BS ISO 15638-20:2020

BSI Standards Publication

Intelligent transport systems — Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV)

Part 20: Weigh-in-motion monitoring

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National foreword

This British Standard is the UK implementation of ISO 15638-20:2020.

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A list of organizations represented on this committee can be obtained on request to its committee manager.

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Part 20: Weigh-in-motion monitoring

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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 documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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.

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

A list of all parts in the ISO 15638 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.

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Introduction

Many ITS technologies have been embraced by commercial transport operators and freight owners, in the areas of fleet management, safety and security. On-board applications have also been developed for governmental use. Such regulatory services in use or being considered vary from jurisdiction to jurisdiction, but include electronic on-board recorders, digital tachograph, on-board mass monitoring, 'mass' data for regulatory control and management, weigh-in-motion, vehicle access methods, hazardous goods tracking and eCall. Additional applications with a regulatory impact being developed include fatigue management, speed monitoring and vehicle penalties imposed based on location, distance and time.

The ISO 15638 series of standards defines and addresses the framework for a range of cooperative telematics applications for regulated vehicles (e.g. access methods, driver fatigue management, speed monitoring, on-board mass monitoring, Remote Tachograph Monitoring, ADR management). The overall scope includes the concept of operation, legal and regulatory issues, and the generic cooperative provision of services to regulated vehicles, using an on-board ITS platform. The framework is based on a (multiple) service provider-oriented approach with provisions for the approval and auditing of service providers.

The ISO 15638 series of standards provides both the means to achieve current requirements for telematics applications for regulated vehicles and the basis for future development of cooperative telematics applications for regulated vehicles.

The ISO 15638 series of standards is timely as many governments (Europe, North America, Asia and Australia/New Zealand) are considering the use of telematics for a range of regulatory purposes.

This document provides specifications for weigh-in-motion and on-board weighing monitoring and supports several defined communication profiles in which this function may be performed.

Consistent with other parts of the ISO 15638 series of standards, this document does not prescribe nor proscribe particular modes of operation. Rather, it provides a number of defined communication and data profiles within which jurisdictions may achieve their objectives for remote weigh-in-motion monitoring within the objectives and constraints of their regulations. This document recognizes that those requirements and constraints will differ between jurisdictions.

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Intelligent transport systems — Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) —

Part 20: Weigh-in-motion monitoring

1 Scope

This document addresses the provision of 'weigh-in-motion monitoring' and specifies the form and content of the transmission of such data required to support such systems, and access methods to that data.

This document provides specifications for both on-board weighing (WIM-O) systems and in-road "weigh-in-motion" (WIM-R) systems, and provides a profile where the vehicle weight measured is recorded on-board using equipment already installed for "Remote Tachograph Monitoring".

This document provides specifications for common communications and data exchange aspects of the application service weigh-in-motion monitoring (WIM-O and WIM-R) that a jurisdiction regulator can elect to require or support as an option, including:

a) High level definition of the service that a service provider has to provide (the service definition describes common service elements, but does not define the detail of how such an application service is instantiated, nor the acceptable value ranges of the data concepts defined);

b) Means to realize the service;

c) Application data naming, content and quality that an IVS has to deliver, including a number of profiles for data (noting that requirements and constraints of what can/cannot be transmitted over the air can vary between jurisdictions);

d) Support for a number of defined communication profiles to enable remote inspection.

The present version of this document provides specifications for the following application profiles:

— **Application Profile A1: Vehicle weight measurement from "On-Board Weighing" systems (WIM-O);**

— **Application Profile A2: Vehicle weight measurement from in-road 'weigh-in-motion' systems where data is transferred to the IVS (WIM-R).**

NOTE 1 Vehicle weight measurement from in-road 'weigh-in-motion' systems where data is linked to a specific vehicle by ANPR or other techniques and sent via landline or cellular communications to a processing centre is also a viable and alternate option, but as it does not include carrying data on-board the vehicle is not a TARV use case.

The present version of this document provides specifications for the following communication profiles:

— **Communication Profile 1: Roadside inspection using a short range wireless communication interrogator instigating a physical roadside inspection (master-:-slave):**

  — Profile C1a: via a hand aimed or temporary roadside mounted and aimed interrogator;

  — Profile C1b: via a vehicle mounted and directed interrogator;

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— Profile C1c: via a permanent or semi-permanent roadside or overhead gantry.

— **Communication Profile 2: Roadside inspection using a short range wireless communication interrogator instigating a download of data to an application service provider via an ITS-station communication (master-:-slave + peer-:-peer):**

  — Profile C2a: via a hand aimed or temporary roadside mounted and aimed interrogator;

  — Profile C2b: via a vehicle mounted and directed interrogator;

  — Profile C2c: via a permanent or semi-permanent roadside or overhead gantry.

— **Communication Profile 3: Remote inspection addressed via an ITS-station instigating a download of data to an application service provider via a wireless communications interface** (as defined in ISO 15638-2).

Subsequent versions of this document can support additional communication profiles.

NOTE 2 The ISO 15638 series of standards has been developed for use in the context of regulated commercial freight vehicles (hereinafter referred to as 'regulated vehicles'). There is nothing, however, to prevent a jurisdiction from extending or adapting the scope to include other types of regulated vehicles, as it deems appropriate.

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 11898-1, *Road vehicles — Controller area network (CAN) — Part 1: Data link layer and physical signalling*

ISO 15638-1, *Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 1: Framework and architecture*

ISO 15638-2, *Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 2: Common platform parameters using CALM*

ISO 15638-3, *Intelligent transport systems — Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) — Part 3: Operating requirements, 'Approval Authority' procedures, and enforcement provisions for the providers of regulated services*

ISO/TS 15638-4, *Intelligent transport systems — Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) — Part 4: System security requirements*

ISO 15638-5:2013, *Intelligent transport systems — Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) — Part 5: Generic vehicle information*

ISO 15638-6:2014, *Intelligent transport systems — Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) — Part 6: Regulated applications*

ISO 15638-9, *Intelligent transport systems — Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) — Part 9: Remote digital tachograph monitoring*

EN ETSI 300 674-1, *ETSI EN 300 674-1 V1.2.1 (2004-08) Electromagnetic compatibility and Radio spectrum Matters (ERM); Road Transport and Traffic Telematics (RTTT); Dedicated Short Range Communication (DSRC) transmission equipment (500 kbit/s / 250 kbit/s) operating in the 5,8 GHz Industrial, Scientific and Medical (ISM) band; Part 1: General characteristics and test methods for Road Side Units (Interrogator) and On-Board Units (OBU)*

ARIB STD-T75, *Dedicated Short-Range Communication (Japan)*

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TTAS KO-06.0025, Standard of *DSRC* Radio Communication between Road-side Equipment and On-board Equipment in 5.8 GHz band (Korea)

EN 12253, *Road transport and traffic telematics — Dedicated short-range communication — Physical layer using microwave at 5.8 GHz*

EN 12795, *Road transport and traffic telematics — Dedicated Short Range Communication (DSRC) — DSRC data link layer: medium access and logical link control*

EN 12834:2003, *Road transport and traffic telematics — Dedicated Short Range Communication (DSRC) — DSRC application layer*

EN 13372:2012, *Road transport and traffic telematics — Dedicated Short Range Communication (DSRC) — Profiles for RTTT applications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15638-1 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
app
small (usually) *Java™* (3.23) applets, organized as software bundles, that support *application services* (3.3) by keeping the *data pantry* (3.16) provisioned with up to date data

3.2
application profile
characteristics and specification of the information and transaction detail required to meet a set of *user* (3.49) needs which within the common high-level *framework* (3.19) of this document, allows different *jurisdictions* (3.24) to receive different detail of transaction or to specify a particular communications means

3.3
application service
service provided by a *service provider* (3.44) enabled by accessing data from the *IVS* (3.19) of a *regulated vehicle* (3.43) via a wireless communications network

3.4
application service provider
ASP
party that provides an *application service* (3.3)

3.5
app library
separately secure area of memory in *IVS* (3.19) where apps are stored [with different access controls to *data pantry* (3.16)]

3.6
approval
formal affirmation that an applicant has satisfied all of the requirements for appointment as an *application service provider* (3.4) or that an *application service* (3.3) delivers the required service levels

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3.7
approval agreement
written agreement made between an *approval authority (regulatory)* (3.8) and a *service provider* (3.44)

Note 1 to entry: An *approval authority (regulatory)* (3.8) *approval agreement* recognizes the fact that a *service provider* (3.44), having satisfied the *approval authority's* requirements for appointment as a *service provider,* is appointed in that capacity, and sets out the legal obligations of the parties with respect to the on-going role of the *service provider.*

3.8
approval authority
<regulatory> organization (usually independent) which conducts *approval* (3.6) and ongoing *audit* (3.10) for *service providers* (3.44) on behalf of a *jurisdiction* (3.24)

3.9
architecture
formalized description of the design of the structure of *TARV* and its *framework* (3.19)

3.10
audit
auditing
review of a party's capacity to meet, or continue to meet, the initial and ongoing *approval agreements* (3.7) as a *service provider* (3.44)

3.11
basic vehicle data
data maintained/provided by all *IVS* (3.19) [regardless of *jurisdiction* (3.24)]

3.12
communications access for land mobiles
CALM
layered solution that enables continuous or quasi continuous communications between vehicles and the infrastructure, or between vehicles, using such (multiple) wireless telecommunications media that are available in any particular location, and which have the ability to migrate to a different available media where required and where media selection is at the discretion of *user* (3.49) determined parameters by using a suite of standards based on ISO 21217 [*CALM* (3.12) architecture] and ISO 21210 (*CALM* networking) that provide a common platform for a number of standardized media using *ITS-stations* (3.22) to provide wireless support for applications, such that the application is independent of any particular wireless medium

3.13
commercial application(s)
ITS applications in *regulated vehicles* (3.43) for commercial (non-regulated) purposes

EXAMPLE Asset tracking, vehicle and engine monitoring, cargo security, *driver* (3.17) management.

