ITS Standardization Activities of ISO/TC 204

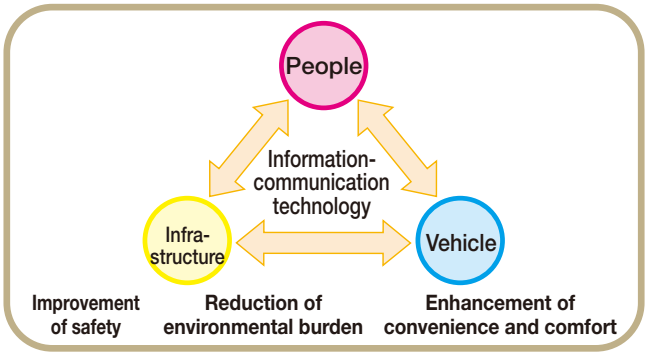
2021

Standardization of ITS

What is ITS?

ITS (Intelligent Transport Systems) is designed to rapidly improve road traffic safety, transport efficiency and comfort and to significantly contribute to energy and environmental conservation through traffic flow facilitation, such as elimination of traffic jams, by using communication technologies to link between people, infrastructure and vehicles.

Due to its wide variety of related technologies and its ability to drastically change social and economic structures, ITS has the potential to create new industries and markets.



Importance of participating in international standardization programs

The WTO (World Trade Organization)'s TBT Agreement (Agreement on Technical Barriers to Trade) aims to eliminate unnecessary trade barriers by aligning various standards with international standards.

The GPA (Agreement on Government Procurement), an appendix of the TBT Agreement, requires countries party to the agreement to define a technical specification based on the applicable international standard (if one exists) when they carry out government procurement that exceeds a certain size. Even for international procurement, in addition to traditional evaluation indexes, including technological advantages, cost (cost performance), and international prevalence, it is increasingly required that the technology applied complies with an international standard in areas where global standards exist. Thus, to improve Japan's global competitive strength in the industrial field, it is essential for Japan to actively participate in international standardization programs and to position Japan's superior technologies as open and global standards in accordance with global trends.

Especially from the standpoint of ensuring user convenience, it is important to reduce costs while promoting international standardization of its various basic technologies without sacrificing the interoperability and expandability of the systems and, at the same time, smoothly enabling the social changes that will be fostered by ITS. In addition, more companies are expanding overseas as domestic markets shrink due to the aging population and low birthrate or are collaborating with foreign companies for development and application of advanced technologies. Under such circumstances, businesses are more likely internationalized or diversified across industries, so Japanese companies need to develop technologies accepted worldwide while completing or collaborating with foreign companies to maintain their presence.

Landscape of standardization of ITS (related standardization bodies)

ITS supports the movement of people and goods on a variety of levels.

The core technologies of ITS are information and telecommunication technologies.

As shown in the next page, ITS international standardization is carried out by ISO, IEC, JTC and ITU. The TC 204 committee specializes in ITS standardization activities.

Under study at TC 204 are standardization proposals for (1) systems architecture, (2) interfaces (message sets, etc.), (3) frameworks (data dictionaries and message templates), (4) system performance requirements, and (5) test methods. This booklet describes the present state of ITS standardization, with a focus on TC 204 programs.

Reference

What is standardization?

Standardization consists of programs to minimize, simplify, and rationalize things, whenever possible, which, if left alone, would become divergent, complex, or chaotic.

The original aim of standardization in the industrial field is to secure the compatibility of products and provide an environment where customers willing to buy products are not confined to purchasing things from a specific supplier.

What are standards?

Written rules defined by standardization are generally referred to as “standards.”

Typically, a standard has no binding power as would a legal requirement, which means that standards are optional. In ordinary transactions the standard on which parties concerned rely should be defined based on an agreement among them. In fact, government agencies often mandate compliance with specific standards (mandatory standards) for the purpose of public benefit, such as for maintaining compatibility, preventing mutual intervention, or protecting consumers.

Key roles of standardization:

- Securing the compatibility of products. Assurance of interface
- Improvement of production efficiency
- Assurance of quality
- Accurate communication, promotion of mutual understanding
- Prevalence of technologies from research and development
- Assurance of safety and security
- Reduction of environmental burden
- Enhancement of industrial competitive strength, preparation of competitive environment
- Promotion of trade, and more

Framework for Standardization

TC 204 Activities (International)

TC 204, the technical committee for ITS standardization within the ISO was established in 1992, and held its first meeting the following year. Subcommittees (SCs) are often placed under technical committees (TCs), but within TC 204, working groups (WGs) are placed under the direct jurisdiction of the TC. Some working groups have been suspended or merged for over 26 years since the inception of TC 204, and there are currently 12 active working groups. Nine countries serve as lead countries for the working groups, with Japan leading two groups, and the U.S. leading three.

As shown in the list below, TC 204 has published numerous international standards. (As of July 2021)

Deliverable	Published	Under development
International Standards	174	78
Technical Specifications	62	34
Publically Available Specifications	0	1
Technical Reports	55	18
Other (Amendments, etc.)	9	0
Total	300	131

Scope:

Standardization of information, communication and control systems in the field of urban and rural surface transportation, including intermodal and multi-modal aspects thereof, traveller information, traffic management, public transport, commercial transport, emergency services and commercial services in the intelligent transport systems (ITS) field.

