road traffic management measures to be implemented for vehicles that have been detected as being suspicious because they are carrying HAZMAT or explosive materials through services defined in [Clause 12](#). However, the scope shall also enable measures to be implemented as a precaution in case such vehicles are found to be using any part of the road network.

The scope and content of the measures that can be put in place through this service shall include:

- a) output of warning indications to all drivers to keep a safe distance from a particular vehicle;
- b) speed restrictions for the type of vehicle that is believed to be suspicious;
- c) the availability of separate lanes and/or parts of the road network for suspicious vehicles;
- d) the imposition of changes to traffic signal timings to improve or hinder the progress of suspicious vehicles through the road network.

It shall be possible within the scope of this service for any or every one of the above measures to be implemented in some part(s) or across the entire road network, and for the implementation to be locally at the roadside or through a centre responsible for managing how the road network is used.

### 8.10.2.3 Emergency notification to key agencies of suspicious vehicles

The scope of this service shall enable the appropriate emergency services to be notified of the detection of a vehicle that has been designated as suspicious because it is carrying HAZMAT or explosive materials. It shall be possible within the scope of this service for this designation to arise either through services that are defined in [Clause 12](#), or through other mechanisms, e.g. manual observation from the roadside.

The appropriate emergency services shall only be informed about those vehicles that are suspicious, unless vehicles that are legitimately carrying these materials present a hazard to other road users and there is no other mechanism available for passing on this information.

The information provided to the appropriate emergency services shall include some or all of the following:

- a) if appropriate, details of the type of HAZMAT or explosive material the vehicle is carrying;
- b) the current location of the suspicious vehicle;
- c) the expected trajectory of the suspicious vehicle if it is moving;

- d) the identity of the suspicious vehicle.

Suggested and/or expected action(s) that the emergency services are expected to take in relation to the suspicious vehicle shall also be included in the information. It shall be possible within the scope of this service for the information to be provided from one or both of the following:

- 1) the centre that manages the use of the road network;
- 2) the roadside where manual observation has been used.

#### 8.10.2.4 Management of the impact of suspicious vehicles on their surroundings

The scope of this service shall enable the presence of a detected suspicious vehicle to be managed so that the impact on buildings, persons, other road users and the surrounding environment is minimized. Once the detection of a suspicious vehicle has been confirmed, the service shall enable the following actions to be taken:

- a) an assessment shall be made of its current and future impact on the use of the managed road network;
- b) the situation in and around the suspicious vehicle shall be monitored for any unexpected activity;
- c) if a threat is apparent, other road users shall be provided with messages telling them to avoid the part of the managed road network in which the suspicious vehicle is located;
- d) public transport and operators or other transport modes shall be requested to re-route, or if that is not possible, suspend any of their services that pass the location of the suspicious vehicle.

The service shall be able to call on other services such as incident management to implement any of the actions in this list.

## 9 Vehicle services domain

### 9.1 Overview

The scope of this domain shall include the provision of ITS services in the vehicle. Its focus is on the enhancement of safety, security and efficiency in vehicle operations, by warnings and assistance to users or input to the operation of the vehicle. There are both services which use external information, and services which use in-vehicle information only. However, none of them shall actually exercise control over the vehicle as any services that do this shall be covered by other International Standards developed by ISO and standards developed by other Standards Development Organizations.

Within this scope, the domain shall include the following groups of services:

- a) automated vehicle operation — see [9.2](#);
- b) collision mitigation/avoidance — see [9.3](#);
- c) driver warning or advisory — see [9.4](#);
- d) safety warning — see [9.5](#);
- e) management of suspicious vehicles — see [9.6](#).

### 9.2 Automated vehicle operation

#### 9.2.1 Overview

This service group covers either the automation of the vehicle driving process, creating a "hands-off" driving environment, or partially-automated operation supporting drivers.

Each of the services in this group shall enable the following actions to be taken:

- initiate the service by a specific input from the driver;
- cease to operate the service when the driver de-selects it.

Security issues are addressed in ISO/SAE 21434.

## 9.2.2 Constituent ITS services

### 9.2.2.1 Automated highway operation

The scope of this service shall enable suitably equipped vehicles to operate without the intervention of their drivers over a dedicated transport network or specific part(s) of the road network that are equipped for automatic highway operation. The drivers of all other vehicles shall be required to find alternative routes. The service shall enable the following actions to be taken:

- a) suitably equipped and operating vehicles can join and leave the dedicated transport network or the specific part(s) of the road network that are equipped for automatic highway operation at places other than their beginning and/or end;
- b) if the vehicle suffers a problem that prevents it from following the automatic highway operation, the vehicle can either move into a safe area of the transport or road network without detrimental effects on the safety of other vehicles using adjacent parts of the transport or road network, or come to a complete stop. In both cases a warning indication will be provided to the drivers and/or passengers;
- c) if the mechanism(s) used to implement the automatic highway operation ceases to operate correctly, all vehicles can either revert to driver operation in a manner that is safe for all vehicles using the transport or road network, or come to a complete stop. In both cases a warning indication shall be provided to the drivers and/or passengers.

Once it has entered a dedicated transport network or a part of the road network equipped for automatic operation, the vehicle shall be controlled and guided along the road within certain constraints. These constraints shall comprise the following:

- 1) road keeping — keep within the dedicated transport network or specific part of the road network equipped for automatic highway operation;
- 2) lane keeping — keep within the lane occupied at the start of the dedicated transport network or specific part(s) of the road network assigned to automatic highway operation and only change lanes in response to specific command(s);
- 3) speed — maintain the speed required by the dedicated transport network or specific part(s) of the road network equipped for automatic highway operation, only changing speed in response to specific command(s);
- 4) headway — maintain the appropriate headway with the vehicle in front taking into account speed, road conditions and the operating condition of the vehicle, e.g. effectiveness of brakes.

The service shall operate under the following condition:

- accomplish joining or leaving without affecting other vehicles using the dedicated transport network or the part(s) of the road network that are equipped for automatic highway operation, or if appropriate vehicles using other adjacent parts of the transport or road network.

### 9.2.2.2 Automated low-speed vehicle operations assistance

The scope of this service shall enable suitably equipped and operating vehicles to carry out specific low-speed manoeuvres automatically, i.e. without the active participation of the driver in the manoeuvre. The service shall enable the following actions to be taken:

- a) if for any reason the vehicle is unable to start or complete the automated low-speed manoeuvre, immediately provide a warning to the driver;
- b) in the case of being unable to complete the operation, immediately cease carrying out the requested manoeuvre without adversely affecting the safety of the occupants and of other users of the dedicated transport or road network.

While the low-speed manoeuvre feature is in operation, the following conditions shall apply:

- 1) all other vehicle mitigation facilities such as those that detect objects close by remain in operation during the manoeuvre;
- 2) when carrying out the manoeuvre the vehicle takes whatever action is necessary to ensure it maintains the safety of its occupants and of other users of the dedicated transport or road network.

### 9.2.2.3 Automated parking

The scope of this service shall enable suitably equipped and operating vehicles to carry out parking manoeuvres automatically, without the driver participating in the operation of the vehicle. The service shall enable the following actions to be taken:

- a) the driver can initiate the automated parking manoeuvres which can be started from inside or outside the vehicle. If the driver is outside the vehicle, then the communication mechanism shall ensure that the driver is only a short distance away and so can be reasonably expected to be within visual sight of the vehicle;
- b) the driver can cancel the automated parking manoeuvre prior to completion of the action.

While the parking manoeuvre feature is in operation, the following conditions shall apply.

- 1) If for any reason the vehicle is unable to start or complete the automated parking, an immediate warning is provided to the driver. If the driver is not in the vehicle, then the warning will be communicated through an external mechanism.
- 2) When carrying out an automated parking manoeuvre, the vehicle will take whatever action is necessary to ensure it maintains the safety of itself and of other users of the parking facility, or, if parking at a roadside location, other road users.
- 3) When the vehicle ceases the automated parking operation it will do so without adversely affecting the safety of itself and of other users of the parking facility, or if parking at a roadside location, other road users.

### 9.2.2.4 Adaptive cruise control

The scope of this service shall enable the vehicle systems to be instructed to automatically maintain a selected range or distance from the forward vehicle as it travels through the dedicated transport or road network. The service shall enable the following action to be taken:

- a) cease the service upon application of the brakes of the vehicle.

While the service is in operation, the following conditions shall apply:

- 1) the vehicle systems shall maintain the selected range or distance regardless of speed changes of the forward vehicle;
- 2) an indication of the control is provided to the driver whilst the service is in operation.

### 9.2.2.5 Cooperative adaptive cruise control

The scope of this service shall include an enhancement to the adaptive cruise control by the addition of wireless communication with preceding vehicles to augment the adaptive cruise control active sensing capability for “connected vehicles”. The service shall enable the following actions to be taken:

- a) cease operation of the service when the driver applies the brakes of the vehicle;
- b) perform active sensing of data such as ranging to forward vehicle, subject vehicle data, over the air data from other surrounding vehicles and from infrastructure.

While the service is in operation, the following conditions shall apply:

- 1) driver inputs are used to longitudinally control the vehicle via throttle and brake controls;
- 2) an indication of the cooperative adaptive cruise control status is provided to the driver whilst the service is in operation.

### 9.2.2.6 Vehicle platooning

The scope of this service shall enable a group of suitably equipped vehicles to travel very closely together, safely, at a high speed. The service shall enable the following actions to be taken:

- a) initiate the platoon by a specific input from the lead driver of the platoon;
- b) cease to operate the platoon when the lead driver de-selects it or leaves the platoon;
- c) request entry to the platoon from a driver whose vehicle is not currently a part of the platoon;
- d) accept a vehicle into an existing platoon;
- e) allow a vehicle to leave an existing platoon.

While the service is in operation, the following conditions shall apply:

- 1) each vehicle is in communication with the other vehicles in the platoon;
- 2) the lead vehicle controls the speed and direction, and all following vehicles (which have precisely matched braking and acceleration) will respond to the lead vehicle’s movement;
- 3) an indication of the control is provided to each driver in the platoon whilst the service is in operation.

### 9.2.2.7 Automated lane-keeping

The scope of this service shall enable suitably equipped and operating vehicles to maintain their operation within a single lane of the roadway. The service shall enable the following actions to be taken:

- a) initiate the automated lane-keeping service via a specific input from the driver;
- b) cease to operate the service when the driver de-selects it.

While the service is in operation, the following condition shall occur:

- 1) an indication of the service is provided to the driver.

### 9.2.2.8 Automated road departure prevention

The scope of this service shall enable suitably equipped and operating vehicles to continue operating within the lanes of the roadway. The service shall enable the following actions to be taken:

- a) provide an indication of the service to the driver whilst the service is in operation;

- b) if the vehicle is operating in a platoon, provide an indication of the service operation to each driver in the platoon whilst the service is in operation;
- c) enable vehicle actions to ensure the vehicle remains on the roadway without input from the driver of the vehicle.

#### 9.2.2.9 Automated lane change systems

The scope of this service shall enable suitably equipped and operating vehicles to provide an audible, visual, or haptic warning to the vehicle driver that the vehicle is changing lanes. The service shall enable the following actions to be taken:

- a) if the vehicle is operating in a platoon, provide an indication of the service operation to each driver in the platoon whilst the service is in operation;
- b) provide warning to the driver that the service is about to cease operating for the vehicle they are driving in sufficient time for the driver to be properly prepared to take control of the vehicle.

#### 9.2.2.10 Automatic weigh-in-motion (WIM)

The scope of this service shall enable suitably equipped and operating vehicles to determine one or both of the following:

- a) the gross vehicle weight (GVW);
- b) the weight on each of vehicle axle.

Both list items shall apply to the vehicle and to any trailer(s) or semi-trailer to which it is attached and is towing.

The service shall make use of on-board weighing equipment (OBW) to determine these weights under both static and dynamic conditions, i.e. the vehicle and trailer(s) are in motion. The collection of dynamic data shall commence after the vehicle [and trailer(s)] have been in motion for a suitable length of time and shall be repeated at suitable intervals of time.

The weight data collected by this service shall be sent to suitable roadside devices. It shall be possible within the scope of this service for these data to be used to:

- 1) manage the access that vehicles have to certain parts of the managed road network, e.g. bridges;
- 2) enable the prosecution of vehicle operators and drivers who allow their vehicles to exceed the weight limitations imposed by regulatory authorities (see the description of the service in [8.6.2.2](#)).

### 9.3 Collision mitigation/avoidance

#### 9.3.1 Overview

The collision mitigation/avoidance service group includes the use of communications, sensors and control systems to detect potential for collisions either between vehicles or between vehicles and other objects in their surrounding areas.

Each of the services in this group shall enable the following actions to be taken:

- a) initiate the service by a specific input from the driver;
- b) cease to operate the service when the driver de-selects it.

## 9.3.2 Constituent ITS Services

### 9.3.2.1 Roadway collision mitigation/avoidance

The scope of this service shall enable suitably equipped and operating vehicles to avoid collisions with other vehicles that appear to be in the predicted trajectory of the vehicle along the roadway. The service shall enable the following actions to be taken.

- a) modify speed of the vehicle to prevent a longitudinal collision, which can occur due to failure to detect a vehicle ahead of the vehicle with the service;
- b) modify the trajectory of the vehicle to prevent a lateral collision which can occur due to poor lane keeping, incorrect lane changing, plus not checking for surrounding vehicles when entering or leaving high-speed roads or overtaking.

While the service is in operation, the following conditions shall apply:

- 1) use of obstacle detection and tracking systems that determine the likelihood of an impact;
- 2) communications with surrounding vehicles in order to determine the likelihood of an impact;
- 3) endeavour to mitigate the effects of any collision dependent on the speed and content of the driver's action;
- 4) ensure that the action taken by the service to avoid a collision is done in a way that is not unsafe for other road users.