3.14
communications profile
characteristics and specification of the communication detail required to meet a set of *user* (3.49) needs using a selected wireless medium

3.15
core data
basic vehicle data (3.11) plus any additional data required to provide an implemented *regulated application service* (3.42)

3.16
data pantry
secure area of memory in *IVS* (3.19) where data values are stored [with different access controls to *app library* (3.5)]

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3.17
driver
person driving the *regulated vehicle* (3.43) at any specific point in time

3.18
facilities layer
layer that sits on top of the communication stack and helps to provide data interoperability and reuse, and to manage applications and enable dynamic real time loading of new applications

3.19
framework
particular set of beliefs or ideas referred to in order to describe a scenario or solve a problem

3.20
in-vehicle system
IVS
ITS-station (3.22) and connected (TARV/*WIM*) equipment on board a vehicle

Note 1 to entry: Known in EFC specific equipment as OBE (on-board equipment) or OBU (on-board unit).

Note 2 to entry: Often known in weigh-in-motion and *tachograph* (3.47) specific regulations as VU (vehicle unit).

3.21
interrogator
off-board device which can establish a wireless communications session with the IVS (including 5,8 GHz DSRC) and request the provision of weigh-in-motion data, often a mobile device under the control of an agent of the *jurisdiction* (3.24)

3.22
ITS-station
ITS-s
entity in a communication network, comprised of application, *facilities layer* (3.18), networking and access layer components specified in ISO 21217 that operate within a bounded secure management domain

3.23
Java™[1)]
object oriented open source operating language developed by SUN systems

3.24
jurisdiction
government, road or traffic authority which owns the *regulatory applications* (3.41)

EXAMPLE Country, state, city council, road authority, government department (e.g. customs, treasury, transport).

3.25
jurisdiction regulator
agent of the *jurisdiction* (3.24) appointed to regulate and manage *TARV* within the domain of the *jurisdiction* which may or may not be the *approval authority (regulatory)* (3.8)

3.26
on-board weighing system
generation of vehicle weight data from equipment on-board the vehicle

Note 1 to entry: The technical means of generating such data is not specified in this document, only the resultant data.

1) Java™ is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.

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3.27
operator
operator of interrogation equipment

3.28
physical roadside inspection
physical inspection of the weigh-in-motion data of a stopped vehicle by agents of the *application service provider* (3.4) [most usually police or inspectors appointed by the *jurisdiction* (3.24)]

3.29
prime service provider
service provider (3.44) who is the first contractor to provide *regulated application services* (3.42) to the *regulated vehicle* (3.43), or a nominated successor on termination of that initial contract, responsible to maintain the installed *IVS* (3.19) and to install and commission new *IVS* (3.19)

3.40
profile
common and consistent elaboration of content and sequence of a set of chosen classes, conforming subsets, options, parameters, and/or data concepts to accomplish a particular function/specification

3.41
regulated application
regulatory application
application arrangement using TARV utilized by *jurisdictions* (3.24) for granting certain categories of commercial vehicles rights to operate in regulated circumstances subject to certain conditions, or indeed to permit a vehicle to operate within the *jurisdiction*

Note 1 to entry: May be mandatory or voluntary at the discretion of the *jurisdiction.*

3.42
regulated application service
TARV application service (3.3) to meet the requirements of a regulated application (3.41) that is mandated by a regulation imposed by a *jurisdiction* (3.24), or is an option supported by a *jurisdiction*

3.43
regulated vehicle
vehicle that is subject to regulations determined by the *jurisdiction* (3.24) as to its use on the road system of the *jurisdiction* in regulated circumstances, subject to certain conditions, and in compliance with specific regulations for that class of *regulated vehicle*

Note 1 to entry: At the option of *jurisdictions,* this may require the provision of information via *TARV* or provide the option to do so.

3.44
service provider
party which is certified by an *approval authority (regulatory)* (3.8) as suitable to provide regulated or commercial ITS *application services* (3.3)

3.45
session
wireless communication exchange between the *ITS-station* (3.22) of an *IVS* (3.19) and the *ITS-station* of its *application service provider* (3.4) to achieve data update, data provision, upload apps, or otherwise manage the provision of the *application service* (3.3), or a wireless communication provision of data to the *ITS-station* of an *IVS* (3.19) from any other *ITS-station*

3.46
specification
explicit and detailed description of the nature and functional requirements and minimum performance of equipment, service or a combination of both

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3.47
tachograph
sender unit usually mounted to a vehicle gearbox, a tachograph head and a digital *driver* (3.17) card, which records the *regulated vehicle* (3.43) speed and the times at which it was driven and aspects of the *driver's* (3.17) activity selected from a choice of modes

3.48
telematics
use of wireless media to obtain and transmit (data) from a distant source

3.49
user
individual or party that enrols in and operates within a regulated or *commercial application* (3.13) *service* (3.2)

EXAMPLE *Driver* (3.17), fleet manager, freight owner.

3.50
weigh-in-motion
weigh-in-motion system
generation of vehicle weight data from equipment either onboard (WIM-O) or embedded in the road pavement (WIM-R) and transferred to the *IVS* (3.20) of the vehicle ready for subsequent inspection

Note 1 to entry: The technical means of generating such data is not specified in this document, only the resultant data.

3.51
weigh-in-motion system-onboard
WIM-O
generation of vehicle weight data from equipment within the vehicle

Note 1 to entry: The technical means of generating such data is not specified in this document, only the resultant data.

3.52
weigh-in-motion system-roadway
WIM-R
generation of vehicle weight data from equipment embedded in the road pavement and transferred to the *IVS* (3.20) of the vehicle ready for subsequent inspection

Note 1 to entry: The technical means of generating such data is not specified in this document, only the resultant data.

4 Symbols and abbreviated terms

ADU	Application Data Unit
APDU	application protocol data unit
ANPR	Automatic number plate recognition
App	applet (JAVA™ application or similar)
ASN.1	Abstract Syntax Notation One
ASP	application service provider
BER	Bit Error Rate
BLE	Bluetooth Low Energy

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BST	Beacon Service Table
CALM	communications access for land mobiles
CAN	controller area network
CRC	cyclic redundancy check
DSRC	dedicated short-range communication
EID	Element identifier
EFC	Electronic Fee Collection
EN	European Norm (Standard)
GNSS	Global Navigation Satellite System
ID	Identity
ITS-s	ITS station
IVS	In-vehicle system
L7	Layer 7 of DSRC (Application Layer Core of DSRC)
LDT	Local data tree
LID	logical link control identifier
LLC	logical link control
LPDU	link layer protocol data unit
MAC	Media Access Control (Media Access Layer Core of DSRC)
MA-DATA	MAC sublayer primitive to the LLC sublayer
OBE	On-board equipment (EFC term for IVS)
OBU	On-board unit (EFC term for IV unit)
PrWA	private uplink window allocation
PuWA	public uplink window allocation
RR	response request
RSU	Road-side unit (EFC term for roadside interrogator)
SAP	Service access point
SE	service element
T-APDU	Transfer-Application Protocol Data Unit
TARV	telematics applications for regulated vehicles
VST	vehicle service table

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VU	vehicle unit (EU regulatory term for weigh-in-motion IVS)
WIM	Weigh-in-Motion
WIM-O	Weigh-in-Motion from onboard equipment
WIM-R	Weigh-in-Motion from in-road equipment
WGS84	World Geodetic System 1984
Ms	Microsecond

5 Conformance

Requirements to demonstrate conformance to any of the general provisions or specific application services described in this document shall take into consideration the data requirements imposed by the jurisdiction where they are instantiated.

Systems claiming conformance with this document may support one or more applications (Application Profiles 1 and/or 2) as defined in Clause 1, but shall support at least one of these options.

Systems claiming conformance with this document may support one or more of Communication Profiles 1, 2 and 3 as defined in Clause 1, but shall support at least one of these options.

6 General overview and framework requirements

6.1 General

This document addresses the provision of 'weigh-in-motion monitoring' and specifies the form and content of the transmission of such data required to support such systems and access methods to that data. The data may be transferred by a variety of means (as ITS-station -:- ITS-station data transfers in a C-ITS environment using 5,9 GHz, 3G, 4G, LTE or similar) transfers using interrogations from short range dedicated communication systems (such as 5,8 GHz) or other agency approved methods.

ISO 15638-1 provides a framework and architecture for TARV. It provides a general description of the roles of the actors in TARV and their relationships.