Excluded:

• In-vehicle transport information and control systems (ISO / TC 22).

Note:

ISO / TC 204 is responsible for the overall system aspects and infrastructure aspects of intelligent transport systems (ITS), as well as the coordination of the overall ISO work programme in this field including the schedule for standards development, taking into account the work of existing international standardization bodies.

Relationship between ITS standardization organizations

TC 204 Chairperson

Secretariat : SAE International

Mutual liaison within the ISO

- JTC1 (INFORMATION TECHNOLOGY)
- JTC1/SC6 (Telecommunications and information exchange between systems)
- JTC1/SC17 (Cards and security devices for personal identification)
- JTC1/SC27 (Information security, cybersecurity and privacy protection)
- TC22 (Road vehicles)
- TC22/SC31 (Data communication)
- TC22/SC32 (Electrical and electronic components and general system aspects)
- TC22/SC33 (Vehicle dynamics and chassis components)
- TC22/SC39 (Ergonomics)
- TC23/SC19 (Agricultural electronics)
- TC104 (Freight containers)
- TC122 (Packaging)
- TC154 (Processes, data elements and documents in commerce, industry and administration)
- TC211 (Geographic information/Geomatics)

Liaison Organizations (A, B)

- **APEC** (Asia-Pacific Economic Cooperation)
- **ERA** (European Union Agency for Railways)
- **ETSI** (European Telecommunication Standards Institute)
- **ICAO** (International Civil Aviation Organization)
- **IEEE** (Institute of Electrical and Electronic Engineers)
- **ISOC** (Internet Society)
- **ITU** (International Telecommunication Union)
- **OGC** (Open Geospatial Consortium)
- **SAE** (Society of Automotive Engineers)
- **TISA** (Travelers Information Services Association)
- **UNECE** (United Nations Economic Commission for Europe)

Working Group	Convenor
WG 1 : Architecture	USA
WG 3 : ITS geographic data	Japan
WG 5 : Fee and toll collection	Sweden
WG 7 : General fleet management and commercial/freight	Canada
WG 8 : Public transport/emergency	USA
WG 9 : Integrated transport information, management and control	Australia
WG 10 : Traveller information systems	UK
WG 14 : Vehicle/roadway warning and control systems	Japan
WG 16 : Communications	USA
WG 17 : Nomadic Devices in ITS Systems	Korea
WG 18 : Cooperative systems	Germany
WG 19 : Mobility Integration	Norway

Participating members (29 countries): Contribute to the meetings, participate actively in the work, and have the obligation to vote.

Australia, Austria, Belarus, Belgium, Canada, China, Cyprus, Czech Republic, Finland, France, Germany, Hungary, India, Islamic Republic of Iran, Ireland, Italy, Japan, Republic of Korea, Malaysia, Netherlands, New Zealand, Russian Federation, Norway, South Africa, Spain, Sweden, Switzerland, United Kingdom, United States of America

Observing members (30 countries): Follow the work as observers with the right to submit comments and attend the meetings.

Algeria, Bulgaria, Chile, Colombia, Congo, Croatia, Cuba, Denmark, Egypt, Ethiopia, Greece, Hong Kong China, Indonesia, Israel, Mexico, Mongolia, Montenegro, Pakistan, Philippines, Poland, Portugal, Romania, Republic of North Macedonia, Saudi Arabia, Serbia, Singapore, Slovakia, Thailand, Turkey, Ukraine

WG 1 Architecture

ITS is a large-scale collection of systems covering many areas of application, with a large number of people involved in its development over a long period. This makes it crucial to establish an architecture that ensures the expandability of the systems that comprise ITS as well as their interoperability and compatibility. WG 1 is developing standards for common information and methods in the ITS sector, including shared terminology, the standardization of data representation formats, architectures for sharing service and system concepts, as well as risk assessment methods and the benefits of services.