### 9.3.2.2 Intersection collision mitigation/avoidance

The scope of this service shall enable a suitably equipped and operating vehicle approaching a road intersection to avoid collisions with other vehicles that are approaching the same intersection. The service shall enable the following actions to be taken:

- a) when a vehicle determines that it is going to collide with another vehicle approaching the same intersection, request that the vehicle systems modify its speed to prevent the collision;
- b) alert the driver of the vehicle to the reason for the change of its speed.

While the service is in operation, the following conditions shall apply:

- 1) systems (such as sensors and control systems) are used in each vehicle to monitor the progress of other vehicles toward the intersection;
- 2) when a vehicle determines that it is going to collide with another vehicle approaching the same intersection, it shall be possible within the scope of this service for a vehicle system to be requested to modify its speed to prevent the collision and to alert the driver of the vehicle to the reason for the change of its speed.

### 9.3.2.3 Automatic vulnerable road user collision mitigation systems

The scope of this service shall enable suitably equipped and operating vehicles to avoid collisions with vulnerable road users that appear to be in the predicted trajectory of the vehicle. The service shall enable the following actions to be taken:

- a) modify the speed and/or trajectory of the vehicle to prevent a collision with a vulnerable road user;
- b) alert the driver of the vehicle to the reason for the change of its speed or trajectory.

While the service is in operation, the following conditions shall apply:

- 1) obstacle detection and tracking systems are used which determine the likelihood of an impact;

- 2) vehicle communications with vulnerable road user devices are maintained in order to determine the likelihood of an impact.

## 9.4 Driver warning or advisory

### 9.4.1 Overview

The driver warning and advisory service group covers the use of monitoring and warning or advisory systems for all types of vehicles and their drivers. They cover both the conditions of the vehicles themselves and the conditions in the area surrounding the vehicle in order to communicate the need for action to the driver of the vehicle via suitable warnings, or to provide advisory information to the driver.

Each of the services in this group shall enable the following actions to be taken:

- a) initiate the service by a specific input from the driver;
- b) cease to operate the service when the driver de-selects it.

### 9.4.2 Constituent ITS services

#### 9.4.2.1 Lane departure warning system

The scope of this service shall enable warnings to be provided to the driver of a suitably equipped and operating vehicle that the vehicle is leaving the lane in which it is currently travelling. The service shall also provide a warning to the vehicle driver during a lane change attempt if the blind-spot zone into which the vehicle intends to switch is, or will soon be, occupied by another vehicle travelling in the same direction. The service shall enable the following actions to be taken:

- a) provide an audible, visual or haptic warning to the vehicle driver that the vehicle is leaving the lane of travel.

While the service is in operation, the following conditions shall apply:

- 1) warning will not be provided if the driver activates the turn signal prior to the lane change and there is not a vehicle in the blind spot zone in the adjoining lane;
- 2) active sensing data are used, such as ranging to surrounding vehicles, subject vehicle data, and over the air data from other surrounding vehicles.

#### 9.4.2.2 Emergency braking assistance

The scope of this service shall enable a suitably equipped and operating vehicle to broadcast a self-generated emergency brake event to surrounding vehicles. Upon receiving the event information, the receiving vehicle determines the relevance of the event and if appropriate provides a warning to the driver in order to avoid a crash.

The service shall enable a warning to be provided to the vehicle driver that a nearby external hazard has been detected in one or more of the following ways:

- a) audible;
- b) visual;
- c) haptic.

#### 9.4.2.3 External hazard detection and notification

The scope of this service shall enable a suitably equipped and operating vehicle to determine if the road conditions measured by other vehicles represent a potential safety hazard for the vehicle.

The service shall enable a warning to be provided to the vehicle driver that a nearby external hazard has been detected in one or more of the following ways:

- a) audible;
- b) visual;
- c) haptic.

The service shall operate when other suitably equipped and operating vehicles broadcast relevant road condition information to the vehicle, such as fog or icy roads.

#### 9.4.2.4 Driver advisory

The scope of this service shall enable the provision of an advisory message to the driver regarding the posted speed limit of the roadway, or the speed recommended in order to pass through a series of signalized intersections with the minimum of delay. The service shall enable the following advisories to be provided to the driver of a suitably equipped vehicle:

- a) posted speed limit of the roadway on which the vehicle is travelling;
- b) recommended speed in order for the vehicle to progress through signalized intersections with a minimum of delay.

In this service the term “advisory” means an output to the driver that may be in visual and/or audible forms.

## 9.5 Safety warning

### 9.5.1 Introduction

The safety warning group covers the use of monitoring and warning systems for all types of vehicles and their drivers. They cover both the conditions of the vehicles themselves and the conditions in the area surrounding the vehicle.

### 9.5.2 Constituent service

#### 9.5.2.1 Special vehicle alert

The scope of this service shall enable alerts to the driver about the location of and the movement of public safety vehicles responding to an incident, slow moving vehicles, oversized vehicles, and other special vehicles that can require special attention from the driver.

The service shall enable the following actions to be taken:

- a) provide an audible, visual or haptic warning to the vehicle driver that a nearby external hazard has been detected.

## 9.6 Management of suspicious vehicles

### 9.6.1 Introduction

This service group enables the operational control of suspicious vehicles [e.g. permitting shut down of vehicle operations if it is currently occupied by terrorists or known to be equipped (e.g. rigged with explosives) to cause destruction].

## 9.6.2 Constituent service

### 9.6.2.1 Identification of suspicious vehicles

The scope of this service shall enable the identification of vehicles found to be either carrying any materials designated as HAZMAT or explosive, or designated as being suspicious by the service in [8.10.2.1](#). The identification of the vehicle features that make it suspicious shall be carried out by systems (supported by sensors) on-board the vehicle that can determine any of the following:

- a) the type of load being carried, e.g. the HAZMAT category or explosive;
- b) the type of vehicle, i.e. is it appropriate for the load that is being carried;
- c) if the vehicle is behaving in any of the following ways:
  - 1) it is stationary in a part of the managed road network where vehicles do not do this, e.g. on a bend in the road, or at a junction,
  - 2) it has been parked in the same location for a time that is longer than normal, e.g. overstaying the maximum time allowed in a parking space,
  - 3) it is being driven in an erratic manner, e.g. speeding, or making un expected manoeuvres,
  - 4) it looks over-loaded, or is carrying a load that is too big for its size.

The service shall enable checks to be made as to the legitimacy of the vehicle and the HAZMAT or explosive materials that it is carrying. Thus, for example, vehicles carrying HAZMAT or explosive materials as part of their lawful and legitimate business can be identified as opposed to those that are illegally carrying these materials.

### 9.6.2.2 Disablement of vehicles believed to be suspicious

The scope of this service shall enable vehicles believed to be suspicious either because of their behaviour, or because they are carrying materials designated as HAZMAT or explosive to be disabled. Although this service is primarily aimed at vehicles carrying HAZMAT or explosive materials illegally, it shall also be possible for it to be applied to those carrying these materials as part of their lawful and legitimate business.

While the service is in operation, the following conditions shall apply:

- a) the disablement of the vehicle will be carried out in such a way that it does not have any negative impact on, and causes the minimum of disruption to, any other road network users, including pedestrians;
- b) when disabled, the vehicle will cease moving and come to rest in a place where it can be dealt with by the emergency services or other appropriate agencies.

## 10 Freight transport services domain

### 10.1 Overview

The scope of this domain shall include the management of the operation of commercial vehicle fleets and the movement of freight, including activities that expedite the authorization process for freight to move across national and jurisdictional boundaries. It includes activities that expedite inter-modal transfers of freight and the operation of freight vehicles that use telematics applications to enhance their operation and management.

Within this scope, the domain shall include the following groups of services:

- a) commercial vehicle pre-clearance — see [10.2](#);
- b) commercial vehicle administrative processes — see [10.3](#);

- c) automated roadside safety inspection — see [10.4](#);
- d) commercial vehicle on-board safety monitoring — see [10.5](#);
- e) intercity freight transport fleet management — see [10.6](#);
- f) intermodal information management — see [10.7](#);
- g) management and control of intermodal centres — see [10.8](#);
- h) management of dangerous freight — see [10.9](#);
- i) management of heavy goods vehicles — see [10.10](#);
- j) management of local delivery vehicles — see [10.11](#);
- k) telematics applications for regulated commercial freight vehicles (TARV) — see [10.12](#);
- l) freight transport content management — see [10.13](#).

## 10.2 Commercial vehicle pre-clearance

### 10.2.1 Overview

This service group has the following characteristics.

- It shall provide services that enable commercial vehicles, such as trucks and vans to have credentials and other documents, safety status and weights checked automatically at normal road speeds.
- It shall affect the pre-clearance of freight vehicles with minimal disruption to the vehicle journey and the general flow of traffic.

### 10.2.2 Constituent ITS services

#### 10.2.2.1 Weigh-in-motion

The scope of this service shall enable the detection and recording of the following information about individual commercial vehicles:

- a) wheel and axle loads;
- b) gross vehicle weight (GVW).

The collection of this information shall be accomplished as the vehicle moves over a measurement point without the need for it to stop.

It shall be possible within the scope of this service for the following support to be provided:

- 1) the non-stop preclearance service (see [10.2.2.2](#)) at normal speed;
- 2) the precision weighing of individual vehicles at reduced speed;
- 3) other services, such as access control, infrastructure protection and monitoring, road user charging, law enforcement and infrastructure planning.

#### 10.2.2.2 Non-stop preclearance

The scope of this service shall enable the safety, credentials, and size and weight data for transponder-equipped commercial vehicles to be electronically checked before they reach an inspection site.

The service shall operate under the following conditions:

- a) compliant carriers and vehicles can travel without stopping for compliance checks at weigh stations, ports-of-entry and other inspection sites;
- b) only non-compliant or potentially unsafe vehicles to be selected for the requirement to enter the site for an inspection.

#### 10.2.2.3 Vehicle safety records monitoring

The scope of this service shall enable the safety records of a commercial vehicle to be accessed and monitored as the vehicle passes a suitable interrogation point in the managed road network.

The service shall operate under the following conditions:

- a) the collection of the information containing the records is accomplished without the need for the vehicle to stop;
- b) the collected information is used to check that the vehicle and/or its cargo are not in breach of any safety regulations.

### 10.3 Commercial vehicle administrative processes

#### 10.3.1 Introduction

This service group enables a number of individual services to be provided to commercial vehicle fleet drivers and operators and/or freight shippers. It shall enable them to:

- exchange information about freight movements, including those that utilize different transport modes;
- automatically identify, monitor and exchange emergency response information about freight that is classed as “dangerous goods”;
- purchase annual and ad-hoc vehicle credentials, using communications and computer technologies.

The scopes of the services in this group shall enable these credentials to include those necessary for the crossing of regional and national boundaries.

#### 10.3.2 Constituent ITS services

##### 10.3.2.1 Freight movement information exchange

The scope of this service shall include the provision of information exchange necessary for the movement of freight:

- a) transfer of goods on a single mode;
- b) by different transport modes;
- c) its transfer between different modes;
- d) its conveyance across national borders.

The scope of the information to be exchanged shall include that for motor transport and logistics within the international supply chain that shall satisfy the requirements of both businesses and governmental organizations.

This service shall be applicable to freight shipments that:

- 1) originate in one country and terminate in another;
- 2) stay in the same country.

It shall be possible within the scope of this service for it to be applied to freight shipments that:

- are made entirely by road;
- represent freight movements that start or finish in the surface transport systems mode but include the use of other transport modes.

#### 10.3.2.2 Automatically identify, monitor and exchange emergency response information for dangerous goods

The scope of this service shall include the application of automated identification, monitoring and exchange of emergency response information for freight that is classed as “dangerous goods” carried on board surface transport systems vehicles. It shall be possible within the scope of this service for such information to include the following details about the “dangerous goods”:

- a) identification;
- b) quantity;
- c) current condition, e.g. its pressure and temperature;
- d) any relevant information that is required in case of an emergency response.

Suitably equipped freight vehicles carrying “dangerous goods” shall be able to respond to queries regarding their status from authorized organizations or self-initiate a message to such organizations. It shall be possible within the scope of this service for the exchange of information and queries to be made using whatever communications means are available to the freight vehicle and the organizations.

#### 10.3.2.3 Automated credential filing

The scope of this service shall enable the automated filing of credentials about commercial vehicles and drivers. It shall be possible within the scope of this service for this to be done electronically, i.e. application to application across either fixed line or mobile interfaces, or through manual entry to an application by a commercial vehicle fleet administrator or a commercial vehicle owner/driver.

The credentials for a commercial vehicle shall include information that comprises any or all of the following:

- a) information about the vehicle itself, e.g. identity, type and number of axles, plus number of trailers and method of attachment;
- b) carrier information, e.g. carrier identification, identity of vehicle within a fleet and details of valid operating licences currently held, plus if not held elsewhere, contact details;
- c) cargo information, e.g. type of cargo and whether or not it is classified as HAZMAT or explosive material, plus its origin, its destination, who owns it and who is paying for its shipment;
- d) trip information, e.g. origin, destination, way points (including places where cargo is to be collected and/or dropped off and stops made for regulated driver rest stops), expected times of departure and arrival, plus the route;
- e) driver information, e.g. identity, qualifications (i.e. they are qualified to drive the vehicle), experience, number of hours worked and details of any licence endorsements.

It shall be possible within the scope of this service for the information in this list to be:

- 1) updated as the vehicle carries out its work;
- 2) permanent;
- 3) temporary, with a time of expiry.

Credential information about the cargo shall be capable of being split down into each load item, so that where several load items are being carried on one vehicle during one trip, those load items with different origins and/or destinations can be easily identified.

The service shall also provide an appropriate response to show that the supplied credential information (or its update) has been accepted, or if not, what has to be done for it to be accepted.