For a clear understanding of the TARV framework, architecture and detail and specification of the roles of the actors involved, the reader is referred to ISO 15638-1.

ISO 15638-6 provides the core requirements for all regulated applications. For a clear understanding of the general context into which the provision of this application service is provided, the reader is referred to ISO 15638-6.

The present version of this document provides specifications for the following Application Profiles:

— **Application Profile A1: The generation of vehicle weight data from equipment on-board the vehicle (WIM-O)**

  The technical means of generating such data is not specified in this document, only the resultant data.

— **Application Profile A2: The generation of vehicle weight data from equipment embedded in the road pavement and transferred to memory on-board (WIM-R)**

  The technical means of generating such data is not specified in this document, only the resultant data.

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The present version of this document provides specifications for the following Communication Profiles:

— **Communication Profile C1: Roadside inspection using a short range wireless communication interrogator instigating a physical roadside inspection (master-:-slave)**

  — Profile C1a: via a hand aimed or temporary roadside mounted and aimed interrogator;

  — Profile C1b: via a vehicle mounted and directed interrogator;

  — Profile C1c: via a permanent or semi-permanent roadside or overhead gantry.

  (See 6.2 for overview).

— **Communication Profile C2: Roadside inspection using a short range wireless communication interrogator, instigating a download of data to an application service provider (master-:-slave + peer-:-peer)**

  — Profile C2a: via a hand aimed or temporary roadside mounted and aimed interrogator;

  — Profile C2b: via a vehicle mounted and directed interrogator;

  — Profile C2c: via a permanent or semi-permanent roadside or overhead gantry.

  (See 6.3 for overview).

— **Communication Profile C3: Remote inspection addressed via an ITS-station instigating a download of data to an application service provider via a wireless communications interface (peer-:-peer) (as defined in ISO 15638-2)**

  (See 6.4 for overview).

Jurisdictions requiring and regulating the use of remotely monitored WIM-O/WIM-R systems are recommended to specifically regulate in the case of the use of Communication Profile 1 and/or Communication Profile 2, and for each Application Profile. It is further recommended (but not required) that jurisdictions whose data requirements require support of Profile 1 for regulatory enforcement purposes also at least encourage the ability to technically support Profiles 2 and 3 in addition (for later potential migration purposes).

6.2 Overview of Communication Profile C1 — Remote roadside inspection using a short-range wireless communication interrogator instigating a physical roadside inspection

6.2.1 General overview of Communication Profile C1

This profile covers the use case where an agent of the jurisdiction:

a) Uses a short-range communication interrogator (e.g. 5,8 GHz DSRC) to remotely identify a vehicle which is potentially in violation of the vehicle weight regulations of the jurisdiction;

b) Once identified, the agent of the jurisdiction controlling the interrogation may use the data in accordance with the enforcement data requirements of the jurisdiction. or decide whether the vehicle should be stopped, and if so, instruct colleagues downstream to stop the vehicle.

This last scenario is appropriate (but not limited to) situations where local data requirements require the physical 'arrest' of a vehicle potentially in violation of regulations and/or where the regulations require a physical download of data made by an agent of the jurisdiction, directly from the 'arrested' vehicle in order to support a prosecution, and/or situations where data concerning the driver is prohibited from being sent via wireless communications. There are three subset profiles of this remote inspection:

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6.2.1.1 Communication Profile C1a— via a hand aimed or temporary roadside mounted and aimed interrogator

In this use case the agent of the jurisdiction is situated at the roadside, and aims a hand held, tripod mounted, or similar portable interrogator from the roadside towards the centre of the windshield of the targeted vehicle. The interrogation is made via short range communication such as 5,8 GHz DSRC, taking into consideration the data requirements of the jurisdiction. See Figure 1.

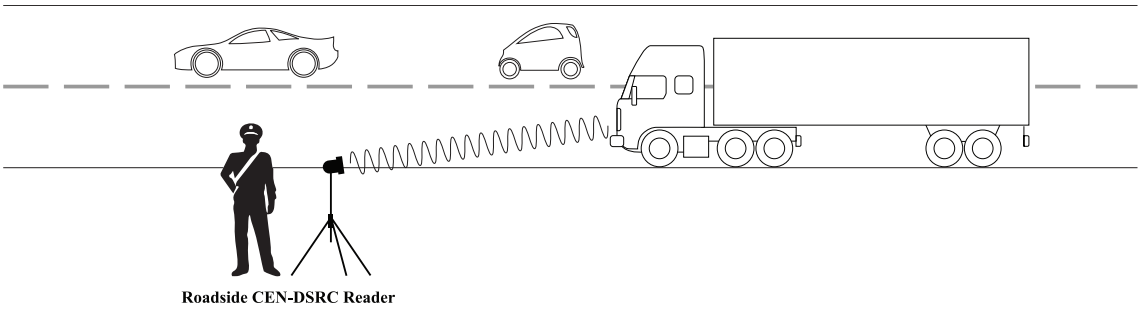

Figure 1 — Use case 1: C1a-roadside interrogation using short range communication

6.2.1.2 Communication Profile C1b — via a vehicle mounted and directed interrogator

In this use case the agent of the jurisdiction is situated within a moving vehicle, and either aims a hand held, portable interrogator from the vehicle towards the centre of the windshield of the targeted vehicle, or the interrogator is mounted within the vehicle so as to point towards the centre of the windshield of the targeted vehicle when the interrogator's vehicle is in a particular position relevant to the targeted vehicle (for example directly ahead in a stream of traffic). The interrogation is made via short range communication such as 5,8 GHz DSRC), taking into consideration the data requirements of the jurisdiction. See Figure 2.

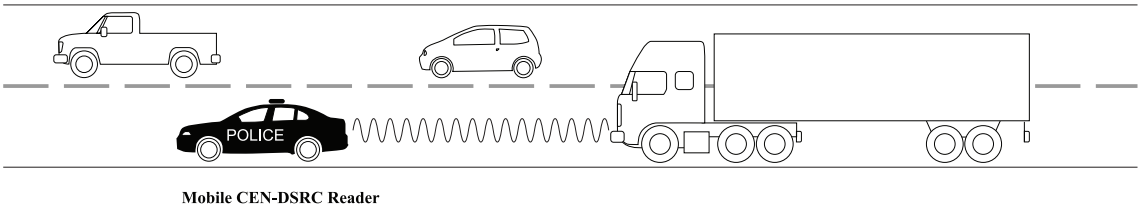

Figure 2 — Use case 2: C1b-vehicle based interrogation using short range communication

6.2.1.3 Communication Profile C1c — via a permanent or semi-permanent roadside or overhead gantry

In this use case a permanent or semi-permanent gantry or roadside interrogation equipment is activated remotely to the instruction of the agent of the jurisdiction so as to point towards the centre of the windshield of the targeted vehicle when the vehicle passes under or by the interrogator. The interrogation is made via short range communication such as 5,8 GHz DSRC), taking into consideration the data requirements of the jurisdiction. See Figure 3.

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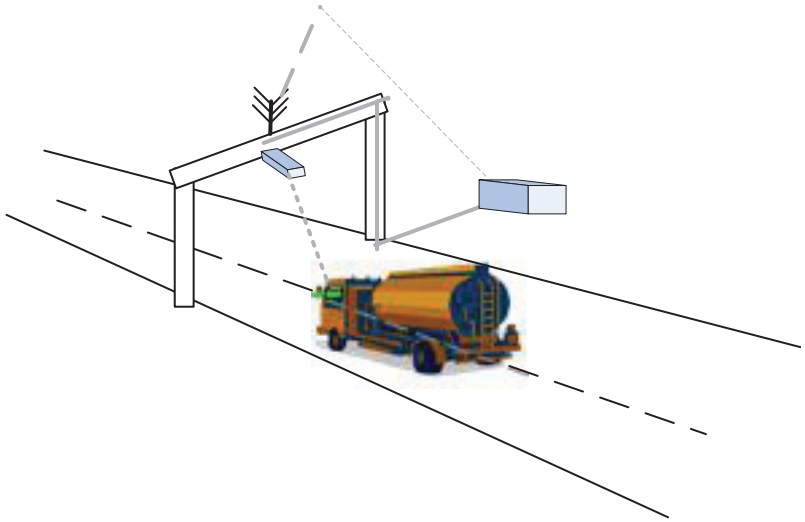

Figure 3 — Gantry mounted interrogator using short range communication

6.3 Overview of Communication Profile 2 — Roadside inspection using a short-range wireless communication interrogator, instigating a download of data to an application service provider

6.3.1 General overview of Communication Profile 2

This use case covers the scenario where an agent of the jurisdiction:

a) Uses a short range communication interrogator (e.g. 5,8 GHz DSRC) to remotely identify a vehicle which is potentially in violation of the vehicle weight regulations of the jurisdiction.

b) Once so identified, the interrogator provides the vehicle IVS with a case reference code and a destination IP address via the DSRC communication, and instructs the vehicle IVS to provide the weigh-in-motion data required by the weigh-in-motion regulation of the jurisdiction.

c) The vehicle IVS then sends the data via its ITS-station, together with the requested destination IP address and case reference, to a previously supplied address of the application service provider.

NOTE Consistent with other TARV standards, as part of security measures, except for remote interrogation using secured short-range wireless equipment, it does not send data directly to the requested destination address.