List of WG 1 Work Items

		Standardization themes	ISO Number	Content
	1	Privacy aspects in ITS standards and systems	TR 12859:2009	Guidelines for protecting privacy in the development of ITS standards and Systems
	2	Reference model architecture(s) for the ITS sector	WD 14813-1	Definitions of service domains (categories, groups)
			ISO 14813-5:2020	The terms and forms to be used when documenting or referencing the architecture
			ISO 14813-6:2017	The description of ASN.1 to be used as standardised syntax notation and its relation to other data description languages
	3	ITS central data dictionaries/Part 1: Requirements for ITS data definitions	ISO 14817-1:2015	Defines the requirements for data dictionaries that list the data definitions to be shared by the parties involved in ITS
	4	ITS central data dictionaries/Part 2: Governance of the Central ITS Data Concept Registry	ISO 14817-2:2015	Management procedures for data registration
	5	ITS data dictionaries/Part 3: Object identified assignments for ITS data concepts	ISO 14817-3:2017	OID structure
	6	Using UML for defining and documenting ITS/TICS interfaces	TR 17452:2007	Guidelines for UML use in defining and documenting ITS interfaces
★	7	Using web services (machine-machine delivery) for ITS service delivery -Part 1: Realization of interoperable web services	ISO 24097-1:2017	Stipulation of guidelines on the use of web services designed to support collaboration between internet-based systems
★	8	Using web services (machine-machine delivery) for ITS service delivery -Part 2: Elaboration of interoperable web services' interfaces	TR 24907-2: 2015	Technical guidelines to achieve web service interoperability in the context of ITS
★	9	Using web services (machine-machine delivery) for ITS service delivery -Part 3: Quality of services	TR 24097-3:2019	Quality of services in the context of ITS
★	10	Procedures for developing ITS deployment plans utilizing ITS system architecture	TR 24098:2007	Description of procedures to develop ITS deployment plans utilizing ITS system architecture
	11	Use of unified modelling language (UML) in ITS International Standards and deliverables	TR 24529:2008	Stipulation of rules and guidelines on the use of UML for ITS standards, data registries and data dictionaries
	12	Using XML in ITS standards, data registries and data dictionaries	ISO 24531:2013	Stipulation of rules on the use of XML for ITS standards, data registries and data dictionaries
	13	Harmonization of ITS data concepts	TR 25100:2012	Provision of guidelines for data concepts related to registration in data registries
	14	'Use Case' pro forma template	TR 25102:2008	Provision of a template to facilitate use case description
	15	Training requirements for ITS architecture	TR 25104:2008	Definition of requirements concerning training courses about ITS architecture
	16	Use of 'process-orientated methodology' in ITS International Standards and other deliverables	TR 26999:2012	Stipulation of rules for process (function) oriented methodologies for ITS standards, data registries and data dictionaries
	17	Cooperative ITS - Part 1: Terms and definitions	TR 17465-1:2014	Definition of Cooperative ITS
	18	- Part 2: Guidelines for standard documents	TR 17465-2:2014	Guidelines on the formulation of Cooperative ITS standards documents
	19	- Part 3: Release procedures for standards documents	TR 17465-3:2015	Release procedure for the development of standards documents on cooperative ITS
	20	Vocabulary	DTS 14812	Vocabulary Related to ITS
	21	Architecture - Applicability of data distribution technologies within ITS	DTR 23255	Report on possibility of application for the data delivery technology
	22	Identifiers – Processes	DIS 5345	Procedure for specifying ITS identifiers

★ Item(s) that Japan is / has been actively working on

ITS Reference Model Architecture (ISO 14813 Series)

System architecture plays an important role in ensuring that everyone concerned shares a common understanding of the services and systems, and in guaranteeing the expandability of systems as well as their interoperability and compatibility. The ITS reference architecture (ISO 14813 series) was established for reference in developing architectures and as a model to compare architectures in different countries.

Continuous maintenance is required to deal with new services and systems arising from technological advances. Currently, the periodic review of Part 1, which specifies ITS's services, is being conducted with the cooperation of each WG. The remaining parts are also being revised or abolished sequentially in response to revisions to description languages and the 14817 series, taking advantage of the periodic review.

Requirements for the ITS Central Data Registry and Data Dictionary (ISO 14817)

While it is extremely important that the various system components in ITS use consistent names for the data they handle for reasons that include ensuring interoperability and improving the efficiency of system development through the sharing of data, the fact that the development of multiple systems, specifications, and standards is carried out simultaneously and in parallel and the large number of people involved in system development makes this very difficult.

Data dictionaries are designed to promote sharing by managing dictionaries of information about the definitions and formats of data subject to shared use.

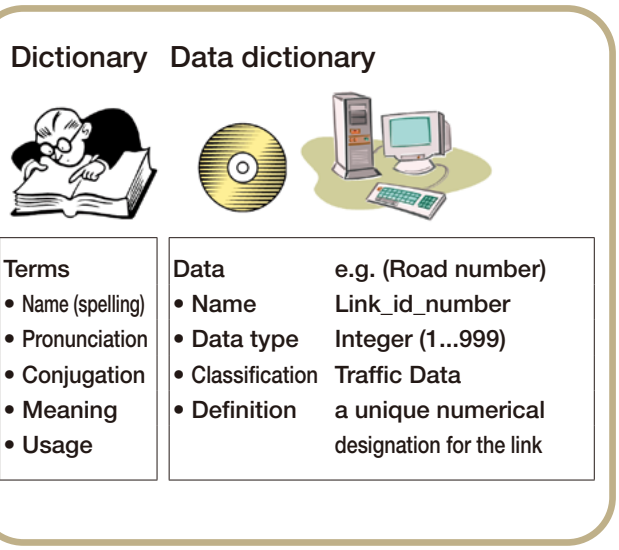
Although WG 1 developed the ISO 14817 series around the year 2000, and has conducted data registry trial operations in the past, it has yet to move to actual operations. We will put forth application ID (ITS-AID), vocabulary (data concept) and data model, among others, as content candidates for the data registry.

Many of these have already been defined by standards organizations within and outside of ISO, and collaborative activities are already proceeding in order to plan the alignment and harmonization of definitions.

The ISO 14817 series has been developed to define the framework, format and procedures for information and data exchange used in the ITS field. Part 1 describes the logical structure of the data dictionary and registered data, Part 2 the operation of data registry, and Part 3 the adoption of the OID (Object Identifier) layered in a tree format within the data management system.