#### 10.3.2.4 Automated commercial vehicle administration

The scope of this service shall enable commercial vehicle fleet operators and/or owner/drivers to purchase credentials and to collect and report fuel and mileage tax information electronically. It shall be possible within the scope of this service for this to be done:

- a) electronically, i.e. application to application;
- b) through manual entry to an application by a commercial vehicle fleet administrator or a commercial vehicle owner/driver;
- c) across either fixed line or mobile interfaces.

The service shall enable the following types of credentials to be purchased or payments made for previous purchases:

- 1) annual, monthly or weekly electronic credentials, i.e. those only valid for a specified period of time;
- 2) temporary electronic credentials, i.e. those only valid for a particular trip, regardless of whether or not any cargo is being carried;
- 3) multiple permits to make specific trips, or carry specific cargos on a variety of identified trips;
- 4) specific situation permits, i.e. those that cover the conveyance of a particular cargo or the use of a particular route, or other commercial vehicle service.

The service shall also enable the following types of report to be provided or for previously submitted reports to be updated:

- quarterly reports about vehicle use, including mileage driven;
- electronic vehicle log showing the status of the vehicle, including any maintenance and/or repairs that have been carried out;
- data about the amount of fuel that has been purchased, including dates, type and quantities;
- the creation of any reports required for audit or tax purposes.

All purchases and payments shall be processed electronically regardless of how they were input, with the possibility of additional banking information being requested if necessary.

The service shall also provide an appropriate response to show that the submitted purchase, payment or report entry has been accepted, or if not, what has to be done for it to be accepted.

#### 10.3.2.5 Automated border crossings

The scope of this service shall enable commercial vehicle fleet operators and/or owner/drivers to submit data required for their vehicles and their cargos to cross international borders and for that data to be verified. The verification process shall enable the commercial vehicle to cross the national border without stopping, unless for a spot check or for another reason.

It shall be possible within the scope of this service for the submission and verification processes to be done:

- a) electronically, i.e. application to application;

- b) through manual entry to an application by a commercial vehicle fleet administrator or a commercial vehicle owner/driver;
- c) across either fixed line or mobile interfaces.

The service shall enable the following data about the vehicle, its cargo and its driver to be submitted and verified so that it is possible for the vehicle to cross a national border without stopping:

- 1) information about the driver, including their identity;
- 2) the nature of the cargo, including any safety issues and/or duties that have to be paid;
- 3) information about the vehicle carrying the cargo, including its identity, weight and credentials;
- 4) details of the shipper, particularly if it is not the owner or the vehicle carrying the cargo;
- 5) information about the safety record of the owner and/or operator of the vehicle carrying the cargo.

All verification of these data shall be processed electronically regardless of how the data was input, with the possibility of additional information and payment of unpaid duties being requested as and when required.

The service shall also provide an appropriate response to show that the submitted data has been verified and accepted, or if not, what has to be done for this to be achieved.

## 10.4 Automated roadside safety inspection

### 10.4.1 Overview

The automated roadside safety inspection service group includes services that provide roadside access to safety performance records of commercial vehicle fleet managers, the commercial vehicles themselves and the vehicle drivers. This shall enhance existing systems of spot checks by providing inspectors with easy access to current data relevant to the inspection.

### 10.4.2 Constituent ITS services

#### 10.4.2.1 Remote access to commercial vehicle safety data

The scope of this service shall enable data about the operation and status that is held electronically on board a commercial vehicle to be accessed from a remote location. It shall be possible within the scope of this service for this remote location to be:

- a) at the roadside so that the data are accessed as the commercial vehicle passes;
- b) in a central location, such as a vehicle inspection station, border crossing or centre responsible for some aspect of road management, e.g. traffic management or toll collection.

The types of safety data that the scope of this service shall make it possible to access remotely from a commercial vehicle shall comprise the following:

- 1) vehicle identity, type, classification, weights (laden and un-laden) and number of axles, plus type(s) and number of trailers;
- 2) vehicle maintenance data including details of when the last maintenance was carried out on the vehicle, plus details of any emissions checks that have been done, with the date(s) when those checks were carried out;
- 3) vehicle repair data including details of any breakdowns and accidents in which the vehicle has sustained damage, plus information about what has been repaired;
- 4) current vehicle operating parameters, included powertrain, brakes and suspension plus tyre wear and pressures;

5) fuel state, i.e. how much fuel is in the tank(s).

All of these data are to be collected for both the vehicle itself as well as for each of any trailers it is towing. If any data cannot be obtained electronically, this shall be reported by the system responsible for collecting the data remotely from the vehicle.

A report shall also be made if the driver of the vehicle had to be contacted in order for the vehicle data to be retrieved, or there are communications link problems of any kind.

#### 10.4.2.2 Remote access to commercial vehicle driver data

The scope of this service shall enable data about the current status and history that is held electronically on board a commercial vehicle about its driver to be accessed from a remote location. It shall be possible within the scope of this service for this remote location to be:

- a) at the roadside so that the data are accessed as the commercial vehicle passes;
- b) in a central location, such as a vehicle inspection station, border crossing or centre responsible for some aspect of road management, e.g. traffic management or toll collection.

The type of driver status and history data that shall be made remotely accessible from a commercial vehicle via the scope of this service shall comprise the following:

- 1) identity and qualifications;
- 2) any licence endorsements, with nature(s), date(s) and location(s);
- 3) number of hours the driver has been working since the last rest break;
- 4) number of hours the driver plans to work before taking the next rest break.

If any of these data cannot be obtained electronically from the commercial vehicle, this shall be reported by the system responsible for collecting the data remotely from the vehicle.

A report shall also be made if the driver of the vehicle had to be contacted in order for their data to be retrieved, or there are communication link problems of any kind.

### 10.5 Commercial vehicle on-board safety monitoring

#### 10.5.1 Overview

This service group covers the sensing and collection of data and its use by monitoring systems on board commercial vehicles to oversee the safety status of:

- the vehicles themselves;
- their drivers;
- their cargo.

This shall be done during the entire course of any trip that is being made by the commercial vehicle. The data shall include information on the internal systems of the commercial vehicle, the state of its cargo and the vehicle driver.

The scopes of the services in this group shall enable the results of these activities to include the provision of warnings to both the driver and/or remote monitoring facilities.

## 10.5.2 Constituent ITS services

### 10.5.2.1 Commercial vehicle internal systems monitoring

The scope of this service shall enable the use of on-board vehicle monitoring systems to oversee the safety status of commercial vehicles during the course of their trips. It shall include the real-time sensing and collection of data about the operation and state of internal systems in the commercial vehicle and any trailers it is towing. Data shall be collected so that the safety status of some or all of the vehicle and trailer equipment can be monitored:

- a) brakes;
- b) tyres;
- c) lighting.

The collected data shall be used to provide real-time warnings to either or both of the following:

- 1) the commercial vehicle driver, using; any combination of visual, acoustic and/or mechanical means, e.g. a vibrating steering wheel;
- 2) any remote monitoring facilities, e.g. fleet management systems, using any combination of audio and visual mechanisms.

It shall also be possible for the remote monitoring facilities to store the collected data in such a way that the operational history of the commercial vehicle can be reviewed to enable such things as the need for repair and/or maintenance to be determined.

The scope of the service shall also enable provision to be made for the collected data to be archived and if required made available to regulatory authorities responsible for the monitoring of the safety of vehicle operations.

### 10.5.2.2 Commercial vehicle driver alertness monitoring

The scope of this service shall enable the use of on-board vehicle systems to monitor the alertness displayed by drivers of commercial vehicles during the time that they are at the vehicle controls. The service shall enable the real-time sensing and collection of data about the current alertness of the driver through the monitoring of some or all of the following driver inputs:

- a) eye movement;
- b) steering wheel movement;
- c) use of the throttle and brakes.

The collected data shall be used to provide real-time warnings to either or both of the following:

- 1) the commercial vehicle driver, using any combination of visual, acoustic and/or mechanical means, e.g. a vibrating steering wheel;
- 2) any remote monitoring facilities, e.g. fleet management systems, using any combination of audio and visual mechanisms.

It shall also be possible for the remote monitoring facilities to store the collected data in such a way that the performance of the driver on the current trip and/or the history of previous trips can be reviewed to enable such things as the need for rest and/or further training to be identified.

The scope of the service shall also enable provision to be made for the collected data to be archived and if required made available to regulatory authorities responsible for the monitoring of drivers' hours of work.

### 10.5.2.3 Commercial vehicle cargo state monitoring

The scope of this service shall enable the use of on-board vehicle systems to monitor the state of the cargo being conveyed by a commercial vehicle and/or any trailers it is towing during the course of its trips. This shall include the real-time sensing and collection of data about the state of the cargo.

It shall be possible within the scope of this service for the data that shall be collected to relate to one or more of the following:

- a) the existing physical characteristics of the cargo like temperature, volume, pressure, moisture or weight;
- b) where appropriate the status of any on-going chemical or physical processes, e.g. fermentation, or evaporation;
- c) the position of the cargo on the vehicle, particularly if this changes during the course of the trip;
- d) any changes in behaviour of the cargo during the trip not covered by the previous points, e.g. the condition of livestock including the availability of food and/or water.

The collected data shall be used to provide real-time warnings to either or both of the following:

- 1) the commercial vehicle driver, using any combination of visual, acoustic and/or mechanical means, e.g. a vibrating steering wheel;
- 2) any remote monitoring facilities, e.g. fleet management systems, using any combination of audio and visual mechanisms.

It shall also be possible for the remote monitoring facilities to store the collected data in such a way that the status of the cargo on the current trip and/or the history of previous trips can be reviewed to enable the way that particular types of cargo are transported to be reviewed and updated as a result of experience.

Provision shall also be made for the collected data to be archived and if required made available to the relevant regulatory authorities.

## 10.6 Intercity freight transport fleet management

### 10.6.1 Introduction

This service group covers the dispatch and tracking of commercial vehicles on trips between cities to enable the optimization of use and safety of the vehicles. Thus, it includes the use of automatic vehicle location (AVL) to achieve automatic freight carrier location/container location and vehicle-to-control centre communications to provide vehicle location and other status information to those operating fleet management systems.

### 10.6.2 Constituent ITS services

#### 10.6.2.1 Intercity commercial vehicle fleet tracking

The scope of this service shall enable the continual and automatic determination of the location of a commercial vehicle that is involved in freight transport between cities. It shall be possible within the scope of this service for these data to be:

- a) sent to a dispatching centre where the vehicle's journey can be monitored by a fleet operator;
- b) displayed in the dispatching centre.

The service shall be able to display this positional data for all vehicles of a fleet so that the fleet operator obtains an overview of the positions of all vehicles.

### 10.6.2.2 Intercity commercial vehicle fleet dispatching

The scope of this service shall enable support to be provided for communication between commercial vehicles that are involved in freight transport between cities and their dispatching centre(s). It shall ensure that their despatching centre(s) receive status information about:

- a) the vehicles;
- b) any cargo they are carrying;
- c) their origin and destination.

The possibility of data about a vehicle being sent to a centre other than the one in charge of its operation shall be excluded.

The scope of this service shall also enable transport orders and instructions to be sent from the fleet operator to the vehicle driver. It shall be possible within the scope of this service for an acknowledgement that the driver of the vehicle has received the orders and instructions to be returned to its dispatching centre. Again, the possibility that a vehicle can be in communication with a dispatching centre other than the one in charge of its operation shall be excluded.

## 10.7 Intermodal information management

### 10.7.1 Overview

This service group covers the exchange of information about the transport of freight across different transport modes. It shall include knowledge of where the containers and/or vehicles transporting the freight are located, plus their condition and status. It is also possible to locate vehicle trailers and provide customers with information about the progress with the movement of the containers containing their freight.

NOTE This service group includes services which cross modal boundaries.

### 10.7.2 Constituent ITS services

#### 10.7.2.1 Vehicle and container arrival information exchange

The scope of this service shall enable container arrival information to be made available for use by fleet managers and intermodal carriers and the managers of freight storage nodes. It shall use sensors to determine that a vehicle or container being used to transport freight:

- a) has arrived at the location where the transfer to another transport mode will take place;
- b) is in a suitable condition and status for the transfer to take place.

The information provided by this service shall be made available to fleet managers and intermodal carriers in electronic form and shall only apply to the vehicles and/or containers for which they are responsible.

#### 10.7.2.2 Consignor freight information access

The scope of this service shall enable information about consignor freight to be made available for use by consignors, consignees and shippers. It shall use sensors and systems to enable them to be provided with the following information about the vehicle and/or container carrying the freight that they are shipping:

- a) their location;
- b) the condition and status.

The possibility that consignors, consignees and/or shippers can obtain information about vehicles and/or containers other than those that are moving their freight shall be excluded from the scope of this service.

### 10.7.2.3 Freight container tracking

The scope of this service shall enable the automatic determination of the current physical location of a freight container. It shall be possible within the scope of this service for the container number to be determined and used as identification of the container.

The location and the container number shall be repeatedly sent to a despatching centre of the carrier responsible for moving the container throughout the portion of its journey for which that carrier is responsible. Thus, the scope of this service shall make it possible for the location of the container to be passed from one carrier to another if more than one is involved in the movement of a container from its origin to its destination.

The scope of this service shall also enable an information service to be provided for the organization(s) that contracted with the carrier(s) to move the container in order to track its current location and status.

## 10.8 Management and control of intermodal centres

### 10.8.1 Introduction

This service group includes services that manage the operation of intermodal centres. It differs from other services in this service domain because it concerns the facilities and not the commercial vehicles or freight containers themselves. Services in this group include managing the operation of the modal interchanges.

### 10.8.2 Constituent ITS services

#### 10.8.2.1 Intermodal centre facility management

The scope of this service shall enable the co-ordinated handling and operation of the facilities at intermodal centres including modal interchanges. It shall include the planning and management of all internal resources of an intermodal centre for freight transshipment, i.e.:

- a) the handling equipment, e.g. cranes;
- b) any internal means of transport for freight, e.g. conveyor systems, straddle carriers and mobile cranes;
- c) storage areas and storage facilities, e.g. cold stores.