The application service provider is then responsible for validating the requested destination IP address, and if valid, forwards the case reference code and weigh-in-motion data to the requested IP address (but these stages of the process are outside the scope of this document. Regulations are given in the data requirements of the jurisdiction).

In this use case, the application service provider may be an agent of/appointed by the jurisdiction or may be a commercial application service provider who is under legal obligation to provide weigh-in-motion data to the jurisdiction on request from the jurisdiction. In the case of a jurisdiction where the ASP for this use case is to be an agent of the jurisdiction, then the valid IP address of the ASP shall have been programmed into the memory of the weigh-in-motion/ITS-station of all affected vehicles.

There are three subset profiles of this remote inspection:

— Profile C2a: via a hand aimed or temporary roadside mounted and aimed interrogator;

— Profile C2b: via a vehicle mounted and directed interrogator;

— Profile C2c: via a permanent or semi-permanent roadside or overhead gantry.

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The interrogation variants are as shown in Figures 1 to 3 above. The overall interrogation scenario is as shown in Figure 4.

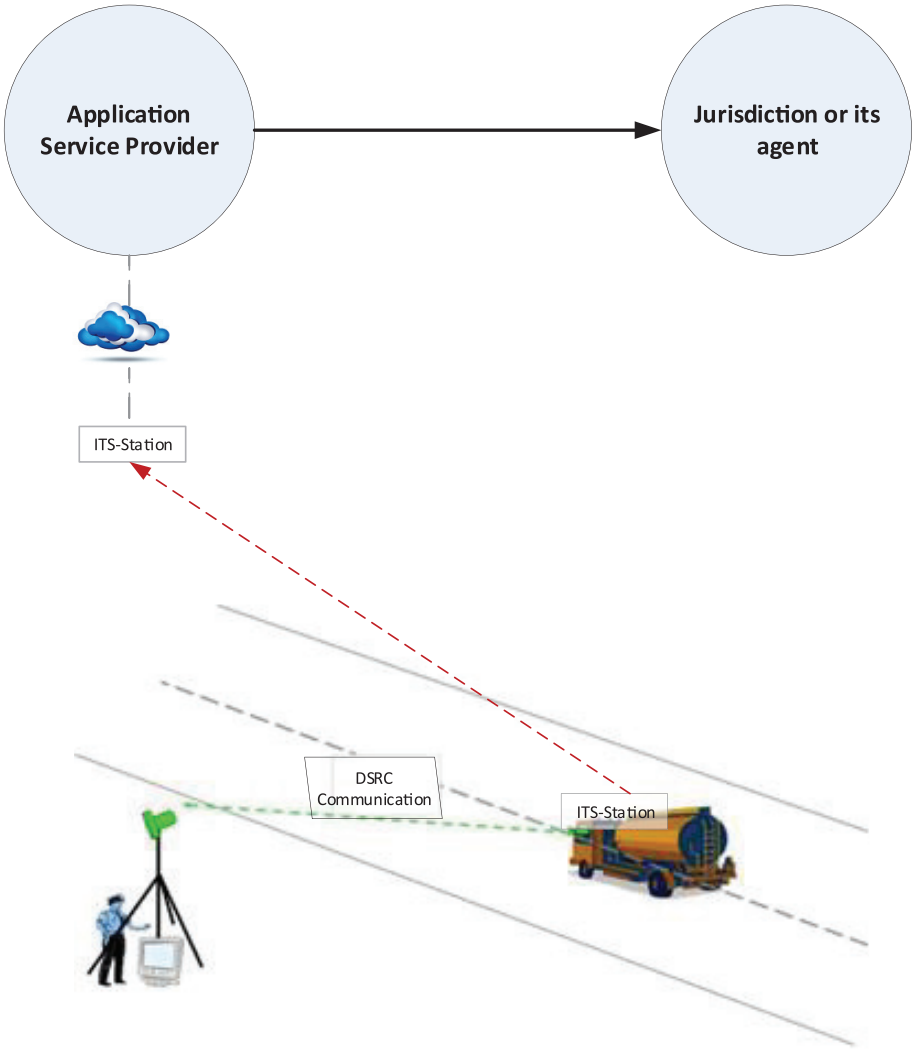

Figure 4 — Communication Profile C2

6.4 Overview of Communication Profile C3 — Remote inspection addressed via an ITS-station instigating a download of data to an application service provider via a wireless communications interface (as defined in ISO 15638-2)

6.4.1 General overview of Communication Profile C3

This profile covers the scenario where:

a) An agent of the jurisdiction either directly uses an ITS-station to interrogate the target vehicle via the ITS-station of the target vehicle (probably because of its location in a target zone, or a systematic or random remote vehicle check), or remotely (from any internet connected location) addresses the vehicle via the IP address of the target vehicle, to remotely identify a vehicle which is potentially in violation of the vehicle weight regulations of the jurisdiction.

b) Once so identified the agent of the jurisdiction via the ITS-station - *:* - ITS-station communication provides the vehicle IVS with a case reference code and a destination IP address, and instructs the vehicle IVS to provide the weigh-in-motion data required by the weigh-in-motion regulation of the jurisdiction.

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c) The vehicle IVS then sends the data via its ITS-station, together with the requested destination IP address and case reference, to a previously supplied address of the application service provider. (Consistent with other TARV standards, as part of security measures, in this communication profile it never sends data directly to the requested destination address).

The application service provider is then responsible for validating the requested destination IP address, and if valid, forwards the case reference code and weigh-in-motion data to the requested IP address (but these stages of the process are outside the scope of this document. Regulations are given in the data requirements of the jurisdiction).

In this use case, the application service provider may be an agent of/appointed by the jurisdiction or may be a commercial application service provider who is under legal obligation to provide weigh-in-motion data to the jurisdiction on request from the jurisdiction, or may simply be a legitimate application service provider seeking data from the vehicle (for example for the fleet manager). In the case of a jurisdiction where the ASP for this use case is to be an agent of the jurisdiction, then the valid IP address of the ASP shall have been programmed into the memory of the weigh-in-motion/ITS-station of all affected vehicles.

See Figure 5 for a pictorial example.

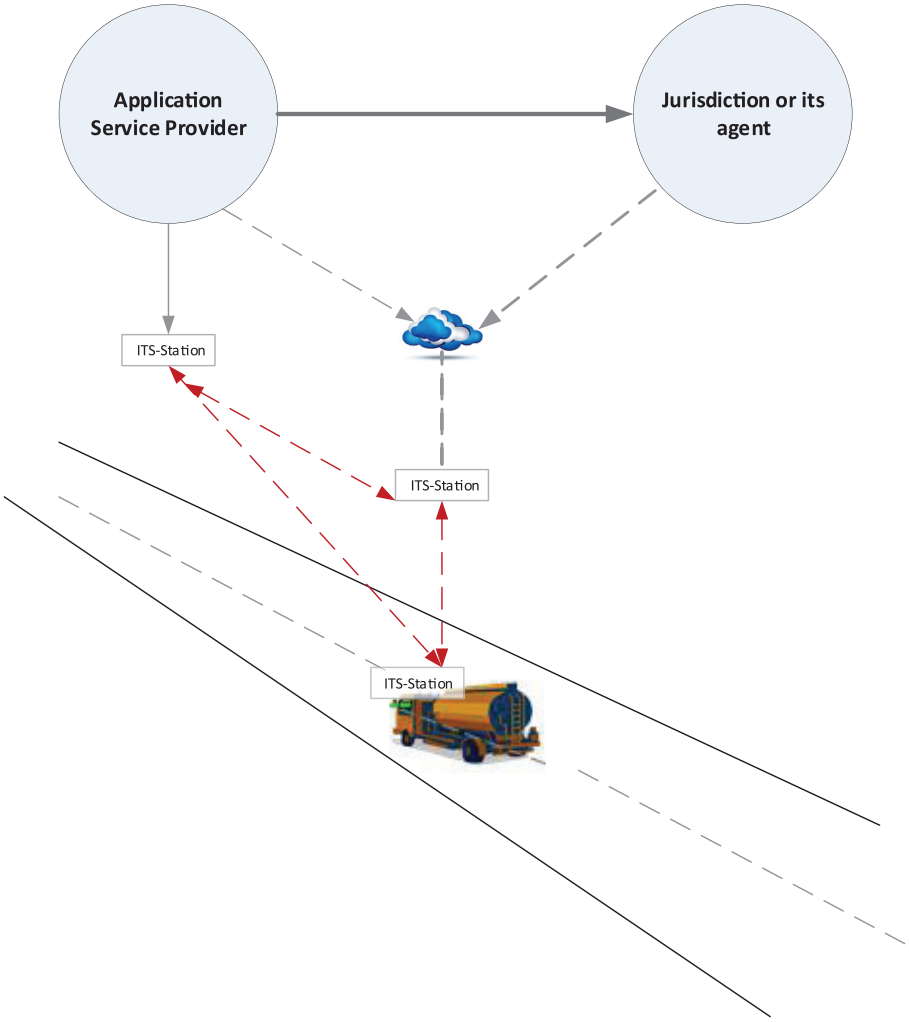

Figure 5 — Communication Profile C3

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6.5 Communications requirements

6.5.1 General communications requirements

6.5.1.1 In order to be conformant with this document, the communications employed shall comply with a communications option specified in ISO 15638-2.