WG1 conducted trial operations of a data registry around the year 2000, but this did not result in it being operated. When the cooperative ITS standardization activities became more active, it was judged necessary to introduce a data registry as soon as possible. In response, trial operations began to recommence in 2013.

Although recruitment of the registry management organization commenced, having obtained the approval of the TC 204 plenary meeting in Florida in April 2019, there was no operational period that satisfied the recruitment conditions. As such, for the time being, the ITS application identifier is managed offline. At the TC204 General Assembly in April 2020, the establishment of an advisory group for the work on identifier designation was approved. At the same time, the development of a standard (ISO/DIS 5345) to specify the process of identifier designation is also underway.

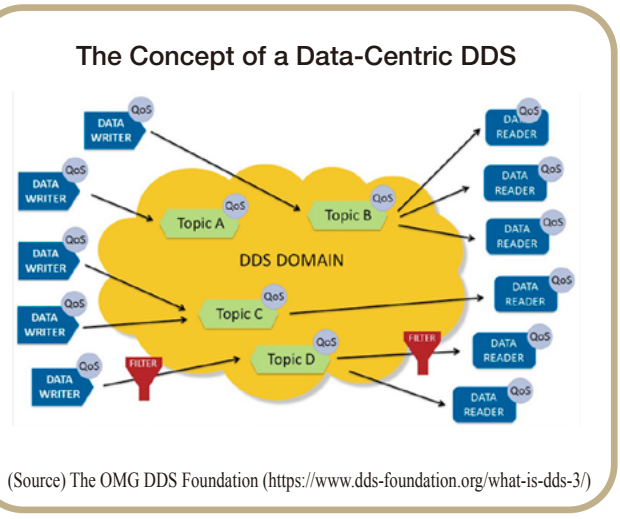


Application of ICT-related technologies in ITS

In the context of the rapid advancement of ICT-related technologies, a high degree of safety and reliability, as well as information security is important for utilizing ICT-related technologies in ITS systems which often see long term use as social systems. WG 1 is working on standardizing the rules and guidelines required for leveraging the ICT-related technologies and data description languages in the construction of the overall ITS structure. Until now, it has issued the standards for use of web service (ISO 24097-1) and guidelines related to interoperability and quality of service (ISO/ TR 24097-2, 3) and in addition, it has issued the usage rules, etc. for data description languages such as UML, XML, etc.

Recently, the TR (ISO/DTR 23255) concerning ITS applicability of data distribution services (DDS) technologies in distributed systems has been developed.

DDS provides QoS-controlled data sharing, and is being adopted in many fields, including the automotive field. Applications communicate by publishing and subscribing to topics identified by their topics name. Subscriptions can specify time and content filters and get only a subset of the data being published on the Topic. Different DDS Domains are completely independent from each other. There is no data-sharing across DDS domains. OMG® (Object Management Group®) has established the middleware protocol and API standard.



(Source) The OMG DDS Foundation (https://www.dds-foundation.org/what-is-dds-3/)

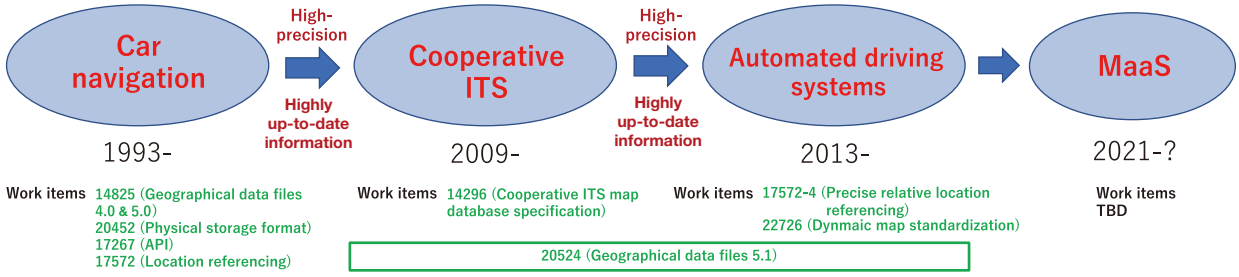
WG 3 ITS geographic data

WG3 is working towards standardization of geographic data for navigation and automated driving.

Most applications in ITS involve services relating to the movement of people, goods and vehicles. As they require information on starting point/destination and routes in addition to data such as time or cost, these services use geographic data. The rapid growth of in-car navigation systems and the imminent deployment of cooperative ITS make the role of geographic data critical. In addition, information comprising high precision 3D images of the road environment and dynamic spatiotemporal information which supersedes the conventional concepts of geographic data are likely to play an important role in rapidly evolving automated driving technology.

WG 3 has been involved in standardizing exchange formats between geographic data providers, as well as compact storage formats allowing high-speed searching and location reference methods, etc. It has also worked on developing functional requirement specifications, data models, and data elements for geographic data. WG 3 has limited its scope to static geographic data for many years, but has started to include dynamic spatio-temporal information in its scope.