The "operation" covered by this service shall comprise the elements of the full handling chain, i.e.:

- 1) the receipt of cargo;
- 2) the handling of freight within the facilities;
- 3) the storage and re-arrangement of received consignments of freight to enable distribution to a variety of destinations and using different modes of transport;
- 4) the onward despatch of previously received freight.

The service shall support the organization and monitoring of all associated planning and management processes required by the intermodal centre for its operation.

#### 10.8.2.2 Intermodal vehicle and container control

The scope of this service shall enable the monitoring and control of the transport and handling of intermodal vehicles and containers, regardless of whether they are carrying cargo or not. It shall be possible within the scope of this service for this service to control:

- a) specialist vehicles that are capable of using more than one transport mode, e.g. road-rail trucks or barges;
- b) intermodal vehicles e.g. swap bodies, trailers or semitrailers.

The service shall provide processes across the whole transport chain from the consignor to the consignee like despatching, tracking and tracing and status messaging. Between the origin and destination of their trips, the intermodal vehicles or containers shall be conveyed by changing means of transport, e.g. rail, road and maritime (i.e. ferries, barges and ships).

## 10.9 Management of dangerous freight

### 10.9.1 Introduction

This service group includes services that manage the operation of transport fleets concerned with the movement of “dangerous goods”, including:

- the monitoring of their status and condition and their movement through the surface transport systems network and any other transport modes that are to be used;
- the exchange of information with organizations responsible for the actual transportation of the dangerous goods.

### 10.9.2 Constituent ITS services

#### 10.9.2.1 Dangerous goods movement data collection and sharing

The scope of this service shall enable the collection and sharing of data that gives an overview of the planned, approved and on-going transport of “dangerous goods” in a defined geographic area. It shall be possible within the scope of this service for this geographic area to be defined by national, state, region, county or city administrative boundaries, or be within part of a nation, state, region, county or city, or cover multiple combinations of these.

The service shall give information about the transport of “dangerous goods” to a range of interested stakeholders such as the police, fire and other emergency services and road authorities. This information shall comprise the following:

- a) the nature of the “danger”;
- b) the quantity of the “goods”;
- c) the type(s) of vehicles transporting the “goods”;
- d) the planned route that the vehicles shall take;
- e) the position(s) or the vehicle(s) in real time, which shall be collected from sensors on-board the vehicle(s).

It shall also be possible to make the data available to experts in the transport of dangerous goods so that advice on routes and the need for precautions in the event of incidents can be made available for potential use by the police, fire and other emergency services and road authorities.

#### 10.9.2.2 Dangerous goods movement data registry

The scope of this service shall enable the provision of facilities for the systematic collection, storage and management of data about the transport of “dangerous goods” in a defined geographic area. It shall be possible within the scope of this service for this geographic area to be defined by national, state, region, county or city administrative boundaries, or be within part of a nation, state, region, county or city, or cover multiple combinations of these.

Within the scope of this service, it shall be possible for the data to cover the planned, approved and on-going transport of “dangerous goods” and for these data to be:

- a) used for the provision of another service for the transport of “dangerous goods”, e.g. the service described in [10.9.2.1](#);

- b) archived and used as a historic record of when, how and by what route particular types of “dangerous goods” were transported in the past.

#### 10.9.2.3 Dangerous goods movement fleet coordination

The scope of this service shall enable support to be provided for the despatching of a vehicle to transport “dangerous goods” either from within a fleet of vehicles, all of which are designed for that purpose, or a specially designed vehicle from within a fleet of vehicles designed to transport all types of goods. The service shall enable the following despatching actions to be carried out:

- a) the planning and issuing transport orders to drivers and despatchers;
- b) the real-time monitoring of the status of the vehicle;
- c) the real-time tracking of the vehicle position during both the transport of the “dangerous goods” and any movement of the vehicle after the “goods” it was conveying have been unloaded;
- d) the real-time monitoring the condition of the “dangerous goods”;
- e) the real-time monitoring of the operational state and status of the vehicle;
- f) the real-time monitoring of the state of the driver, paying particular attention to the ability of the driver to handle a vehicle conveying “dangerous goods”.

The scope of this service shall also provide facilities for two-way communication with the driver of the vehicle, using voice and/or data communication. It shall enable instructions to be given to the driver and for the driver to report any events that can potentially affect the “dangerous goods” being conveyed by the vehicle.

#### 10.9.2.4 Dangerous goods movement police/safety coordination

The scope of this service shall enable the provision of support to enable the coordination of the activities of the police and other relevant emergency services plus road authorities for the transport of “dangerous goods”. The service shall provide the following facilities:

- a) the planning, registration and approval process for the route to be used to move each and every item of “dangerous goods”;
- b) the identification and implementation of safety measures that shall ensure the safe transport of the “dangerous goods”. These measures can include such things as the closure of roads, and providing information to road authorities, police, fire and other emergency services, plus any other relevant stakeholders;
- c) the real-time monitoring of the movement of the vehicle(s) conveying the “dangerous goods”;
- d) the provision and implementation of escorting measures, e.g. escort vehicles.

Depending on the nature of the “dangerous goods” that are to be transported, the service shall be able to support different criteria for the following:

- 1) route choice;
- 2) objects to be avoided;
- 3) times at which movement can take place;
- 4) weather and other transport-related factors.

### 10.9.2.5 Dangerous goods movement location monitoring

The scope of this service shall enable the real-time determination of a position and the tracking of a vehicle which is carrying “dangerous goods”. The position shall be sent together with a vehicle ID to:

- a) a system located in a “centre” where the position data are assigned to a digital map so that the movement of the vehicle can be monitored by an operator; or
- b) if the “centre” is not one that is operated by the road authority(ies) through whose jurisdiction(s) the “dangerous goods” are being transported, then the collected data shall be made available to such (a) centre(s).

It shall also be possible for these data to be stored and archived at such (a) centre(s) so that a historical record of the movement of the “dangerous goods” can be provided. This archived data shall be readily available for subsequent retrieval and analysis by a relevant organization.

## 10.10 Management of heavy goods vehicles

### 10.10.1 Overview

This service group includes services that are related to the movement of vehicles that are either

- carrying “heavy goods”; or
- carrying “goods” which mean that by their nature, they have an abnormally high un-laden weight.

Thus, these vehicles are defined as those that, due to their GVW, need some form of permit to travel through the managed road network.

Also included in this service group is the monitoring of these vehicles to check that they have not used parts of the managed road network that are inappropriate for their weight.

### 10.10.2 Constituent ITS services

#### 10.10.2.1 Heavy goods vehicle data collection and sharing

The scope of this service shall enable a centre to have an overview of planned, approved and on-going movement of “heavy goods” vehicles in a defined geographic area. It shall be possible within the scope of this service for this geographic area to be defined by national, state, region, county or city administrative boundaries, or be within part of a nation, state, region, county or city, or cover multiple combinations of these.

The scope of this service shall enable the real-time collection of data and the provision from it of information about the movements of heavy goods vehicles to a range of interested stakeholders such as the police and road authorities for shared use. It shall enable the collection and sharing of the following data:

- a) the nature of “heavy goods” that can be carried by the heavy goods vehicle, e.g. its weight and dimensions;
- b) data about the heavy goods vehicle, e.g. GVW, dimensions and gross weights per axle;
- c) the route that the heavy goods vehicle is to take;
- d) the real-time position of the heavy goods vehicle as it moves along its route.

It shall be possible within the scope of this service for this collected data to be made available to and shared with all relevant road authorities and other authorities that have the potential to be affected by the passage of the heavy goods vehicles, e.g. organizations providing utilities that make use of underground cables, pipes, etc. on or near the route to be used.

### 10.10.2.2 Heavy goods vehicle registration and route planning

The scope of this service shall enable the provision of facilities that enable the support of the process by which the transport of “heavy goods” can be registered. These facilities shall include:

- a) the planning and approval of the route that the heavy goods vehicle is to take;
- b) the registration and approval process for heavy goods vehicles;
- c) the preparation of any safety measures that are required for the movement of the heavy goods vehicle, e.g. closure of roads, plus informing authorities and other relevant stakeholders;
- d) the provision of escort services for the heavy goods vehicle movement.

The scope of this service shall be able to support different stipulations for route choice, objects to be avoided, times at which movement can take place and other transport-related factors (e.g. weather), depending on the weight of the heavy goods vehicles.

### 10.10.2.3 Heavy goods vehicle location monitoring

The scope of this service shall enable the continuous and automatic determination of the location of a heavy goods vehicle during its journey through the managed road network. It shall be possible within the scope of this service for these data to be sent to the dispatching centre from which the vehicle’s journey can be monitored by an operator.

The scope of this service shall enable the position of the heavy goods vehicle to be displayed by an appropriate mechanism to the operator in the dispatching centre from which the movement of the vehicle is being monitored.

It shall be possible within the scope of this service to check any of the following:

- a) that the vehicle is following its previously determined route;
- b) if no route has been produced, that the vehicle does not use parts of the managed road network which it is not permitted to access due to its weight.

## 10.11 Management of local delivery vehicles

### 10.11.1 Overview

This service group includes services that are related to the management of the movement of vehicles that are making freight deliveries and/or pick-ups within a confined geographic area. On their trips, stops are made to load/unload freight at two or more locations, necessitating the optimization of the routes and sequence with which the trips are made. Services in this group shall include the need to provide information about the management of access to zones within the managed road network and the availability of parking to enable freight to be loaded/unloaded.

### 10.11.2 Constituent ITS services

#### 10.11.2.1 Delivery vehicle fleet tracking

The scope of this service shall enable the continuous and automatic determination of the location of a delivery vehicle as it makes its deliveries and/or pick-ups. It shall be possible within the scope of this service for these data to comprise:

- a) time;
- b) date;
- c) vehicle identity;

d) vehicle location.

These data shall be sent to the dispatching centre from which the vehicle's journey can be monitored by a fleet operator. In the dispatching centre, the position of the vehicle is to be displayed by an appropriate mechanism. It shall be possible within the scope of this service for this to be done for all vehicles of a fleet so that the fleet operator obtains an overview of the positions of all vehicles and monitor their progress with their deliveries and/or pick-ups.

#### 10.11.2.2 Delivery vehicle fleet dispatching

The scope of this service shall enable the communication between delivery vehicles and their dispatching centre during freight deliveries and/or pick-ups. It shall ensure that status information on the vehicle, its cargo and its progress with the current transport task(s) is sent to the despatching centre.

The service shall also enable transport orders and instructions to be sent from the fleet operator to the vehicle driver. It shall be possible within the scope of this service for these instructions to achieve better optimization of the vehicle and/or driver use and to include the changes to the:

- a) route;
- b) sequence with which the deliveries and/or pick-ups are made.

The ability of the driver to provide an acknowledgement that the changes have been received and understood shall also be included.

#### 10.11.2.3 Delivery zone and parking information services

The scope of this service shall enable the provision of information about the availability of parking to drivers of vehicles making deliveries to enable the freight in their vehicles to be loaded/ unloaded. It shall be possible within the scope of this service for this to be done prior to the start of and/or during the delivery and/or pick-up trip.

If no parking is available for the required loading/unloading, the scope of this service shall enable the driver to be provided with directions to a location where the vehicle can be parked until it is possible for the loading/unloading to commence. It shall be possible within the scope of this service for this location to be either:

- a) a dedicated delivery vehicle parking area;
- b) a roadside location that does not cause disruption to other road users.

It shall be possible for drivers making deliveries to do any of the following:

- 1) reserve a parking place in advance;
- 2) indicate they are occupying a parking place.

### 10.12 Telematics applications for regulated commercial freight vehicles (TARV)

#### 10.12.1 Overview

This service group embraces the framework for a range of telematics applications for regulated commercial freight vehicles (TARV). The overall scope includes:

- the concept of operation;
- legal and regulatory issues;
- the generic cooperative provision of services to these vehicles, using an on-board ITS platform for highly cost-effective delivery of a range of services.

The provision of these services is based on a (multiple) service provider-oriented approach provisions for the approval and auditing of service providers.

## 10.12.2 Constituent ITS services

### 10.12.2.1 Procedures and enforcement provisions for the providers of regulated services

The scope of this service shall enable the monitoring and enforcement of regulated freight vehicles and the approval of the necessary procedures by an approval authority. The monitoring, enforcement and necessary procedures are expected to be generic and independent of a specific application or platform.

### 10.12.2.2 Provision of system security

This scope of this service shall enable both hardware and software aspects for telematics applications for regulated commercial freight vehicles (TARV) and shall include the certification of a service plus the auditing of a service provider so that client confidence can be maintained and risks to privacy avoided.

It also includes the management of security for messages, identities and access control (see ISO/SAE 21434).

### 10.12.2.3 Provision of vehicle information

The scope of this service shall enable generic basic freight vehicle data to be provided to application service providers for use by in-vehicle systems in the provision of other services and to support interoperable and cooperative ITS.

The data provided by this service shall include items that are only relevant within a particular jurisdiction, or to a class of telematics applications for regulated commercial freight vehicles (TARV) within a jurisdiction.

Equipped vehicles operating internationally shall carry all of the additional data required by all of the jurisdictions within which they operate, so that it is possible for the expected services to be provided.

### 10.12.2.4 Provision of vehicle access management

The scope of this service shall enable a freight vehicle to have access to certain parts of a geographical area and for this access to be monitored and managed by either;

- a) an appropriate regulatory authority;
- b) a nominated and approved service provider.

The scope of this service shall enable the identity of the regulatory authority and/or the service provider to change as the vehicle moves from one jurisdiction to another through the course of its movement of freight.

It shall be possible within the scope of this service for access restrictions to be applied, particularly if any part of the consignment being carried by the vehicle is classed as 'dangerous' or 'hazardous' goods.