6.5.1.2 The ISO 15638 series has been developed for use in the context of regulated commercial freight vehicles. There is nothing, however, to prevent a jurisdiction from extending or adapting the scope to include other types of regulated vehicles, as it deems appropriate.

6.5.2 Communications profile C1 requirements

Communication may be made via any short-range communications medium supported by ISO 15638-2, specifically:

a) EN ETSI EN 300 674-1 V1.2.1 (2004-08),

b) ARIB STD-T75,

c) TTAS.KO-06.0025,

but it shall be specified which of these options is supported, taking into consideration the vehicle weight regulations of the jurisdiction in which the vehicle is registered.

6.5.2.2 These are controlled circumstances where the initial communication is made directly between the vehicle and equipment operated by the agent of the jurisdiction acting as an 'inspector' or a mobile inspection point of the jurisdiction (an 'interrogator').

6.5.2.3 The transaction and its security provisions shall be effected in accordance with the relevant normative annexes of this document (and within the context of TARV, the interrogator of the jurisdiction shall be considered in this case to be a special case of an 'application service provider').

6.5.2.4 The inspector of the jurisdiction shall comply to the security provisions specified in annexes to this document.

6.5.2.5 Specific aspects of weigh-in-motion data shall be as determined in annexes to this document, or given in the data requirements of the jurisdiction.

6.5.3 Communications profile C2 requirements

6.5.3.1 The short-range interrogation shall conform to the requirements of 6.5.2.1.

6.5.3.2 The provision of data to the application service provider shall conform to the requirements of 6.5.4.1.

6.5.4 Communications profile C3 requirements

6.5.4.1 Communications may be any communications medium supported in ISO 15638-2.

a) The overall architecture employed shall comply to ISO 15638-1 and to ISO 15638-6.

b) The security employed shall comply to ISO/TS 15638-4.

c) The 'basic vehicle data' shall comply to ISO 15638-5.

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d) The generic conditions for this application service shall comply to ISO 15638-6.

7 Requirements for services using generic vehicle data

The means by which the access commands for generic vehicle information specified in ISO 15638-5 can be used to provide all or part of the data required in order to support a regulated application service shall be as defined in ISO 15638-6 or as specified in the annexes supporting this document.

8 Application services that require data in addition to basic vehicle data

8.1 General

Shall be conducted as defined in ISO 15638-6 or as specified in the annexes of this document.

8.2 Quality of service requirements

This document contains no general requirements concerning quality of service. Such aspects shall be determined by a jurisdiction as part of its data requirements for any particular regulated application service. However, where a specified regulated application service has specific quality of service requirements essential to maintain interoperability, these aspects shall be as specified in Clause 10 or as specified in annexes of this document.

8.3 Test requirements

This document contains no general requirements concerning test requirements. Such aspects shall be determined by a jurisdiction as part of its data requirements for any particular regulated application service, and issued as a formal test requirements specification document. However, where a specified regulated application service has specific test requirements essential to maintain interoperability, these aspects shall be as specified in Clause 10, relating to this regulated application service, or in a separate standards document referenced within that Clause, or specified in annexes of this document, and where multiple jurisdictions recognize a benefit to common test procedures for a specific regulated application service, this shall be the subject of a separate standards document, or be as specified within data requirements with common requirements issued by or on behalf of those jurisdictions.

8.4 Marking, labelling and packaging

This document has no specific requirements for marking labelling or packaging. The marking and labelling requirements for any in-vehicle equipment shall be specified in standards pertaining to that physical equipment, or be specified within a data requirement issued by the jurisdiction.

However, where the privacy of an individual may be potentially or actually compromised by any instantiation based on the ISO 15638 series of standards, the contracting parties shall make such risk explicitly known to the implementing jurisdiction and shall be aware of the data requirements of the implementing jurisdiction and shall mark up or label any contracts specifically and explicitly drawing attention to any loss of privacy and precautions taken to protect privacy. Attention is drawn to ISO/TR 12859 in this respect.

9 Common features of regulated TARV application services

9.1 General

The details of particular instantiations of regulated application service are as designed by the application service system to meet the requirements of a particular jurisdiction and are not specified herein, save as described below. ISO 15638-6 specifies the generic roles and responsibilities of actors

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in the systems, and instantiations that claim conformance with this document shall also be conformant with the general requirements of ISO 15638-6.

Annexes to this document provide a number of communication transaction profiles (Annex A) and data concept profiles (Annex C), which may be selected and mandated for use by a jurisdiction or group of jurisdictions.

The services included in this document include both communications using ITS-station transactions consistent with other TARV applications, and also the special case of roadside inspection using secured short-range communication (e.g. 5,8 GHz DSRC) interrogation.

9.1.1 Communication Profiles C1 and C2

9.1.1.1 This document provides profiles for a direct communication between an 'inspector' or 'mobile inspection point' of the jurisdiction (an 'interrogator'), that does not involve any other application service provider. Communication Profiles C1 and C2 use specific short-range communications means specified in annexes of this document. See 10.1.2 and Annex B.

9.1.1.2 In the case of the specific instance of a short range communication between an inspector of the jurisdiction and a vehicle using specific means specified in annexes of this document, the inspector, acting as an "interrogator" may be considered as special instantiation of an application service provider and any on-board file content deletion shall take into consideration the data requirements of the jurisdiction.

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9.1.1.3 See Figure 6.

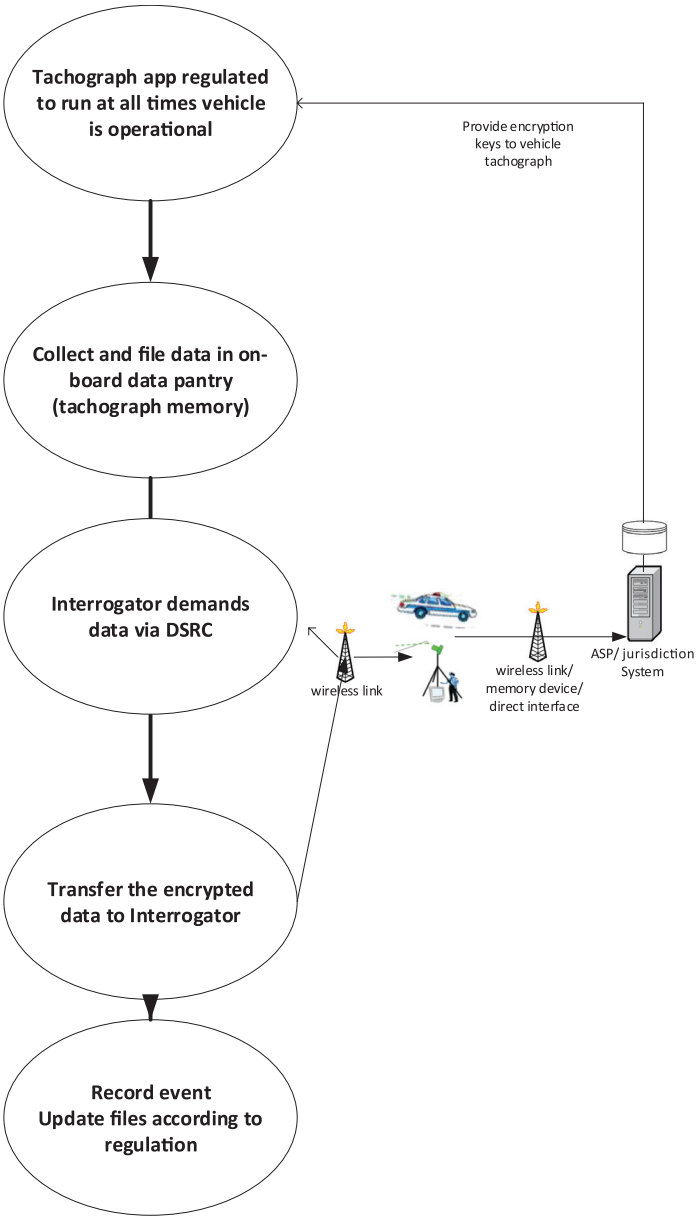

Figure 6 — Short Range Interrogation (Communication Profiles C1 and C2)

9.1.2 Communication Profile C3

9.1.2.1 The means by which data is provisioned into the data pantry and the means to obtain the TARV local data tree (LDT) and core data, where required, are described in ISO 15638-6:2014, Clause 8.

9.1.2.2 In order to minimize demand on the IVS (which it is assumed may be performing multiple application services simultaneously, as well as supporting general safety related cooperative vehicle systems), and because national requirements and system offerings will differ, a 'cloud' approach has been taken in defining TARV regulated application services.

9.1.2.3 The TARV approach is for the on-board app supporting the application service to collect and collate the relevant data, and at intervals determined by the app, or on demand from the application service provider (ASP), pass that data to the ASP. All of the actual application service processing shall

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occur in the mainframe system of the ASP (in the 'cloud'). For further information see ISO 15638-6:2013, Clause 9.

9.1.2.4 At a conceptual level, the TARV system is therefore essentially simple, as shown in Figure 7. The process is similar to that for CoreData, but data is supplied to a different on-board file in the data pantry.