Changes in Requirements for ISO TC204 WG3



- Car navigation: In 1993, Japan was the only country in the world where car navigation was popular.
  - Japan chaired ISO TC204 WG3 established in 1993
- Cooperative ITS: The European CVIS Project (2006-2010) proposed the concept of Cooperative ITS.
  - Local dynamic map: an important system element *CVIS=Cooperative Vehicle-Infrastructure Systems
- Automated driving systems: SIP-adus Project (2014-2022) proposes dynamic maps.
  - Dynamic map: an important system element *SIP-adus=Cross-Ministerial Strategic Innovation Promotion Program -Innovation of Automated Driving for Universal Services
- MaaS: WG19 (Mobility Integration) established in TC204 in 2018.
  - Candidates for cooperation with WG3: Tourist navigation, useable transportation networks (costs, nodes), parking management systems...

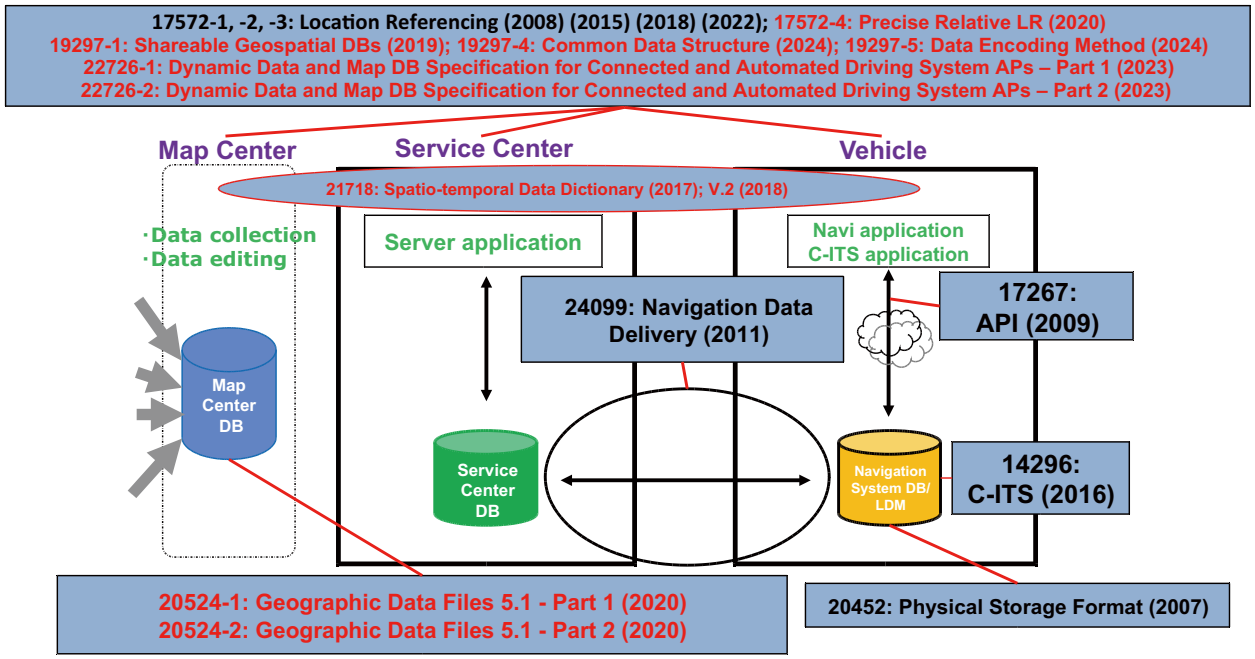
List of WG 3 work items

		Standardization themes	ISO Number	Content
★	1	Requirements and Logical Data Model for a Physical Storage Format (PSF) and an Application Program Interface (API) and Logical Data Organization for PSF used in Intelligent Transport Systems (ITS) Database Technology	TS 20452	Standardization of physical storage format for hard discs and etc. used for navigation
★	2	Navigation data delivery structures and protocols	ISO 24099	Standardization of data structures and protocols to transmit map data
★	3	Location referencing for geographic databases	ISO 17572-1 to 3	Standardization of location referencing when exchanging data between different applications or geographic databases
	4	Navigation systems – Application Programming Interface (API)	ISO 17267	Standardization of data access methods for application programs such as navigation systems
★	5	Extension of map database specifications for applications of cooperative ITS	ISO 14296	Building functional requirements and data models concerning the application of map databases in cooperative systems (including ADAS) within ITS
	6	Shareable geospatial databases for ITS applications	ISO 19297-1	Presenting the new framework which enables access to various geographic databases and data sharing between them
★	7	Geographic Data Files – GDF5.1 Part 1	ISO 20524-1	Standard (Part 1) for data exchange in geospatial databases for applications such as cooperative ITS, multi-modal navigation, and automated driving systems
★	8	Geographic Data Files – GDF5.1 Part 2	ISO 20524-2	Standard (Part 2) for data exchange in geospatial databases for applications such as cooperative ITS, multi-modal navigation, and automated driving systems
★	9	Precise Relative Location Referencing for Geographic Databases	ISO 17572-4	Addition of the forth profile that permits location referencing of “Which lane?” and “Where in the lane?” for the cooperation/automated driving system
★	10	Spatio-temporal Data Dictionary	TR 21718 V.2	Data dictionary second edition (TR) of static/dynamic data about spatio-temporal object for ITS and the cooperative/automated driving systems
★	11	Dynamic data and map database specification for connected and automated driving system applications	NP/TS 22726-1	Standardization of static, semi-static, and semi-dynamic map data elements and their data model used for applications of ADS and C-ITS systems (Part 1)
★	12	Dynamic data and map database specification for connected and automated driving system applications	NP/TS 22726-2	Standardization of static, semi-static, and semi-dynamic map data elements and their data model used for applications of ADS and C-ITS systems (Part 2)
	13	Shareable Geospatial Databases for ITS Applications	NP 19297-4	Specification for a common data structure that enables access to and sharing of various geospatial databases
	14	Shareable Geospatial Databases for ITS Applications	NP 19297-5	Specification for a data encoding method that enables access to and sharing of various geospatial databases