It shall also be possible for the service to be provided through a framework that is either regulated using common standards for communication or unregulated and by one, or multiple service providers.

### 10.12.2.5 Provision of remote tachograph monitoring

The scope of this service shall enable a freight vehicle tachograph (or electronic logging device) to be remotely monitored by an appropriate regulatory authority, or its nominated and approved service provider.

It shall be possible within the scope of this service for:

- a) the identity of the regulatory authority and/or the service provider to change as the vehicle moves from one jurisdiction to another through the course of its movement of freight;
- b) the service to be provided through a framework that is either regulated using common standards for communication or unregulated and by one, or multiple service providers.

#### 10.12.2.6 Provision of emergency messaging system/eCall

The scope of this service shall enable the provision of the "Emergency Messaging System/eCall" to freight vehicles by an appropriate regulatory authority, or its nominated and approved service provider. It shall be possible within the scope of this service for:

- a) the identity of the regulatory authority and/or the service provider to change as the vehicle moves from one jurisdiction to another through the course of its movement of freight;
- b) the service to be provided through a framework that is either regulated using common standards for communication or unregulated and by one, or multiple service providers.

#### 10.12.2.7 Provision of driver work records

The scope of this service shall enable some or all of the work records for a freight vehicle driver to be provided to the appropriate regulatory authority, or its nominated and approved service provider. It shall be possible within the scope of this service for:

- a) the identity of the regulatory authority and/or the service provider to change as the vehicle moves from one jurisdiction to another through the course of its movement of freight;
- b) the service to be provided through a framework that is either regulated using common standards for communication or unregulated and by one, or multiple service providers.

#### 10.12.2.8 Provision of vehicle "mass" monitoring

The scope of this service shall enable the 'mass' of a suitable equipped freight vehicle to be monitored by an appropriate regulatory authority, or its nominated and approved service provider. The service shall make it possible for:

- a) this "mass" to be monitored via an on-board device to enable the regulatory authority or its nominated and approved service provider to implement jurisdictional control and enforcement;
- b) the identity of the regulatory authority and/or the service provider to change as the vehicle moves from one jurisdiction to another through the course of its movement of freight;
- c) it to be provided through a framework that is either regulated using common standards for communication or unregulated and by one, or multiple service providers.

#### 10.12.2.9 Provision of vehicle location, speed and consignment data

The scope of this service shall enable suitably equipped freight vehicles to be monitored so that the following data can be continuously provided to an appropriate regulatory authority, or its nominated and approved service provider:

- a) vehicle location;
- b) vehicle speed;
- c) details of the freight consignment the vehicle is carrying.

The scope of this service shall include the provision of extra monitoring that is required when the consignment is classed as 'dangerous' or "hazardous goods".

The scope of this service shall also enable:

- 1) the identity of the regulatory authority and/or the service provider to change as the vehicle moves from one jurisdiction to another through the course of its movement of freight;
- 2) it to be provided through a framework that is either regulated using common standards for communication or unregulated and by one, or multiple service providers.

#### 10.12.2.10 Provision of vehicle parking facilities

The scope of this service shall enable the use of parking facilities by suitably equipped freight vehicles to be managed in the most efficient way that is possible and practical. The management shall enable freight vehicles to make bookings for access to and egress from designated parking facilities. It shall be possible within the scope of this service for these facilities to be provided for any of the following:

- a) the loading and/or unloading of consignments of freight;
- b) secure parking during statutory driver rest periods;
- c) while waiting for a loading or unloading parking space to become available.

The scope of this service shall enable it to be available from one suitable provider (or multiple suitable providers), the identity (or identities) of which may be different (or the same) for each and every parking facility.

It shall be possible within the scope of this service for the service to be provided through a framework that is either regulated using common standards for communication or unregulated.

### 10.13 Freight transport content management

#### 10.13.1 Overview

This service group includes services that enable the following:

- the identification of the content of freight shipments that are being transported by land. The identification can be for particular items or packages of freight, or containers that are used to carry freight, regardless of whether they are empty or full;
- the communication of freight transport content data between the item of freight (or container) and a data collection point at which data can be fused for use by various organizations to provide other services;
- the monitoring of freight for tampering and security.

#### 10.13.2 Constituent ITS services

##### 10.13.2.1 Collection of freight transport content data

The scope of this service shall enable the collection of content data about freight that is being transported by land and is to be obtained from the freight itself. It shall be possible within the scope of this service for the data to be about some or all of the following:

- a) a particular item of freight;
- b) a freight package;
- c) a container in which freight is being carried, or can be carried because the container is currently empty.

##### 10.13.2.2 Communication of freight transport content data

The scope of this service shall enable the communication of data that describes the content of the freight being transported by land. It shall be possible within the scope of this service for the data to relate to:

- a) an individual item of freight;
- b) a freight package;
- c) a container carrying freight, or an empty container.

It shall be possible within the scope of this service for the actual data transfer to use one or more of the currently available international standards and to be between the freight and a data collection point, at which all collected data shall be fused in a coherent manner.

### 10.13.2.3 Monitoring of freight for tampering and security

The scope of this service shall enable the monitoring of freight items to ensure that no tampering or breaches of security occur during their movement from their origin to their final destination. It shall be applied to either particular items or packages of freight, or containers that are used to carry freight, regardless of whether they are empty or full.

The monitoring provided by this service shall include some or all of the following, depending on the type of freight item that is being moved:

- a) a change in weight, except when the freight item is a volatile liquid, some of which is allowed to “boil off” during shipment;
- b) a change in physical size;
- c) breakage or tampering with seals applied by border control and/or other organizations;
- d) change in content, e.g. the actual type of freight item does not correspond to that on the freight order.

## 11 Public transport service domain

### 11.1 Overview

The scope of this domain shall include the management of public transport (transit) to enable the provision of services that operate in a more timely and efficient manner, and the provision of operational information to the operator and user, including multimodal aspects.

Within this scope, the domain shall include the following groups of services:

- 1) public transport management — see [11.2](#);
- 2) demand responsive and shared transport — see [11.3](#);
- 3) automatic vehicle operation, including precision docking of public transport vehicles — see [11.4](#);
- 4) public travel security, including silent alarms and emergency/mayday calls — see [11.5](#).

### 11.2 Public transport management

#### 11.2.1 Introduction

This service group covers the operation, planning and management of public transport operations. It includes the following:

- the application of public transport scheduling and planning systems for assuring reliable connections with minimum disruption to travel between different modes (e.g. bus and rail services);
- the provision of real-time information on vehicle location and status, enabling the identification of departures from schedules and dynamic rescheduling and the monitoring of public transport vehicle status such as passenger loadings and vehicle systems.

## 11.2.2 Constituent ITS services

### 11.2.2.1 Public transport operational management

The scope of this service shall enable the operational management of the normal operation of public transport vehicles that are scheduled for use in earning revenue through the conveyance of passengers. The service includes the following:

- a) operational planning which includes:
  - the design and planning of operator, vehicle and route schedules,
  - dispatching,
  - special event planning activities;
- b) emergency and incident planning activities with other transportation agencies.

### 11.2.2.2 Public transport fleet management

The scope of this service shall enable the management of public transport vehicles to provide for a reliable service in order to meet customer demand. It includes:

- a) the management of headways between public transport vehicles including service pull outs, i.e. the removal of a vehicle from providing a particular service;
- b) special event public transport services;
- c) public transport vehicle availability.

### 11.2.2.3 Public transport vehicle monitoring

The scope of this service shall enable public transport organizations to collect and monitor data from vehicle internal systems to support vehicle maintenance operations. The service shall also enable the collection of data from vehicles in the vicinity of the public transport vehicle in order to improve the operational safety of the public transport vehicles. The data collected from vehicles include:

- a) operating data;
- b) diagnostic data;
- c) data about the on-board environment for passengers and data about the way that the driver is using the vehicle;
- d) data about vehicles in the vicinity of the public transport vehicle.

The scope of this service shall also enable public transport organizations to improve their vehicle maintenance practices, by allowing the vehicles' performance to be monitored, so that they can be brought into the maintenance facility if needed.

### 11.2.2.4 Public transport service monitoring and scheduling

The scope of this service shall enable the collection, monitoring and managing of planned public transport services and service consumption. It includes:

- a) the provision of real-time information on vehicle location and status, enabling the identification of departures from schedules;
- b) the monitoring of service consumption such as passenger loadings, use of lifts, bicycle racks, and other passenger related amenities.

Performance measurement supports public transport demand management strategies and planning activities, plus support for improvements in the operations of public transport services.

#### 11.2.2.5 Public transport operational strategies

The scope of this service shall enable the collection of data about the operation of public transport services. These data shall include:

- a) service and equipment performance;
- b) weather;
- c) congestion;
- d) historic performance information.

These data shall be used to enable various operational strategies to be put in place to improve public transport speed and reliability, as well as to enable more flexible services for public transport customers. These more flexible services shall include:

- 1) demand management;
- 2) integrated corridor management;
- 3) the protection of connections between services (particularly when services are disrupted);
- 4) deviations from fixed routes.

The availability and provision of more flexible services shall enable a better public transport service to be provided, including:

- avoidance of traffic congestion;
- provision of priority at road traffic signals.

#### 11.2.2.6 Public transport wayside status

The scope of this service shall enable the display of information about public transport services at wayside locations, as well as allowing passengers to request that a public transport (transit) vehicle stop at the wayside location. It shall be possible for this service to be provided at the following locations:

- a) public transport vehicle stops on the routes that they are performing;
- b) transport interchanges;
- c) retail shopping outlets;
- d) other public places that are within easy reach of services.

The information that is provided shall be able to comprise any or all of the following:

- 1) static information and show which routes serve the location of the display and their scheduled times of arrival and departure;
- 2) real-time information showing when vehicles on the routes serving the display location are expected to arrive, based on their current location;
- 3) indication of imminent arrival or departure of a public transport vehicle.

The information that is provided shall be made available in visible or audio format, or both.

## 11.3 Demand responsive and shared transport

### 11.3.1 Introduction

This service group covers the provision of on-demand transport services to individuals and/or groups of travellers. It shall address both the needs of:

- commuters by providing a viable shared transport alternative to the single occupancy private car;
- specific groups such as elderly people and people with disabilities;
- people who want to move a particular small item of freight (i.e. an item that one person can carry by hand) from one location to another.

The services in this group shall enable users to request on-demand transport by specifying:

- their origin and destination;
- any special needs they have, such as carrying a baby buggy;
- the need for the use of a wheel chair, guide dog, lifts, etc., or other special services for people with disabilities.

As a result of receiving the request, the most appropriate type of vehicle covering a corridor, or area, shall then be despatched to the traveller by a dispatching system.

It shall be possible within the scope of this service for the types of vehicles deployed on this service group to include buses of any size, vans and taxis.

### 11.3.2 Constituent ITS services

#### 11.3.2.1 On-demand public transport fleet management

The scope of this service shall enable the management of the fleet of vehicles that are employed in providing on-demand public transport services. It shall also include the following facilities:

- a) the real-time scheduling and planning of routes for these vehicles so that they can serve the requests of travellers to use the services in the optimum way;
- b) monitoring the performance of the vehicles so that they can be properly maintained;
- c) monitoring the vehicle drivers to ensure that they are driving vehicles for which they have the necessary skills and do not exceed their maximum permitted hours between rest breaks.

It shall be possible within the scope of this service for the vehicles and/or drivers used to provide this service to be managed by one or more agencies. Each agency shall be able to carry out its management activities either:

- 1) centrally; or
- 2) through a mechanism that promotes self-governance for drivers and their vehicles, in which case the drivers shall only be provided with information about the demand for public transport services when they request it, and then only if they have provided information to show that they are complying with all applicable rules and regulations.

#### 11.3.2.2 On-demand ridesharing management

The scope of this service shall enable the management to be provided for the way that vehicles are "shared" amongst travellers who have request on-demand public transport. This means:

- a) scheduling the most appropriate vehicle to pick-up the traveller at the requested time;
- b) taking the traveller to their desired destination.

These two individual requests shall be implemented in a way that combines them with all the other transport requests from travellers in the same geographic area.

### 11.3.2.3 On-demand movement of freight by public transport

The scope of this service shall enable freight shippers and ordinary people to request one-off transport and delivery of freight by on demand public transport services. A user can be anyone, from a company with products that need to be delivered to different locations at irregular intervals, to an individual who has just sold something via an online auction website.

Typically, the scope of this service shall cover the transport of small items of freight, i.e. any item that one person can carry in their hand, from the location of the shipper to the required destination, making best possible use of the available on-demand public transport vehicle availability and if necessary, using two or more different modes of transport.

## 11.4 Automated vehicle operation

### 11.4.1 Overview

This service group covers the provision of automatic vehicle operation that enables a public transport vehicle to be docked in precisely the right place that will facilitate the easy boarding or disembarking of passengers.

### 11.4.2 Constituent ITS services

#### 11.4.2.1 Precision docking for public transport vehicles

The scope of this service shall enable public transport vehicles to dock at any number of specific points in the dedicated transport or managed road network with precision. The precision with which the docking shall be achieved shall enable passengers to enter and/or leave the vehicle safely and without any access constraints, e.g. curb not the same height as the vehicle entrance or exit and a gap between the curb and the vehicle entrance or exit.

It shall be possible within the scope of this service for the precision docking to be achieved by either:

- a) the driver, through guidance being provided from the vehicle;
- b) automatically, when initiated by a specific input from the driver.

Where and when automatic operation is initiated by the driver, the service shall enable the driver to cancel it at any time and without any detrimental effects on the vehicle passengers, any passengers waiting to board the vehicle, or any other users of the dedicated transport or managed road network.

## 11.5 Public travel security

### 11.5.1 Overview

This service group covers the provision security to travellers using the public transport facilities and public transport vehicles. It shall enable the following facilities to be provided:

- a silent alarm;
- emergency call/mayday alert.