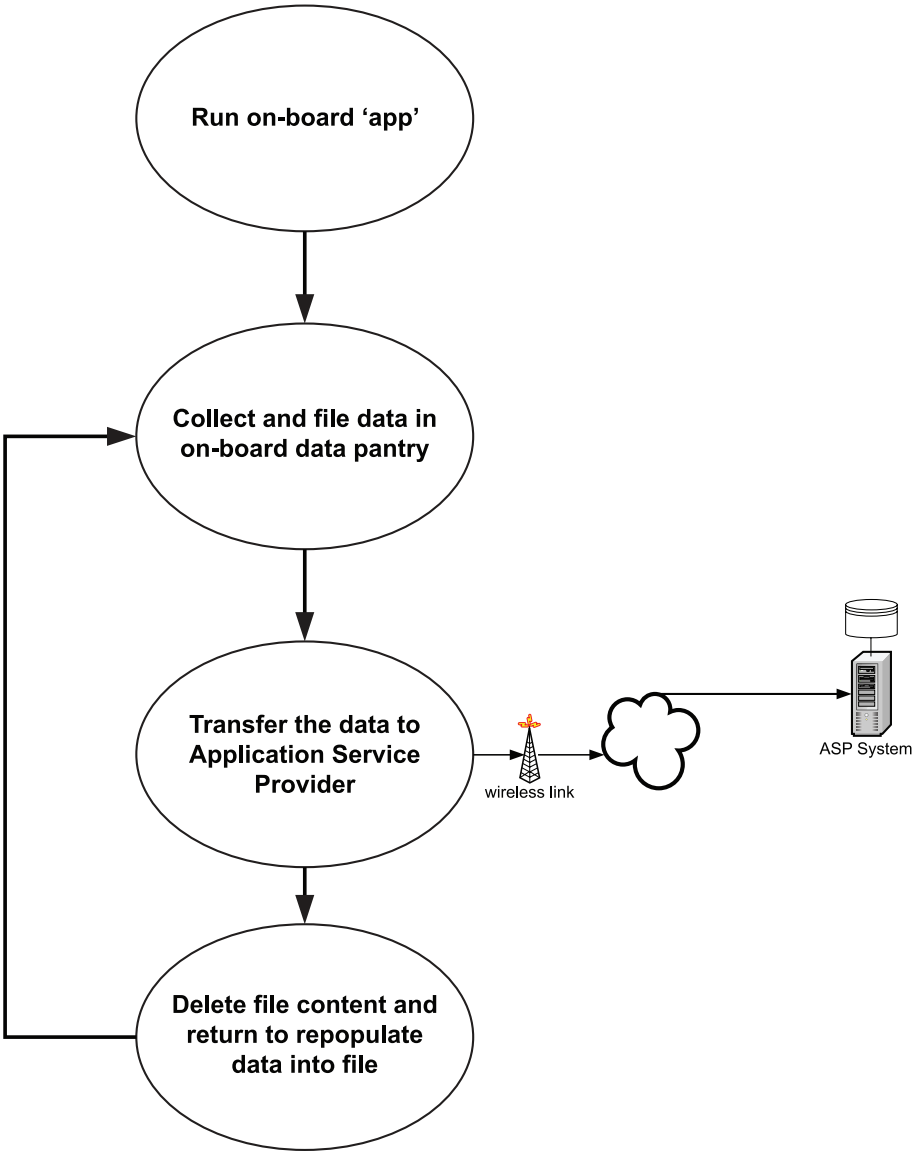

Figure 7 — TARV Regulated application service on-board procedure (Communication Profile C3)

At a common generic functional level for this application service, the process may be seen as shown in Figure 8 below, however the connected equipment may or may not be required in all cases.

9.2 Common role of the jurisdiction, approval authority, service provider and user

In the case of Communication Profiles C1 and C2, the common role of the jurisdiction, approval authority, application service provider and user is given in a data requirement of the jurisdiction in which the vehicle is operating.

In the case of Communication Profile C3, the common role of the jurisdiction, approval authority, application service provider and user shall be as defined in ISO 15638-6 and is given in a data requirement of the jurisdiction in which the vehicle is operating.

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9.3 Common characteristics for instantiations of regulated application services

In the case of Communication Profiles C1 and C2, the common characteristics for instantiations of regulated application services are given in a data requirement of the jurisdiction in which the vehicle is operating.

In the case of Communication Profile C3, the common characteristics for instantiations of regulated application services shall be as defined in ISO 15638-6.

9.4 Common sequence of operations for regulated application services

In the case of Communication Profiles C1 and C2, the common sequence of operations for the remote weigh-in-motion operation is given in a data requirement of the jurisdiction in which the vehicle is operating.

In the case of Communication Profile 3, the common sequence of operations for regulated application services shall be as defined in ISO 15638-6.

9.5 Quality of service

Generic quality of service provisions for application services shall be as defined in ISO 15638-6 or, at the discretion of the jurisdiction, given in a data requirement of the jurisdiction in which the vehicle is operating.

9.6 Information security

It is assumed that data normally will be encrypted before it is sent across the wireless medium.

It is also assumed that encryption techniques will change over time.

Each packet of WIM data shall therefore comprise 5 elements. See Table 1.

Table 1 — Structure of WIM data

A	B	C	D	E
No of octets of payload data	No of octets of security data	Payload data	Security data	10101010 end of field identifier octet
2 octets	2 octets	(A) Octets of payload data	(B) Octets of security data	1 octet
Example: 3	2	111111110000000011111111	0000000011111111	10101010

Payload data shall comprise the information content to be transferred across the air interface. Other than the overall field size constraint of A (65 535 octets), the number of octets of payload data is not limited per se by the standard, but may be limited by the physical and practical constraints of the communication medium (for example when using Communications Profile 1) or by a data requirement of the jurisdiction.

Security data shall comprise the security 'keys' or links to keys or other security mechanisms provided to enable the payload data to be decrypted. Other than the overall field size constraint of B (65 535 octets), the number of octets of security data is not limited per se by the standard, but may be limited by the physical and practical constraints of the communication medium.

In the case of Communication Profile 1, the data is to be transferred in 'frames' of a maximum of 128 octets of which 18 octets are used by header and control data, leaving 110 octets of which 50 octets are reserved for security data, and 10 octets for internal categorization management, leaving up to 50 octets of payload data per frame as defined elsewhere within normative annexes to this document.

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In the case of Communication Profile 3, information security shall be as defined in ISO/TS 15638-4, and there are no practical length restrictions. In the case of Communication Profiles 1, security provisions are as defined in Annex B. In the case of Communication Profile 2, security provisions for the information request functions shall be as determined in Annex B, and the security provisions for information provision shall be as determined in ISO/TS 15638-4.

9.7 Data naming content and quality

In the case of Communication Profile C3, data naming shall be as defined in ISO 15638-5:2013, 8.2, 8.3 and 8.4, or shall be as defined in Annex C of this document.

In the case of Communication Profiles C1 and C2, data naming shall be as defined in Annex C of this document.

Variations specific to the weigh-in-motion application service shall be as defined below.

9.8 Software engineering quality systems

In the case of Communication Profile C3, software engineering quality systems shall be as defined in ISO 15638-6, or, at the discretion of the jurisdiction, given in a data requirement of the jurisdiction in which the vehicle is operating.

9.9 Quality monitoring station

The availability of quality monitoring stations shall be as defined in ISO 15638-6, or, at the discretion of the jurisdiction, given in a data requirement of the jurisdiction, in which the vehicle is operating.

9.10 Audits

In the case of Communication Profile 3, audits shall be as defined in ISO 15638-6.

In the case of Communication Profiles 1 and 2, audits shall take into consideration the data requirements of the jurisdiction in which the vehicle is operating.

9.11 Data access control policy

In the case of Communication Profile C3, to protect the data and information held by the application service provider, each provider shall adopt a risk-based data access control policy for employees of the provider.

In the case of Communication Profiles 1 and 2, audits shall take into consideration the data requirement of the jurisdiction in which the vehicle is operating.

9.12 Approval of IVSs and service providers

In the case of Communication Profile C3, generic provisions for the approval of IVSs and service providers shall be as specified in ISO 15638-3. Detailed provisions for specific regulated applications are given by the regime of the jurisdiction.

In the case of Communication profiles C1 and C2, generic provisions for the approval of IVSs and service providers are given in a data requirement of the jurisdiction in which the vehicle is operating.