★ Item(s) that Japan is / has been actively working on

WG3 All related work items diagram (as of July 2021)

Automated driving system-related = red (planned year of issue/year of issue);
Non-automated driving system = black (planned year of issue/year of issue)



Geographic Data Files

GDF 5.1 (ISO 20524-1, FDIS 20524-2)

In terms of applications, GDF 5.0 primarily deals with geographic databases for navigation systems, but there is a growing need to update it in response to the emergence of new applications for cooperative ITS, multi-modal navigation, and automated driving systems. In October 2014, PWI 20524 was approved, and the process of revising GDF 5.0 was underway.

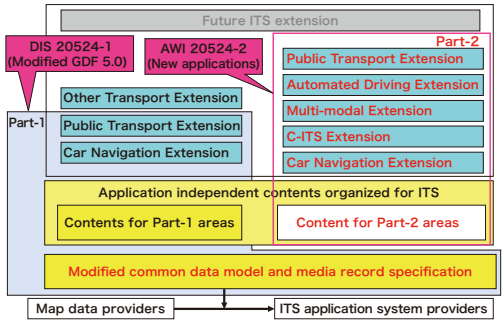
Led by Japan, work toward applying the ISO 14296 specifications to cooperative ITS is moving forward, with specifications being prepared that allow regionally-limited high-precision transmissions that match GDF 5.0 precision for all areas.

For multi-modal navigation, France is taking the lead in preparing specifications to achieve compatibility between the EN 12986 Reference Data Model for Public Transport (Transmodel) and GDF 5.0. Regarding automated driving systems, amidst expectations of future Japanese, European and U.S. input, Japan will be taking the lead in this area. The ISO for Part 1 was issued in April 2020, and the ISO for Part 2 is pending as of July 2020. Japan will also take the lead on automated driving systems, with Part 1 published by ISO in April 2020 and Part 2 published in November 2020.

As there has not been an international standard to date for models describing the road shape data for coordinating systems and/or automated driving systems, Japan suggested the Belt Concept (belt areas such as lanes are determined by physical and painted features) that would become the basic concept. This Belt Concept has received great interest from other participating countries, particularly those in Europe, and so it was able to get approval and a high degree of praise.

In relation to GDF, the TC 211/WG 10 (Ubiquitous public access) and TC 204/WG 3 joint working group (hereafter JWG) has been established, so we present the background to its establishment here. When it was initially developed, GDF (geographic data file), the basic standard of WG 3, was based on the 191xx-array of standards of TC 211. Subsequently, as WG 3 focused on car navigation systems and automated driving systems, gradually a gap began to be seen, partly because the geographical information systems of TC 211 did not target a specified application field. It is perceived that one of the factors behind this gap was caused by the lack of cooperation between TC 211 and TC 204.

GDF 5.1 Functional Block Diagram



For this reason, the two TCs established the JWG to develop a technical report (NP/TR 19169 Geographic information - Gap analysis for Geographic Data Files (GDF) and ISO/TC211 conceptual models to improve harmonization) to analyze this gap. In response, the TR was published in June 2021. Additionally, PWI 5974 (Evolution and revision formation for GDF) is still under joint development, and preparatory work is underway to determine the development direction and scope for GDF 6.0.

Navigation Data Delivery and Structures and Protocols (ISO 24099)

In Japan, there is rising demand for higher-resolution map data in the navigation system and ADAS fields. Addressing this demand requires the study of systems that enable only the necessary map data (necessary portions) to be transmitted when needed in real time. A map data transmission structure and protocol was initiated and proposed by Japan, and the NP was approved at the TC meeting in April 2006. It was issued as an ISO in January 2011.

Note that the systematic review was launched in January 2016, and the ISO 24099 was approved again.

Physical Storage Format (TS 20452) and API Standards (ISO 17267)

Discussions on drafts for Physical Storage Format (NP 14826), API Standard (NP 17267) and Updating (NP 17517) were delayed, and work on these items had to be finished in compliance with the new ISO rules.

An NP ballot to register NP 14826 agreements on standardization as official documents was proposed and approved. It was published as TS 20452 in June 2007. A new PWI was approved in October 2003 for NP 17267. The NP/CD ballot ended in October 2007 and was established as an ISO in November 2009.

In consequence of the systematic review started in November 2014, ISO 17267 was approved again.

Location Referencing (ISO 17572)

This covers methods for location referencing when information is exchanged between different applications and geographic databases. It is designed to find locations in different map databases when traffic information is exchanged between systems.