## 11.5.2 Constituent ITS services

### 11.5.2.1 Silent alarm

The scope of this service shall enable a silent alarm to be raised whenever an emergency situation occurs on-board a public transport vehicle. The purpose of a silent alarm is to alert one or more of the following:

- a) the vehicle driver;
- b) the public transport service operator;
- c) the emergency services.

The nature of the silent alarm shall be in the form of a non-audio (and in the case of the vehicle driver, discrete) visual indication that an emergency situation has occurred. It shall be possible within the scope of this service for the occurrence of an emergency situation to be identified by:

- 1) the vehicle driver;
- 2) a passenger on-board the vehicle.

In both of the above instances, none of the other passengers shall be made aware that an emergency has occurred and been reported. The indication of the alarm shall be accompanied by the following:

- the date and time;
- the location of the vehicle;
- the identity of the vehicle;
- the identity of the service that the vehicle is operating;
- the current state of the vehicle, e.g. operating, moving, stationary, switched off.

When a silent alarm has been raised, it shall be possible within the scope of this service for:

- the driver to be informed in a discrete way about the action(s) being taken by the public transport operator and/or the emergency services;
- the driver to hide the visual indication from any of the passengers on the public transport vehicle.

### 11.5.2.2 Emergency call/mayday alert for public transport

The scope of this service shall enable an emergency call (eCall)/mayday alert to be raised whenever an emergency situation occurs on-board a public transport vehicle. It shall be possible within the scope of this service for the alert to be initiated by:

- a) the vehicle driver;
- b) a passenger on-board the vehicle;
- c) a traveller waiting to board a vehicle at a public transport stop or modal interchange.

Whenever the alert is raised, the service shall enable it to be immediately reported to one or more of the following:

- 1) the vehicle driver;
- 2) the public transport service operator;
- 3) the emergency services.

The indication of the emergency call (eCall)/mayday alert shall be accompanied by each of the following:

- the date and time;
- the location of the vehicle;
- the identity of the vehicle;
- the identity of the service that the vehicle is operating;
- the current state of the vehicle, e.g. operating, moving, stationary, broken down, switched off.

When an alert has been raised, it shall be possible within the scope of this service for the driver of the public transport vehicle to which it relates to be informed about the action(s) being taken by the public transport operator and/or the emergency services so that they can inform the passengers.

## 12 Emergency services service domain

### 12.1 Overview

The scope of this domain shall include the management of public transport (transit) to enable the provision of services that operate in a more timely and efficient manner, and the provision of operational information to the operator and user, including multimodal aspects.

Within this scope, the domain shall include the following groups of services:

- a) transport-related emergency notification and personal security — see [12.2](#);
- b) after theft vehicle recovery — see [12.3](#);
- c) emergency vehicle management — see [12.4](#);
- d) hazardous materials and incident notification — see [12.5](#).

### 12.2 Transport-related emergency notification and personal security

#### 12.2.1 Overview

This service group provides both driver/personal security services and automatic incident notification for private car drivers and freight vehicle drivers. The scopes of the services in this group shall be able to include the automatic dispatch of emergency vehicles in response to emergency (eCall) and user-initiated distress calls.

#### 12.2.2 Constituent ITS services

##### 12.2.2.1 User-initiated distress calls

The scope of this service shall enable a distress call to be sent to a service centre in case of an emergency. Its operation shall be based on the active involvement of a user, such as the driver or a passenger in the vehicle involved in the emergency. Notification shall be provided within the vehicle that the distress call has been sent.

The scope of this service also includes the receipt of the distress call at an emergency centre and the arrangement by operators at that centre of the appropriate response measures. The determination of the "appropriate response measures" shall involve an assessment of the emergency situation by the operator and the alerting of the necessary emergency services. Information about the response that is being provided shall be sent to the vehicle and made available to its driver and passengers.

It shall be possible within the scope of this service for the distress call to be provided by sending one of more of the following items:

- a) data, which shall include the following:
  - 1) date,
  - 2) time,
  - 3) the two immediately previous vehicle locations,
  - 4) direction in which the vehicle is travelling,
  - 5) fuel type;
- b) voice message;
- c) a combination of the data and voice.

Similarly, the response to the receipt of a distress call by the emergency centre shall be provided through either:

- 1) the display of a message;
- 2) the activation of a warning indication;
- 3) a voice message;
- 4) a combination of any of these.

Where voice is the communication mechanism that is used, the scope of this service shall enable there to be a dialogue between the vehicle and the operator in the emergency centre, to better determine the reason for the distress call and the provision of the most appropriate response.

#### 12.2.2.2 Automated emergency call and mayday (eCall) dispatch

The scope of this service shall enable the automatic detection of a vehicle that is involved in an emergency. With the help of on-board systems, it shall automatically generate and send an emergency call (eCall) or mayday call to a dedicated emergency call centre.

It shall be possible within the scope of this service for the distress call to be provided by sending one of more of the following items:

- a) data, which shall include the following:
  - 1) date,
  - 2) time,
  - 3) the two immediately previous vehicle locations,
  - 4) direction in which the vehicle is travelling,
  - 5) fuel type.

Similarly, the response to the receipt of a distress call by the emergency centre shall be provided through either:

- 1) the display of a message;
- 2) the activation of a warning indication;
- 3) an automated voice message;
- 4) a combination of any of these.

The scope of the service shall also enable the receipt of the emergency call at the emergency centre and the immediate arrangement of required emergency measures. This shall involve an assessment of the emergency situation by an operator at the centre and alerting of the necessary and appropriate emergency services.

The vehicle that sent the call shall be provided with both an acknowledgement that the call has been received and updates about the response(s) that has (have) been requested by the operator at the emergency centre.

### 12.3 After theft vehicle recovery

#### 12.3.1 Overview

This service group enables the tracking, immobilizing and/or recovery of stolen vehicles. Tracking of vehicles shall start from the moment that they are stolen. The immobilization shall not be automatic and shall only take place on command to ensure that it is done in a way that does not compromise the safety of other road users and/or the vehicle occupants.

#### 12.3.2 Constituent ITS services

##### 12.3.2.1 Stolen vehicle tracking

The scope of this service shall enable the identification of a vehicle as “stolen” when it has been taken away by a person who is not authorized to do so. The term “taken away” means that the vehicle has been both driven away and/or been towed or transported away by another vehicle.

Once it has been detected that the vehicle has been “taken away”, the scope of this service shall enable the:

- a) determination and real-time update of the vehicle's location together with a stolen vehicle alert to be triggered;
- b) an alert message and the current vehicle location to be sent to an appropriate management centre and/or the vehicle owner.

The real-time update of the vehicle's location included in the scope of this service shall enable its movement to be tracked so that recovery can be affected at some point in the future. All communications between the vehicle and the appropriate management centre shall be hidden from those who are taking the vehicle away.

##### 12.3.2.2 Remote vehicle immobilization

The scope of this service shall enable the immobilization of a vehicle remotely when it has been detected that it has been stolen. It shall be based upon the use of on-board vehicle systems that enable a command to immobilize the vehicle to be sent to the vehicle from an external location. This external location shall have the necessary facilities for such a command to be sent and shall either be:

- a) static, e.g. in the home or place of work of the vehicle's owner or operator;
- b) an appropriate management centre;
- c) in a device carried by the vehicle's owner or operator.

The immobilization of the vehicle shall include the movement of the vehicle to the side of the road, or to any other location that does not make it a hazard to other users of the managed road network.

The action of this service shall be apparent to those in the vehicle and the fact that the vehicle is moving without the involvement of the person in the driving position shall be apparent to those outside the vehicle. It shall not be possible for those in the vehicle to override the movement of the vehicle to the side of the road, or to any other location that does not make it a hazard to other users of the managed road network.

## 12.4 Emergency vehicle management

### 12.4.1 Introduction

The emergency vehicle management service group includes the application of the following management techniques to fleets of emergency vehicles:

- route guidance;
- traffic signal priority.

The emergency vehicle fleets that shall be covered by this service shall include those belonging to the fire, police, ambulance and similar organizations. It shall also include the co-ordination with traffic management centres of the movement of emergency vehicles through the managed road network.

### 12.4.2 Constituent ITS services

#### 12.4.2.1 Emergency vehicle fleet tracking

The scope of this service shall enable emergency vehicles to be tracked in real-time as they respond to emergency calls and/or return from these responses. The tracking shall provide information about the location of the vehicles and their current status, which comprises but is not limited to:

- a) going to or returning from an emergency call;
- b) carrying equipment for use in the emergency response;
- c) carrying injured people, or materials from the emergency.

#### 12.4.2.2 Emergency vehicle fleet management

The scope of this service shall enable the use of individual vehicles in emergency vehicle fleets to be managed. The intention is to ensure that the most appropriate emergency vehicle(s) are sent in response to an emergency call and that they are made available for deployment elsewhere once their involvement in a particular emergency call has been completed.

It shall be possible within the scope of this service for the service to store data about each vehicle in the emergency vehicle fleet. These data shall comprise but not be limited to the following vehicle characteristics:

- a) identity;
- b) type;
- c) location;
- d) availability, e.g. ready to respond to an emergency call, or answering an emergency call;
- e) history, i.e. dates, times, locations and durations of involvement in previous emergency calls.

#### 12.4.2.3 Emergency vehicle — traffic management coordination

The scope of this service shall enable the co-ordination of the movement of emergency vehicles through the managed road network with other traffic. It shall be possible within the scope of this service for this co-ordination to be through the exchange of relevant data with other relevant traffic management centres. The purpose of this co-ordination is to ensure that the emergency vehicle responds to the emergency and any subsequently required vehicle movement in the most efficient and beneficial way.

The co-ordination shall be achieved by the service having the ability to modify the current traffic management strategies being used in the managed road network to enable:

- a) the emergency vehicles to have priority at system-controlled junctions;

- b) normal traffic flow to be restored once the emergency vehicle has passed through the managed road network or reached the location of the emergency.

It shall be within the scope of this service to also include the co-ordination of the operation of facilities shared with other modes of transport, e.g. level crossings and lifting bridges.

## 12.5 Hazardous materials and incident notification

### 12.5.1 Overview

This service group covers the provision of government organizations with data on the nature, location and condition of freight that is classed as “hazardous goods”, i.e. given the code name HAZMAT. This facilitates the enforcement of routing instructions and the effective response to any incident involving the load.

### 12.5.2 Constituent ITS services

#### 12.5.2.1 HAZMAT vehicle tracking and monitoring

The scope of this service shall enable the movement of vehicles carrying freight that is HAZMAT rated to be tracked and monitored as they move through the managed road network. For this to be achieved, the service shall be able to collect data that is relevant to that movement of the vehicles. It shall be possible within the scope of this service for the collected data to be updated at regular intervals and to include but not be limited to:

- a) vehicle location;
- b) vehicle status, e.g. moving, or stationary;
- c) details about the type of HAZMAT material the vehicle is carrying.

#### 12.5.2.2 HAZMAT vehicle route management

The scope of this service shall enable the route taken by vehicles carrying freight that is HAZMAT rated through the managed road network to be managed, so that:

- a) the location of the vehicles is continuously monitored;
- b) the pre-planned route avoids any contentious parts of the network;
- c) any deviation from the pre-planned and authorized route is identified.

When a deviation occurs, the vehicle driver and/or escort vehicle are to be advised of the need to change their direction of travel to return to the pre-planned route.

The scope of this service shall also include the designation of routes for vehicles carrying freight that is HAZMAT rated, either:

- 1) in advance of the commencement of their movement, or
- 2) in real-time during their movement through the managed road network.

#### 12.5.2.3 Automated HAZMAT emergency call/mayday notification

The scope of this service shall enable the initiation of the appropriate response to a vehicle carrying freight that is HAZMAT rated and that is involved in an emergency. The service shall collect and use the following data to determine that a vehicle carrying HAZMAT rated freight is in an emergency situation:

- a) vehicle status, e.g. vehicle is broken down, or is stuck in traffic;
- b) vehicle HAZMAT load status. e.g. the load state has deteriorated or been spilled and is thus creating a hazard for its surroundings.

The response shall be initiated automatically once it has been detected that an emergency exists. The response shall be co-ordinated with the appropriate emergency service(s).

#### 12.5.2.4 HAZMAT preclearance services

The scope of this service shall enable the pre-clearance of the movement of vehicles carrying freight that is HAZMAT rated through the managed road network that is managed by jurisdictions that require prior notification. If clearance is not provided, then the vehicle driver and/or escort vehicle shall be advised in advance of the need for the movement to be re-routed to avoid it being stranded in part of the managed road network.

## 13 Payment for transport-related services domain

### 13.1 Overview

The scope of this domain shall include the provision of activities that permit revenues for transportation services and facilities to be collected electronically through non-cash and non-stop payment.

Within this scope, the domain shall include the following groups of services:

- a) transport infrastructure usage — see [13.2](#);
- b) mobility service usage — see [13.3](#);
- c) transport-related services — see [13.4](#).

### 13.2 Transport infrastructure usage

#### 13.2.1 Overview

This service group includes the use of electronic systems to collect payment for the usage of parts of the transport infrastructure by motorized vehicles. The parts of the transport infrastructure to which payment can be taken shall comprise but not be limited to the following:

- managed roads and road networks;
- bridges;
- tunnels;
- dedicated lanes on highways;
- ferries;
- parking facilities.

It also covers the use of electronic systems to collect payment where the driver is paying for the cost of providing the part of the transport infrastructure that is being used or the external costs the driver generates for other road users and the society. The payment for the first of this is called "electronic fee and toll collection" and the second is called "road user charging".

#### 13.2.2 Constituent ITS services

##### 13.2.2.1 Electronic fee collection (EFC) and electronic toll collection (ETC)

The scope of this service shall enable drivers to pay a fee/toll for the use of any type of transport infrastructure, which may comprise some or all of the following:

- a) a tolled bridge;

- b) a highway;
- c) a tunnel;
- d) the managed road network inside a city toll ring;
- e) a ferry;
- f) a car park (sometimes called a “parking garage”).