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10 Weigh-in-motion (WIM)

10.1 TARV WIM service description and scope

10.1.1 Generic TARV WIM use case via the application service provider

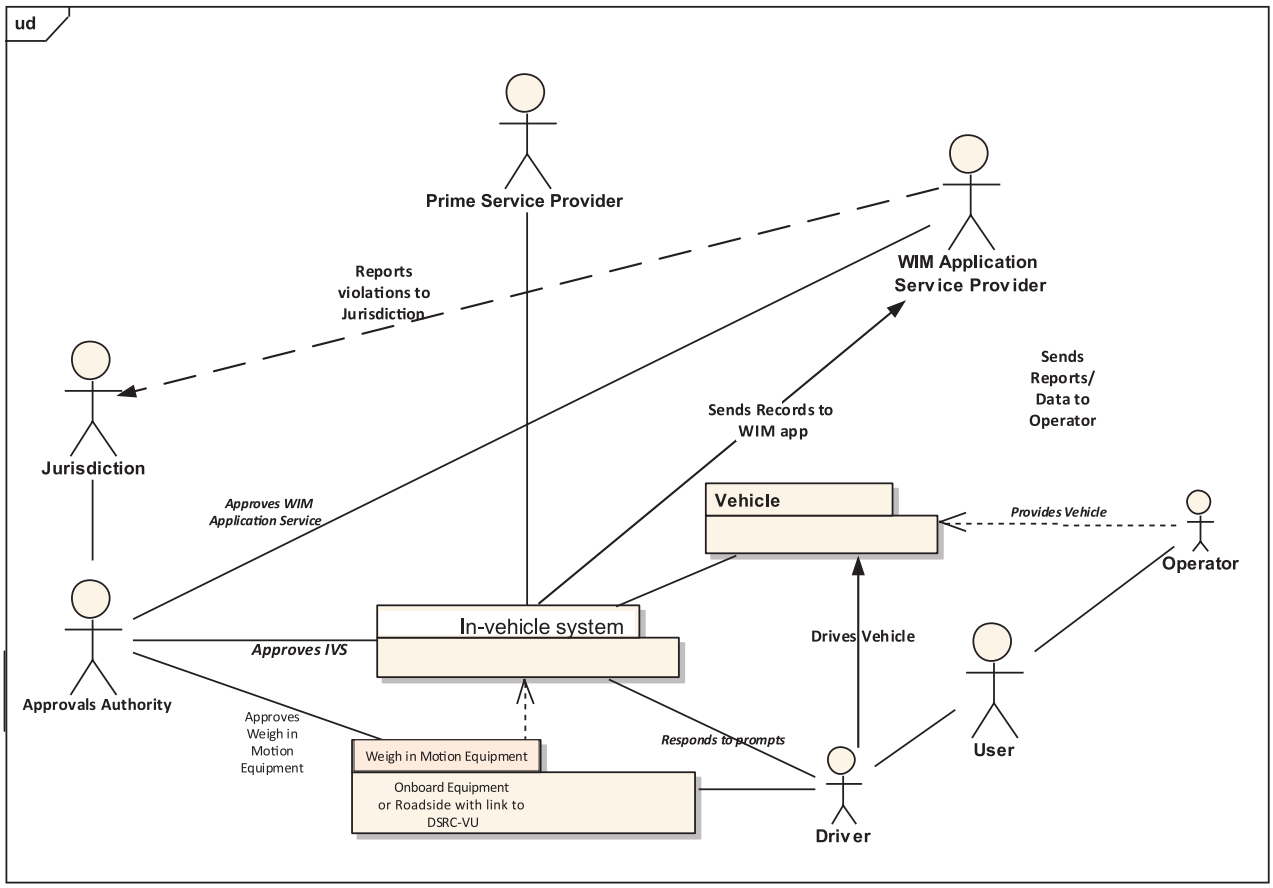

Figure 8 — Weigh-in-motion use case

Figure 8 provides an illustration of a TARV remote weigh-in-motion (WIM) monitoring system. Communication Profiles C1 and C2 of this application service are defined in 10.1.2. Communication Profile C3 of this application service is described in 10.1.3 and 10.1.4.

NOTE In the case of Communication Profiles 1 and 2, the WIM 'Application Service Provider' is an 'inspector' of the jurisdiction using a short-range wireless interrogator.

10.1.2 Types of weigh-in-motion

The architectural objective of weigh-in-motion is to provide an application service provider with the weight of a vehicle, measured while the vehicle is in motion. For the purposes of this document, the agent of a jurisdiction who is regulating vehicles through WIM using secured DSRC communications is deemed to be the ASP.

Vehicle weight can be obtained in two ways:

a) Using weigh equipment on-board the vehicle (WIM-O).

b) Using weigh equipment embedded in the road pavement, (WIM-R), with data transferred to the vehicle by wireless means.

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10.1.3 WIM-O (weigh-in-motion system Onboard)

The generation of vehicle weight data from equipment within the vehicle; the technical means of generating such data is not specified in this document, only the resultant data.

10.1.4 WIM-R (weigh-in-motion system Roadway)

The generation of vehicle weight data from equipment embedded in the road pavement and transferred to the IVS of the vehicle ready for subsequent inspection by wireless means. The technical means of generating such data is not specified in this document, only the resultant data.

NOTE 1 Vehicle weight measurement from in-road 'weigh-in-motion' systems where data is linked to a specific vehicle by ANPR or other techniques and sent via landline or cellular communications to a processing centre is also a viable and alternate option, but as it does not include carrying data on-board the vehicle is not a TARV use case.

Once the roadside equipment has the vehicle weight value(s) established and identified the affected vehicle, it uses wireless means to transfer the WIM-R data to the IVS of the vehicle. This can be achieved using a C-ITS ITS-station - : - ITS-station Communication Profile C3), or, and more likely, by means of short range communications such as 5,8 GHz DSRC. Communication Profile C1 (see also Annex B).

NOTE 2 The advantage of using short range DSRC is that it is easier to localize, identify and transfer the data to the vehicle using such technologies.

In any event, this data transfer requires that the identification of the vehicle (for example ANPR, or a Communication Profile C1 exchange) is made and that identification data accompanies the vehicle weight data to provide a validation that the recorded vehicle weight is that of the vehicle into whose memory it is recorded.

10.1.5 Storage of the WIM data on-board the vehicle

The WIM data (WIM-O and/or WIM-R data) is stored in the IVS.

In a Communication Profile C2/C3 scenario, this will most likely be in the data pantry of the IVS.

In a Communication Profile C1 scenario, this is most likely to be within the IVS-DSRC (See Annex B). This document does not specify how the IVS is organized, but it is recommended that where WIM is used as part of regulatory control, that the jurisdiction specify in their data requirements the exact availability conditions for this data.

10.1.6 WIM inspection and Communication Profiles

This use case applies where weigh-in-motion data is obtained by a jurisdiction in scenarios such as:

a) Communication Profile 1: Interrogation of the weigh-in-motion system data by an inspector of the jurisdiction using a short-range wireless interrogator in accordance with procedures defined in annexes of this document. (See 10.1.2).

b) Communication Profile 2: Interrogation of the weigh-in-motion by an inspector of the jurisdiction using a short-range wireless interrogator with a response via the ITS-station of the vehicle to a predetermined IP address and validation of the requested final destination for the data made by the application service provider.

c) Communication Profile 3: Requests for weigh-in-motion data broadcast to vehicles within range of a fixed or mobile interrogation point using any wireless access medium that can communicate with the ITS-station of the vehicle or requests for weigh-in-motion data by a legitimate source such as the driver of the vehicle or the jurisdiction by addressing the IPv6/IPv4 address of the vehicle ITS-station or its weigh-in-motion system with validation of the requested destination for the data provided by the application service provider.

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10.1.7 Specific use case of weigh-in-motion inspection by an inspector of the jurisdiction using short range equipment (Communication profiles 1 and 2)

In the situation of the inspection of a specific vehicle weigh-in-motion system by an authorized agent of the jurisdiction using a short range mobile means of wireless interrogation (e.g. 5,8 GHz DSRC) in the circumstance where there is no opportunity to validate the destination of the inspectors address via a remote application service provider, validation of the inspectors interrogator shall be made using the processes defined in annexes of this document, and shall use communication profiles and security defined in Annex B of this document, and transaction profiles specified in Annex A of this document and data concept profiles specified in Annex C of this document, or as specified in the data requirements of the jurisdiction.

This application service is described in 10.1.3, 10.1.4 and 10.2 below.

10.1.8 Description of TARV WIM regulated application service

TARV WIM is a means to deliver data concepts containing weigh-in-motion data to an application service provider using the TARV IVS and a wireless communication interface between the IVS and the application service provider central system, or to provide the data via a short-range wireless communication to an agent of the jurisdiction acting as an ASP for the jurisdiction.

The objective of Communication Profile C1 is to provide data to determine whether a vehicle's progress should be 'arrested' in order to fully check the weigh-in-motion data. The objectives of Communications profiles C2 and C3, is, in situations where it is allowed, to automatically provide the relevant weigh-in-motion data to the jurisdiction via an application service provider. What comprises "relevant" weigh-in-motion data in these instantiations may vary between jurisdictions, so this document provides the means to transfer this data, but the specification of the exact data concept transferred shall be at the determination of the jurisdiction. Some optional data profiles that a jurisdiction may select are provided in Annex C, but jurisdictions are not bound to use one of these optional profiles in order to claim compliance with this document. Vehicles may however be bound by the data requirements of the jurisdiction in which the vehicle is operating, to measure and/or retain specific WIM data. Where consensus can be achieved, later versions of this document may add further Profiles for additional communications and/or data concepts.

Communication Profiles as defined in Annexes A and B of this document are therefore a generic means of transferring data which is specified by the local data requirements of the jurisdiction and these profiles do not specify any of the precise content of the weigh-in-motion data concept transferred (which shall be at the determination of the jurisdiction).