Initially, it was decided that a method based on coordinate systems and road descriptors would be adopted as an option, pending the results of demonstration experiments in Europe and the United States. However, progress in this field was stalled for some time because the results were not readily available.

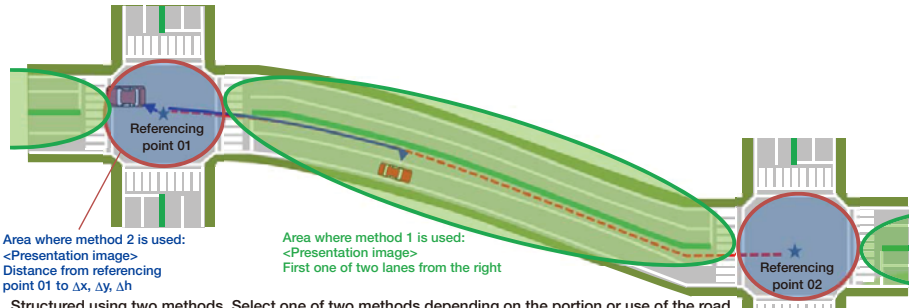
During the stalemate, the need for standardization of general-purpose LR grew sharply as the information community moved rapidly toward standardization. WG 3 therefore decided to broaden its focus from coordinate systems and road descriptors and work to establish a more comprehensive standard. Discussions took place on two methods: pre-coded profiling (precoded location references: a referencing method assuming common pre-coded location tables like VICS or TMC), and dynamic profiling (dynamic location references: a method which varies in real time), were launched in 2000. The draft was completed in November 2006. The CD ballot was completed in July 2007 and the FDIS ballot was completed in November 2008, followed by its issuance as an ISO in December 2008.

Dynamic Profiling evolved from the European proposal (AGORA-C) and incorporated Japan's proposal on using coordinates. The systematic reviews carried out since 2011 provided the opportunity to add Japan's Section ID Method as a new sample location reference method. An updated version was issued as ISO 17572 in January 2015.

In January 2016, following the NP/CD ballot to revise ISO 17572 Part 2 so as to include WG 10's NP 21219-20 (see the WG 10 work item list) to Precoded Profiles, the NP/CD ballot to revise ISO 17572 Part 2 was conducted, and it was issued as an ISO in September 2018.

In April 2016, addition of the 4th profile "Precise relative location referencing method" was accepted. It permits precision location referencing for the cooperative/automated driving systems. The work had already been started as NP 17572-4, and Part 4 was published as an ISO in April 2020.

Precise relative location referencing method



Structured using two methods. Select one of two methods depending on the portion or use of the road.

Method 1: Lane number counting
Applied to the portion of the road where the lane is used to identify the lane

Method 2: Measuring distance from a referencing point
Applied to portions of the road with unclear lane definition (within an intersection, before/after a tollgate, etc.)
Applied to the area within 200 m from a referencing point
Used as positional representation relative to the road (positional accuracy: 25 cm or less)

Extension of Map Database Specifications for Applications of Cooperative ITS (ISO 14296)

For in-vehicle digital map databases, Japan proposed a new PWI, "Extension of current specification of in-vehicle digital map databases" in response to new requirements such as ADAS and multi-modal navigation.

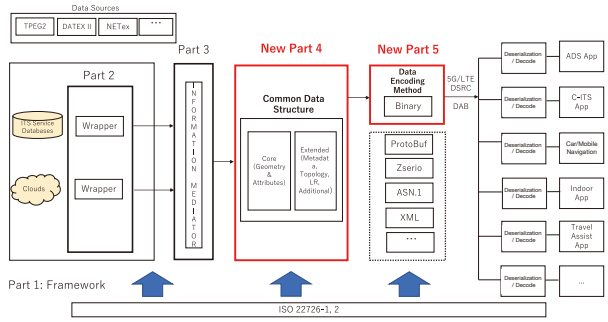
This was approved in May 2009. The scope was then expanded to cover static information in Local Dynamic Maps in Cooperative Systems, and this working item, with the title of "Extension of map database specifications for applications of cooperative ITS" was approved as an NP at the April 2011 TC meeting. The opening of CD/DTS voting for this item was approved in April 2012. WG 3 concluded one phase of the standardization activities for static information in Local Dynamic Maps at the end of 2012, and which was issued as TS 17931 prior to NP 14296, as explained in the next paragraph. Further, starting in 2012, ADAS and multi-modal navigation was studied, and the expansion of specifications for functional requirements, data models and data elements was done, and the resulting ISO was published in February 2016.

Shareable Geospatial Databases for ITS Applications (ISO 19297-1/ NP 19297-4; NP 19297-5)

Developments in communications and database technologies are allowing the introduction of new services such as indoor and multimodal navigation for mobile devices such as smartphones. New future services will require more extensive and detailed geospatial databases than the current car navigation map databases. This work item aims at standardizing the framework for new database services allowing the use and sharing of various geospatial databases.

The scope of this work item comprises four Parts, and the IS concerning the framework was issued as Part 1 in May 2019.

Continuing on from this, the WD of the common data structure is under development as Part 4. In April 2020, the existing Part 4 was split into two parts to improve development efficiency, and development is continuing as Part 4 (common data structure) and Part 5 (data encoding method).