The payment of the fee/toll shall take place in such a way that the vehicle is not required to stop and shall be able to use any payment method and payment means.

The scope of the service shall also support the use of any tariffing principle defined by the fee/toll charger, e.g. vehicle criteria and time, place and distance travelled.

It shall be possible within the scope of this service for any of the following mechanisms to be used to detect and identify vehicles so that payment can be collected:

- 1) an on-board equipment (OBE) unit is used to identify the vehicle and/or its driver and the payment contract and payment method. The OBE may also store other information related to the fee/toll to be paid, e.g. number of axles and environmental vehicle class;
- 2) a mobile device not necessarily connected with or to the vehicle but belonging to the driver. Information in the mobile device enables the driver to pay either by means of a payment contract and payment method stored in the mobile device or in a central system, e.g., the central system operated by a fee/toll service provider or a payment service provider;
- 3) the reading of the licence plate number (LPN) identifying the vehicle and its owner, enabling a claim to be sent from the fee/toll charger to the vehicle owner.

The scope of this service shall be based on the principle that the transport infrastructure user has either:

- one EFC/ETC contract referring to on-board equipment (OBE); or
- one licence plate number (LPN or vehicle registration number).

Either of these shall enable the transport infrastructure user to pay for the usage to multiple transport infrastructure service providers. It shall ensure that the interoperable EFC/ETC appears as a seamless payment system enabling the transport infrastructure user to pay for all transport infrastructure services consumed by receiving only one invoice from their fee/toll service provider.

The service shall use some or all of the following parameters for calculating the fee/toll for each use of the part of the transport infrastructure to which EFC/ETC applies:

- vehicle size;
- number of axles;
- type of energy used, e.g. diesel, petrol, electric;
- distance travelled, i.e. transport infrastructure usage.

The service shall enable dynamic changes in the fee/toll to be used for regulating the relationship between demand and transport infrastructure capacity. The use of dynamic changes in the fee/toll requires high level information systems enabling the driver to continuously take decisions based on the present fee/toll tariffs.

The service shall support the capability for reservations to be made for the use of facilities employing EFC (e.g. parking reservations).

### 13.2.2.2 Road user charging (RUC)

The scope of this service shall enable drivers/vehicle owners to electronically pay charges related to the usage of managed roads and/or road networks where the charges are based on the external costs generated by the road user.

The service shall enable the charge for using the part(s) of the managed road network to which RUC applies to be calculated from one or more of the following parameters:

- a) time and date;
- b) for the part(s) of the managed road network to be used:
  - 1) location,
  - 2) identity,
  - 3) direction of travel;
- c) vehicle identity;
- d) vehicle type, e.g. car, van, bus, coach or freight vehicle;
- e) vehicle size;
- f) number of people in the vehicle;
- g) type of energy used by the vehicle, e.g. petrol, diesel, electric, hybrid or hydrogen.

The amount to be charged shall be displayed to the driver/vehicle owners in advance of the vehicle entering the part(s) of the managed road network for which RUC is in force, so that it is possible for a different part to be taken through the managed road network, i.e. one that will not incur charges.

For the part(s) of the managed road network for which RUC is in force, it shall be possible within the scope of this service for the driver/vehicle owners to pay the charge:

- 1) in advance;
- 2) electronically on entry.

The scope of this service shall enable payment on entry to be achieved physically at the road side, or remotely using detection of the vehicle identity and subsequent billing of the vehicle owner.

The service shall be able to detect any vehicle that has not paid its charge in advance or that cannot be identified for subsequent charging so that the appropriate law enforcement action can be taken.

## 13.3 Mobility service usage

### 13.3.1 Overview

This service group includes the use of electronic payment systems for the usage of mobility services (e.g. public transport, shared rides, shared vehicles, shared bikes, taxi and e-scooters) plus payment for the parking of motorized vehicles. The collection of any payments included in these services may be used in the implementation of the services described in [8.4](#).

### 13.3.2 Constituent ITS services

#### 13.3.2.1 Fee and fare collection for mobility services

The scope of this service shall enable travellers using mobility services, e.g. public transport, shared rides, shared vehicles, shared bikes, taxis, plus e-bikes and e-scooters, to electronically make payment for their use

and validate the proof of payment so that they can legitimately travel. The following two types of payment shall be supported:

- a) fares, usually related to public transport services and taxis;
- b) fees, used for other vehicle-related services like shared vehicles, shared bikes, plus e-bikes and e-scooters.

It shall be possible within the scope of this service for typical fee and fare media (e.g. smart cards and smart phones) to communicate with the validator/payment gateway (e.g. bus validators and shared bike locks), via a contact based or contactless (air interface) communication. Users should be able to pay for all types of mobility services by using one medium (e.g. a smart phone) and complete the payment in a single transaction.

The scope of this service shall enable users of mobility services to travel seamlessly across different mobility service operators providing multimodal and interoperable mobility services. It shall support mobility-as-a-service (MaaS), mobility on demand (MOD) and any other “mobility”-related services.

### 13.3.2.2 Parking payment

The scope of this service shall enable travellers using mobility services (e.g. public transport, shared, rides, shared vehicles, shared bikes, plus e-bikes and e-scooters) to electronically make payment to park their vehicles as part of the payment for these services. The following two types of payment shall be supported:

- a) fares for public transport services;
- b) fees, used for other vehicle-related services like shared vehicles and shared bikes, plus e-bikes and e-scooters.

It shall be possible within the scope of this service for typical fee and fare media (e.g. smart cards and smart phones) to communicate with the payment mechanism available from the transport service provider and for the provider to communicate directly with the parking provider. Users should be able to pay for both the transport and parking services by using one medium (e.g. a smart phone) and complete the payment in a single transaction.

## 13.4 Transport-related services

### 13.4.1 Overview

This service group includes the use of electronic payment systems for any transport-related service not covered by other services in this service domain. These “other services” include the purchase of petrol at gas stations, advanced driver assistance systems (ADAS) provided via apps on a smartphone, and the charging of electric vehicles (EVs). The collection of any payments included in these services may be used in the implementation of the services described in [8.4](#).

### 13.4.2 Constituent ITS services

#### 13.4.2.1 Payment for transport-related services

The scope of this service shall enable travellers to pay for a transport-related service provided by a transport-related service provider. It shall include but not be limited to the following types of transport-related service:

- a) delivery of petrol, diesel, hydrogen and electricity at service stations using the OBE and its link to a payment service provider;
- b) access to car washing machines with the same payment means as a previous service;
- c) access to highway lanes dedicated to High Occupancy Vehicles (HOV) based on OBE or automatic number plate recognition (ANPR). This service could, however, also be categorized as an EFC/ETC service;

- d) access to areas with access restrictions (e.g. harbours or resorts) by means of registered on-board equipment (OBE) or licence plate number (LPN);
- e) information services downloaded via an OBE or vehicle-ITS station from roadside equipment or cellular networks (CN), e.g. points of interest or weather warnings;
- f) high density maps downloaded to the vehicle-ITS station via CN;
- g) advanced driver support applications downloaded to the vehicle-ITS station or user equipment via CN.

It shall be possible within the scope of this service for the payment to take place both in an automatic and non-stop scenario and a scenario where the vehicle or any transport means used by the service user is not moving.

The service shall support any:

- 1) payment method and payment means held by the traveller;
- 2) tariffing principle defined by the transport-related service provider.

It shall be possible for the service to include validation that the correct payment has been made and for this payment to require successful completion before the transport-related service is delivered to the user or the vehicle in the custody of the user.

#### 13.4.2.2 Payment for additional non-transport-related services

The scope of this service shall enable travellers to pay for a non-transport-related service as part of the payment for a transport-related service provided by a transport-related service provider. The non-transport-related services that can be paid for in this way shall include but not be limited to the following:

- a) accommodation services provided by hotels and guest houses;
- b) dining services provided by any type of eating establishment, e.g. restaurant or takeaway store;
- c) entertainment services such as cinemas, theatres, concerts and festivals.

It shall be possible for the cost of any of the services in this list to be included in the cost for the transport-related service, and for the payment to be made as a single transaction by the traveller. The transport service provider shall:

- 1) support any payment method and payment means held by the traveller;
- 2) be responsible for ensuring that the provider(s) of the non-transport-related service(s) are paid once the single payment by the traveller has been validated and approved.

## 14 Weather and environmental conditions monitoring services domain

### 14.1 Introduction

The scope of this domain shall include any activities that monitor and notify users and transport network managers of weather and environmental conditions that can have an impact on the surface transport systems network and its users.

Within this scope, the domain shall include the following groups of services:

- a) weather monitoring — see [14.2](#);
- b) environmental conditions monitoring — see [14.3](#).

## 14.2 Weather monitoring

### 14.2.1 Overview

This service group contains activities that result in monitoring of weather conditions, including fog, ice, snow, wind, rain and heat, along with prediction of specific conditions as they impact the condition of the surface and structure of the managed road network and the overall travelled way, including icing and visibility.

### 14.2.2 Constituent ITS services

#### 14.2.2.1 Road weather information monitoring

The scope of this service shall enable the continuous monitoring of the current weather conditions across the managed road network using special detectors that measure various types of weather data. It shall be possible for the weather conditions that are monitored to include:

- a) fog;
- b) ice;
- c) precipitation (snow, rain);
- d) heat.

The monitoring shall enable conclusions to be drawn from the data provided about changes to the condition of some or all of the following:

- 1) the road surface, including icing;
- 2) the structure of the road;
- 3) the state of the overall travelled way, including visibility.

It shall be possible within the scope of this service for the road weather information to be used as the basis for the provision of traffic information and for traffic management purposes.

#### 14.2.2.2 Road weather prediction

The scope of this service shall enable the prediction of the future weather conditions that are going to affect some or the entire managed road network. It shall be possible for the weather predictions to be made using special algorithms and weather prediction models and to be based on measured data and for them to cover both the immediate and near future.

The service shall be able to predict weather conditions that include some or all of the following conditions:

- a) the formation of fog and ice;
- b) the likelihood of precipitation, e.g. snow and rain;
- c) the occurrence of high temperatures.

It shall be possible within the scope of this service for these predictions to be used to forecast the future development of the condition of some or all of the following:

- 1) the road surface, including icing;
- 2) the structure of the road;
- 3) the state of the overall travelled way, including visibility.

The service shall enable the information about the predicted weather that is going to affect the managed road network to be used as the basis for the provision of traffic information and for traffic management purposes.

### 14.3 Environmental conditions monitoring

#### 14.3.1 Overview

This service group contains activities that result in monitoring of conditions such as flooding (due to high tides), land movement (earthquakes, mud slides, etc.) and pollution levels. Also, the service group includes services that can predict specific conditions that are likely to occur based on current and historical trends.

#### 14.3.2 Constituent ITS services

##### 14.3.2.1 Water level /tidal monitoring and prediction

The scope of this service shall enable the monitoring and prediction of levels and tides of waters (e.g. seas, rivers and lakes) so that the risk of the managed road or road network flooding can be assessed and appropriate warnings can be issued, as well as enabling any appropriate traffic management measures to be taken.

It shall be possible for the scope of this service to enable data to be provided using data resulting from the co-operation between two or more of the following:

- a) road operators;
- b) meteorological services;
- c) port authorities;
- d) coastal protection and/or nautical services authorities and organizations.

The scope of this service shall also enable any contingency planning for transport services in geographic areas served by the managed road network to take into account the possibility of flooding occurring.

##### 14.3.2.2 Seismic monitoring

The scope of this service shall enable the monitoring of the occurrence of seismic events that are liable to affect the state of the managed road network. The monitoring shall be provided by either one or a combination of:

- a) direct input from sensors;
- b) data provided by other organizations, including any that are not in the immediate geographic area occupied by the managed road network.

It shall be possible within the scope of this service for information about the severity of the seismic event(s) that have occurred to be sent to road and other transport management centres so that any appropriate measures can be initiated to minimize the impact on travellers.

##### 14.3.2.3 Pollution monitoring

The scope of this service shall enable the monitoring of the pollution levels in the geographic area occupied by the managed road network. It shall be possible for the monitoring to include any combination of the following:

- a) the air emitted from vehicle exhausts, including CO, CO<sub>2</sub>, NO<sub>x</sub>, etc.;
- b) background (general non-transport-related) pollution levels;
- c) the level of ozone;

d) noise levels.

The scope of this service shall also include the use data about the concentration of pollutants and noise levels that have been collected from monitoring stations that are located at the road side, or elsewhere.

If pollution and noise thresholds are exceeded, it shall be possible within the scope of this service for the service to initiate the provision of warnings to travellers and also to send information to road and other transport management centres so that appropriate measures can be taken to reduce the concentration of pollutants and hence their impact on both travellers and those living and working in the geographic area.

#### **14.3.2.4 Avalanche, mud slide and fallen rock monitoring**

The scope of this service shall enable the occurrence of avalanches, mud slides and rock falls to be monitored across some part(s), or the entire managed road network. It shall use sensors and/or other appropriate detection mechanisms to determine if and where in the managed road network any of these events have occurred.

When one or more of these events have been detected, information about the extent, severity and location shall be sent to the relevant road management centre(s), so that it is possible for appropriate action to be taken to minimize the impact on users of the managed road network.

## **15 Disaster response management and co-ordination services domain**

### **15.1 Overview**

The scope of this domain shall include the provision of surface transport systems-based activities that manage resources from multiple jurisdictions in their responses to natural disasters, civil disturbances or terror attacks.

Within this scope, the domain shall include the following groups of services:

- a) disaster data management — see [15.2](#);
- b) disaster response and evacuation management — see [15.3](#);
- c) coordination with emergency agencies — see [15.4](#).