However, whilst the objective of Communications Profiles C2 and C3 is to provide all of the weigh-in-motion data required for the interrogation by wireless means, the objective in Communication Profile C1 is simply to provide relevant data via the wireless communication in order to determine any regulatory action or whether to stop the vehicle for further inspection. The amount of data that can be transferred within Communication Profile C1 is limited (to 50 octets payload), because of the nature and limitations of the communication transaction.

International, regional and national data requirements determine the content of electronic weigh-in-motion data. However, Annex C provides for information some data concept profiles that support this document.

EXAMPLE In Europe, DIRECTIVE (EU) 2015/719, and *Regulation (EU) 165/2014,* provide the overall requirements in countries of the European Union for weigh-in-motion, and combined with current European driving regulations provide the regime for driver monitoring in Nation states within its jurisdiction Weigh-in-motion data profiles adopted by the EC, and therefore widely in use in at least 28 countries, are provided as optional data concept profiles in Annex C.

NOTE Annex A provides specifications for Communication transaction profiles; Annex B provides 'specifications for 5,8 GHz DSRC communications to access this data (including security provisions); 9.6 provides specifications for security and is complemented in Annex B with direct security measures for 5,8 GHz DSRC (B.1.6.5); and Annex C provides specifications for data profiles.

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The exact nature and form of the requirements and reports will vary from jurisdiction to jurisdiction, and such detail is not standardized in this document. This document specifies the basic architecture and basic information needed to support this type of application service using TARV, so that the in-vehicle system can satisfy the requirements of any likely instantiation by a different jurisdiction/application service provider, or so that the regulated vehicle and equipment can support the different requirements of different jurisdictions when the regulated vehicle and driver are operating within their domain.

The nature and form of the weigh-in-motion device/function within a vehicle is not specified in this document, but may be expected to be standardized and/or regulated elsewhere by jurisdictions. Although weigh-in-motion regulations differ around the world, in order for TARV WIM to operate it is a requirement that at least the following features are present in the weigh-in-motion:

a) Any WIM-O (on-board) weigh-in-motion system shall be able to output the following data using an appropriate dedicated serial link independent from an optional CAN bus connection (ISO 11898-1), to allow their processing by other electronic units installed in the regulated vehicle.

b) When the ignition of a WIM-O equipped vehicle is ON, key weigh-in-motion data (as determined by the weigh-in-motion system design) is permanently broadcast to the IVS.

c) Data stored into the data memory shall not be affected by an external power supply cut-off of less than twelve months in type approval conditions.

d) Notwithstanding that the data to be transferred shall be a function of system design and regulatory requirements and is not determined in this document, the recording equipment of a WIM-O equipped vehicle shall be able to store in its data memory the following vehicle unit identification data:

   — name of the manufacturer;

   — address of the manufacturer (or a reference to a data registry where such data is available. A reference to a publicly available International register of manufacturers may optionally be stored as a ManufacturerID and url of the register.);

   — part number;

   — serial number;

   — software version number;

   — software version installation date;

   — year of equipment manufacture;

   — approval number;

   — length, in bytes (octets) of '`WIM-O data`' file;

   and, shall be able to store in its data memory the data required by the jurisdiction requiring the weigh-in-motion data.

e) The data stored in its data memory shall be made accessible to the IVS and the TARV WIM app in a standard and declared format.

Figure 8 provided an illustration of a TARV weigh-in-motion monitoring system. This application service is described in 10.1.4 and 10.2.

10.1.9 Description of TARV WIM application service

The TARV 'weigh-in-motion' (WIM) application service may exhibit itself in a number of different forms in different jurisdictions. In each case the use case shown in Figure 8 may vary slightly and is therefore an example, not a requirement. It is likely to be named differently according to its origin and the regulatory environment in which it is instantiated.

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The exact nature and form of the requirements and reports will vary from jurisdiction to jurisdiction, and such detail is not standardized in this document. This document specifies the basic architecture and information needed to support this type of application service using TARV, so that the in-vehicle system can satisfy the requirements of any likely instantiation by a different jurisdiction /application service provider, or so that the regulated vehicle and equipment can support the different requirements of different jurisdictions when the regulated vehicle and driver are operating within their domain. Annex A provides details of communication transactions for each Communication profile, and Annex C provides example profiles of weigh-in-motion application data concepts which regulators may elect to adopt as the norm within their jurisdiction, and Annex B provides the specification of a 5,8 GHz DSRC communication transaction.

Figure 8 above shows an example use case appropriate where reports are required by the jurisdiction and where compliance is also monitored such that transgression may result in an offense/prosecution, perhaps the most comprehensive example of the TARV WIM application service.

10.2 Concept of operations for TARV WIM

10.2.1 General

The TARV 'weigh-in-motion' (WIM) is an application service that transfers weigh-in-motion application data (generated by an on-board WIM-O system or transferred to on-board memory from a roadside WIM-R system) from a vehicle to an application service provider (who may be a commercial service provider or may be an inspector of the jurisdiction), using a TARV IVS and a wireless communication interface (Communication Profile 3), or in the case of a direct short range communication, between the inspector ('interrogator') and the vehicle using a short range wireless communication (Communication Profiles C1 and C2). Requirements for weigh-in-motion may vary from one jurisdiction to another. Therefore, this document does not specify nor require the use of particular specific data concepts, nor control the content of the weigh-in-motion data, but a number of example data concept profiles, and transactions, are provided in Annex C of document, which may be suitable to be specified in the data requirements of jurisdictions using this document.

10.2.2 Statement of the goals and objectives of the TARV WIM system

The objective is to provide WIM (WIM-O and/or WIM-R) data from a vehicle to an application service provider, or the agent of the application service provider.

The service is achieved by an app in the IVS requesting weigh-in-motion data from the weigh-in-motion system, storing the data in a uniquely identified file, and sending the data as determined in the app (at defined intervals or on demand from the application service provider system). Principal provision of the application service is provided by the landside application service provider system, or a mobile inspection point ('interrogator'), and the on-board application is a means of feeding data to that landside system, or interrogator, and may on occasions receive data from the landside-based application service system.

10.2.3 Strategies, tactics, policies, and constraints affecting the TARV WIM system

The principle issues affecting the system are those of collecting data from an unspecified device.

This application service restricts itself to providing a medium to transfer (unspecified) data from an on-board device to the application service provider using the TARV IVS. It does not design the application service. That is left to the jurisdiction, the application service provider, and approval authority (regulatory) application service.

The IVS is a device of limited capability, and will be expected to be multi-tasking with other TARV 'apps' and also conducting non-TARV cooperative vehicle system apps at the same time. It is therefore important that the IVS is not overloaded by a complicated TARV WIM app.

In many jurisdictions, there may be a requirement to provide data to a mobile roadside inspection point or a vehicle mounted device ('interrogator') operated by an inspector/agent of the jurisdiction.

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(Communication Profiles C1 and C2). These requirements may vary from one jurisdiction to another, and may indeed vary for different instantiations within a jurisdiction.

This document therefore supports:

a) Obtaining weigh-in-motion data from the vehicle by interrogating via a short range ('interrogator') that is wirelessly connected in accordance with 5,8 GHz DSRC, or infra-red, communication provisions as specified in ISO 15638-2 (Communication Profiles C1 and C2).

b) Obtaining weigh-in-motion data by interrogating via a mobile interrogator that is wirelessly connected in accordance with one or more of the other wireless media specified in ISO 15638-2 (Communication Profile 3).

c) Obtaining weigh-in-motion data by interrogating via a fixed gantry or roadside beacon is wirelessly connected in accordance with one or more of the other wireless media specified in ISO 15638-2 (Communication Profile C1, C2, or C3).

d) Obtaining weigh-in-motion data by remotely addressing the IPv6/IPv4 address of a vehicle ITS-station or its weigh-in-motion that is wirelessly connected in accordance with one or more of the wireless media specified in ISO 15638-2 (Communication Profile 3).

In the case of an instantiation of a) (Communication Profile 1), the data may be sent directly to the interrogating inspector using the transaction and security provisions of Annexes A, B and C of this document or may (Communication Profiles C2 and C3) be provided to only to a predetermined address of an application service provider and forwarded by the ASP to the interrogating inspector.

In the case of instantiations of c) and d), part of the security provisions are that data shall be supplied only to a predetermined address of an application service provider.

10.2.4 Organizations, activities, and interactions among participants and stakeholders of TARV WIM

It should be noted that an entity may perform multiple roles and in doing so takes on the responsibility to perform the functions described under those roles.

In the case of WIM, the application service provider may be a commercial service contracted to provide the operator who has instructed the application service provider to meet the demands of the jurisdiction on behalf of the operator, or the WIM application service provider may be an agent or department of the jurisdiction.

10.2.5 Clear statement of responsibilities and authorities delegated for TARV WIM

Table 2 provides a list of the actors involved, their activities and interactions.

Table 2 — TARV WIM actors involved, their activities and interactions

Actor	Role	Activities	Interactions
Jurisdiction (J)	Sets requirements for mandatory and supported TARV WIM	Publishes specifications	ALL
		Obtains regulations	ALL: Establish regime and regulations PSP:Register ASP Register, receive reports Op: Vehicle Registration Dr: Licence, issue Weigh-in-motion

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