### **15.2 Disaster data management**

#### **15.2.1 Overview**

This service group includes services that collect data from the appropriate agencies about any disasters that have the ability to affect the use of the managed road network by vehicles and other road users. The data can then be shared amongst relevant and interested organizations.

#### **15.2.2 Constituent ITS services**

##### **15.2.2.1 Disaster and emergency data collection**

The scope of this service shall enable the systematic collection of data about disaster and emergency situations with the aim of processing it to provide information to a wider range of stakeholders in surface transport systems and emergency management as well as to the road user. The information about the disaster and emergency situations that shall be provided shall include the following:

- a) their location, time, nature and extent;
- b) the resulting general risks for the population, e.g. explosions, flooding and radiation;
- c) advice about safety and counter-measures;

- d) details about the appropriate and necessary emergency services that must be informed;
- e) the management and mitigation measures that need to be taken;
- f) the people location and/or types of road users likely to be affected;
- g) the part(s) of the managed road network and the traffic management system(s) that are to be affected;
- h) any traffic management measures, e.g. road closures and/or diversions, not already included in the management and mitigation measures already identified.

The scope of this service shall enable the initial alert that a disaster or emergency situation has occurred to be provided to the centre responsible for the management of the road network in the location of the situation through one or more of the following types of mechanism:

- 1) audible;
- 2) mechanical;
- 3) digital.

It shall be possible within the scope of this service for:

- the initial output of the alert to be provided directly or through the operator interfaces available in the centre and to continue to be output until cancelled by an operator;
- the subsequent and more detailed alert information to be provided to the operator interfaces in the centre, with the option of some form of permanent output, e.g. hard copy on paper, also being produced.

#### 15.2.2.2 Disaster and emergency data sharing

The scope of this service shall enable the data and information concerning a disaster or an emergency situation provided by the service in [15.2.2.1](#) to be distributed to a wider range of stakeholders in surface transport systems and emergency management, as well as to the road user. These stakeholders and road users can be in adjacent geographic areas where use of their managed road networks can be affected by the disaster or an emergency situation that has been detected.

The scope of this service shall enable the alert that a disaster or an emergency situation has occurred through one or more of the following types of mechanism:

- a) audible;
- b) mechanical;
- c) digital.

It shall be possible within the scope of this service for:

- 1) the initial output of the alert to be provided directly or through the operator interfaces available in the centre and continue to be output until cancelled by an operator;
- 2) the subsequent and more detailed alert information to be provided to the operator interfaces in the centre, with the option of some form of permanent output, e.g. hard copy on paper, also being produced.

### 15.3 Disaster response and evacuation management

#### 15.3.1 Overview

This service group includes services that manage the operation and use of the road network to mitigate the impact on its use of a disaster, either human-made or naturally occurring. The service group also includes the service to manage evacuations necessitated by disasters.

## 15.3.2 Constituent ITS services

### 15.3.2.1 Disaster response planning for the transport network

The scope of this service shall enable plans to be prepared to mitigate the impact of either a human-made or naturally occurring disaster on the operation and use of some or the entire managed road and wider transport network. It shall enable these plans to include some or all of the following activities, depending on where and when the disaster either has happened, or is expected to happen:

- a) the determination of the part(s) of the managed road and wider transport network on which the disaster is going to have, or has had an impact;
- b) any measures that need to be put in place to restrict the use of the affected part(s) of the managed road and wider transport network by some or all types of vehicles;
- c) the need for these measures to involve unaffected parts of the managed road and wider transport network, e.g. transport modes other than any that are directly affected by the disaster;
- d) the creation of the content and output of information that needs to be sent to the managed road and wider transport network users warning them of the disaster and the consequent changes to their ability to use part(s) of the transport network and including advice on what are the best alternative means of travel or the movement of goods;
- e) the need to involve any information dissemination organizations outside those directly controlled by the authority that manages the road and wider transport network;
- f) the involvement that any of the emergency services should have in order to mitigate the effects of the disaster on the road and wider transport network (see also service [15.4.2.1](#));
- g) the need for remedial and/or maintenance work on the part(s) of the managed road and wider transport network affected in any way by the disaster;
- h) the length of time for which any of the above measures needs to be imposed;
- i) the criteria for lifting each of the above measures and the way in which this is to be carried out;
- j) the need for any long-term changes to the way that some or all of the road and wider transport network is managed and operated and used as a consequence of the disaster.

It shall be possible within the scope of this service for these plans to be created either:

- 1) in anticipation of a disaster occurring; or
- 2) because a disaster has just occurred.

The scope of this service shall enable the plans to be shared between two or more authorities that are responsible for the ownership and/or operation of the road and wider transport network.

If these plans are created in advance, then the scope of this service shall include facilities for their long-term storage, so that they can be easily accessed and either implemented or updated as the need arises. It shall also be possible for plans to be created from measures that are implemented without the benefit of a plan, as described in service [15.3.2.2](#).

### 15.3.2.2 Evacuation planning for the transport network

The scope of this service shall enable the evacuation of the general public from a disaster area and the subsequent re-entry to the area. The scope of this service shall enable the planning for evacuation and re-entry for both small and large-scale evacuations. It shall enable these plans to include some or all of the following activities, depending on where and when the evacuation is planned to occur:

- a) determination of institutional responsibilities to support the evacuation and subsequent re-entry;

- b) identification of evacuation routes;
- c) identification of special traffic control strategies that can be used to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes;
- d) identification of strategies that may be implemented to maximize capacity along the evacuation routes;
- e) identification of public transport (transit) resources that can be used to evacuate people from the affected area and to return them to their origin when re-entry is possible.

The scope of this service shall enable the plans to be shared between two or more authorities that are responsible for the ownership and/or operation of the road and wider transport network.

If these plans are created in advance, then the scope of this service shall include facilities for their long-term storage, so that they can be easily accessed and either implemented or updated as the need arises. It shall also be possible for plans to be created from measures that are implemented without the benefit of a plan, as described in service [15.3.2.4](#).

### 15.3.2.3 Disaster response implementation

The scope of this service shall enable the implementation of measures affecting the operation and use of part(s) of the managed road and wider transport network to be implemented following the occurrence of a disaster. It shall be possible for these measures to be part of a disaster response plan established by the service described in [15.3.2.1](#).

If the disaster response is being implemented without the benefit of a predetermined plan, then the response measures that are implemented shall be created and recorded. These measures shall take into account the scope of the response described by service in [15.3.2.1](#).

It shall be possible for the scope and content of the measures that are implemented to be recorded, and for the recording process to include the responses to each measure. This recording shall be available for study once all the measures have been cleared so that it can either be used to create a new and possibly alternative disaster response plan, or the implemented disaster response plan can be updated as a result of experience from its use.

### 15.3.2.4 Evacuation and re-entry management

The scope of this service shall enable the evacuation of the general public from a disaster area and the subsequent re-entry to the area. It shall be possible for these measures to be part of an evacuation plan established by the service described in [15.3.2.2](#). It shall enable some or all of the following activities depending on where and when the evacuation occurs:

- a) resources necessary to support the evacuation are located, shared between agencies if necessary, and deployed at the right locations at the appropriate times;
- b) information is shared with traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes;
- c) additional strategies such as reversible lanes, shoulder use, and roadway closures may be implemented to maximize capacity along the evacuation routes;
- d) coordination of public transport (transit) resources, including shared public transport (transit) resources, to remove people from an evacuated area.

The scope of this service shall enable all the organizations described in this list to act and implement measures in a coordinated way, in order to implement the evacuation and later re-entry. It shall be possible within the scope of this service for the actions needed to achieve this to be included in any evacuation plan created through the service described in [15.3.2.2](#).

## 15.4 Coordination with emergency agencies

### 15.4.1 Introduction

This service group includes services that co-ordinate the use of the managed road and wider transport network by vehicles belonging to emergency agencies. It shall be possible for this coordination to be with other services in other groups and domains such as those for traffic management and control.

### 15.4.2 Constituent ITS services

#### 15.4.2.1 Disaster response coordination

The scope of this service shall enable the response(s) to a disaster to be coordinated. It shall be possible for this co-ordination to involve some or all of the following:

- a) some or all of the available emergency services, e.g. police, fire and ambulance, including any available paramedical services;
- b) the authorities that own and/or are responsible for the operation of the part(s) of the managed road and wider transport network affected by the disaster;
- c) any authorities that own and/or are responsible for the operation of the part(s) of the managed road and wider transport network that are not affected by the disaster and which are able to offer help in the implementation of any of the mitigation measures;
- d) disaster recovery services, e.g. tow trucks, heavy lifting machinery, and specialist services such as those for earthquakes, typhoons, floods and hurricanes;
- e) authorities and organizations responsible for the provision of utilities such as electricity and other sources of power;
- f) any organization other than those already mentioned that is responsible for, or capable of disseminating information about the disaster and any alternative strategies that are able to help travellers to complete their journeys and goods to be moved.

The scope of this service shall enable all the organizations described above to act and implement measures in a coordinated way, so that the impact of the disaster can be mitigated. It shall be possible within the scope of this service for the actions needed to achieve this to be included in any disaster response plan created through the service described in [15.3.2.1](#).

It shall be possible for the scope and content of the coordination to be recorded, and for the recording process to include the responses to each measure. This recording shall be available for study once all the measures have been cleared to that it can either be used to create a new and possibly alternative disaster response plan, or the implemented disaster response plan can be updated as a result of experience from its use.

## 16 Traffic management performance domain

### 16.1 Overview

The scope of this domain shall include the online and offline simulation of surface transport systems network operation using archived and/or live data that have been obtained from monitoring of the surface transport systems network.

Within this scope, the domain shall include the following groups of services:

- a) data storage — see [16.2](#);
- b) simulation — see [16.3](#).

## 16.2 Data storage

### 16.2.1 Introduction

This service group covers the storage of data by and for other ITS related services, as well as for use by organizations in other areas, e.g. town planning and law enforcement. Access to the data and its sharing is provided by a separate service.

### 16.2.2 Constituent ITS services

#### 16.2.2.1 Data archiving and warehousing

The scope of this service shall enable the archiving of data collected by other ITS related services that are described elsewhere in this document. It shall be possible within the scope of this service for:

- a) the data to be archived without processing, other than to arrange it in a form that makes retrieval easy, e.g. archived by date, time and location;
- b) the archive used to store the data to be set up or included in a data warehouse.

The appropriate measures shall be put in place to ensure the following:

- 1) the coherence and quality of the data is protected so that corruption and tampering cannot occur;
- 2) the access to the archived data takes into consideration the data protection laws enforce in the jurisdiction where the archive is located;
- 3) the data are sanitized to remove personal details such as traveller identities, plus the identities of owners of vehicles and those involved in the movement of freight.

Data to be used by police authorities shall not be included in the archive. Instead, these data shall be sent directly to the appropriate police authority for inclusion in its data archive and then deleted from the collected data.

#### 16.2.2.2 Provide access to data archive and warehouse to interested organizations

The scope of this service shall enable access to be provided to the data archive and data warehouse that will be created by the service described in [16.2.2.1](#). It shall enable organizations to become “content consumers” and to have access to the data that are stored in the archive and/or the warehouse so that the data can be shared.

It shall be necessary for organizations to register to have access to the data loaded into the archive and the warehouse by the service described in [16.2.2.1](#), but otherwise the data shall be freely available. There shall be no limits on the amount of data that is accessed or the number of times it is accessed.

## 16.3 Simulation

### 16.3.1 Overview

This group of services covers the use of simulation techniques to replicate the way that some or the entire road and transport network operates under defined conditions. The following two types of simulation shall be supported by this service:

- online, which can be used to predict the operation of the network in the very near future, e.g. in response to an incident that has just occurred so that mitigation strategies can be prepared for immediate implementation;
- offline, which can be used to prepare such things as traffic management strategies well in advance of their being used.

## 16.3.2 Constituent ITS services

### 16.3.2.1 System performance simulation (online)

The scope of this service shall enable the performance of the road and wider transport network to be simulated for periods of time in the very near future, e.g. in the next five minutes, or an hour. It shall be possible for the simulation to cover any of the following:

- a) an individual part of the transport network;
- b) from two or more parts up to the entire transport network, including several transport modes;
- c) one or more modes of transport using one or more parts of the transport network, e.g. an arterial road or a particular public transport service.

The scope of this service shall make it possible for the simulation to be performed using two types of data, which shall comprise both of the following:

- 1) static data:
  - details about the configuration and layout of the transport network, e.g. road network layout and the location of public transport interchanges,
  - the characteristics of the mechanisms it uses, e.g. vehicle characteristics and the numbers of travellers that can safely use transport interchanges;
- 2) dynamic data:
  - current real-time traffic flows,
  - numbers of travellers using particular public transport services,
  - quantity of different types of goods that are to be moved.

The scope of this service shall enable the user of the simulation process to:

- provide all of the static data, either from other systems or by direct input;
- direct that the starting point for the dynamic data be taken directly from any of the systems that manage the road and wider transport network;
- run the simulation on any type of computer that has the processing power to support its operation.

It is envisaged that the principal use of this service shall be in the preparation of mitigation strategies following the occurrence of some form of incident, e.g. road traffic accident, special event, or natural disaster. The scope of the service shall therefore make it possible for mitigation strategies to be produced directly at the request of the user, quickly reviewed and revised, and when considered to be satisfactory, electronically transferred to the appropriate systems for their immediate use.

### 16.3.2.2 System performance simulation (offline)

The scope of this service shall enable the performance of the road and wider transport network to be simulated for periods of time in the future, with the ability for those periods to start hours, days, weeks or months in the future, or at an unknown future time. It shall be possible for the simulation to cover any of the following:

- a) an individual part of the transport network;
- b) from two or more parts up to the entire transport network, including several transport modes;
- c) one or more modes of transport using one or more parts of the transport network, e.g. an arterial road or a particular public transport service.