Overall Conceptual Diagram for 19297 (consists of 5 parts)

Spatio-temporal data dictionary (TR 21718 second edition)

Data dictionary of static data (map elements, etc.) and dynamic data (traffic jam, vehicle speed, etc.) about spatio-temporal objects for ITS and cooperative/automated driving system. The key objective is to rectify disorder of terminology in the automated driving systems, and the TR first edition was created in 2016 by compiling data names/types/definitions/structures. Since 2017, the development of the spatio-temporal data dictionary second edition has been commenced in cooperation with the U.S. standardization body SAE, and the TR was issued in December 2018.

This work is aiming to create global ISO standards for data dictionaries by collaborating with European standardization body ETSI, but cooperation with respect to global standards could not be obtained from ETSI, and so problems of copyright, etc. could not be solved, and the proposal of new working items was abandoned.

Dynamic data and map database specification for connected and automated driving system applications (NP/TS 22726-1 and NP/TS 22726-2)

While the static map data model required for cooperative ITS is standardized as ISO 14296, this work item standardizes the logical data model of static map data required for new applications including automated driving systems. In addition, the logical data model for semi-static/semi-dynamic data, like traffic jam, accident and weather information, is defined without collision with multiple existing standards (including them instead). Also, by defining the relationship between semi-static/semidynamic data and static map data, the logical data model is provided that includes resulting three types of data items: static/semi-static/semi-dynamic.

The English names of each part of 22726 are as follows.

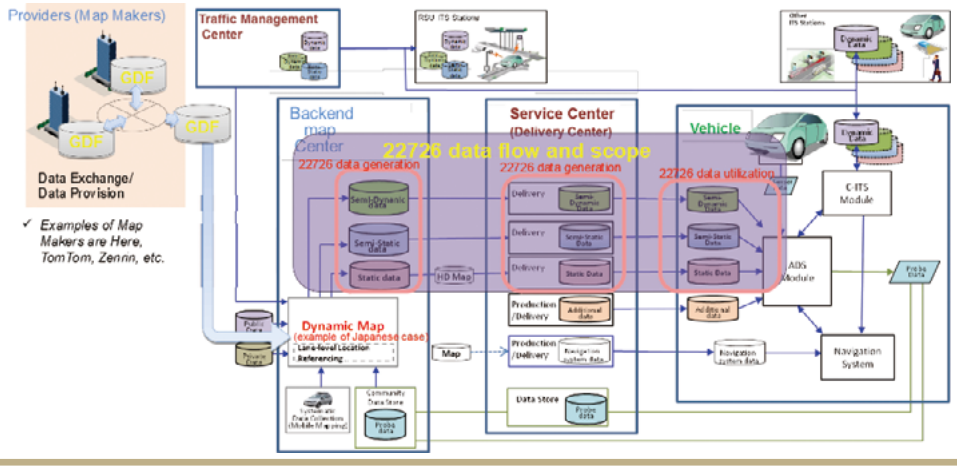
Part 1: Architecture and logical data model for harmonization of static map data

Part 2: Logical data model of dynamic data

As of July 2021, work is being made to respond to comments from various countries on the first version of the WD prepared by Japan for Part 1. Part 2 is currently being prepared primarily by European experts. The development deadlines for Part 1 and Part 2 are February 2023 and January 2023, respectively, with both to be published as TS.

ADAS: Advanced Driver Assistance Systems
PSF: Physical Storage Format
UML: Unified Modeling Language

Scope of PWI 22726



WG 5 Fee and Toll Collection

WG 5 is working on standardizing Electronic Fee Collection (EFC). Initially, all aspects of fees for roads, parking lots, ferries, etc. were targeted for standardization, but current work is focused on road charging systems. In addition to the Dedicated Short-Range Communications (DSRC) method used in Japan's ETC as communication methods between road side unit and vehicle, there is also the GNSS/CN method that uses GNSS (Global Navigation Satellite System) and CN (Cellular Networks).

EFC standardization has focused on interoperability, which has been introduced individually in various European countries since around 1990. In April 2004, the European Commission issued the European Directive on the Interoperability of Electronic Road charging Systems (Directive 2004/52/EC). In October 2009, it introduced the European Electronic Toll Service (EETS) and Definition of Technical Elements (Decision 2009/750/EC). These became the driving force for EFC standardization.

On the other hand, Japan's ETC system, which began full-scale operations in 2000, complied with the preceding European-led standards in the planning stage and then requested modifications to enable ETC to be used, such as IC card payment means. Since then, against the backdrop of the nationwide rollout of ETC and new tolling policies, active proposals for new items for development originating in Japan have been made in cooperation with Korea and China.

A new European Directive on EETS (Directive 2019/520/EC) was issued by the European Commission in March 2019. In addition to the conventional GNSS/CN (autonomous) and DSRC methods, ANPR (billing using number plate information) can also be used. ANPR is expected to be one of the solutions used to realize ETC dedicated expressway (cashless payments only), which is being implemented and deployed in Japan. Since ETC interoperability requires standardization of specific information to identify OBE, a new work item on the OBE setup methodology proposed by Japan was adopted at the 2020 plenary meeting.

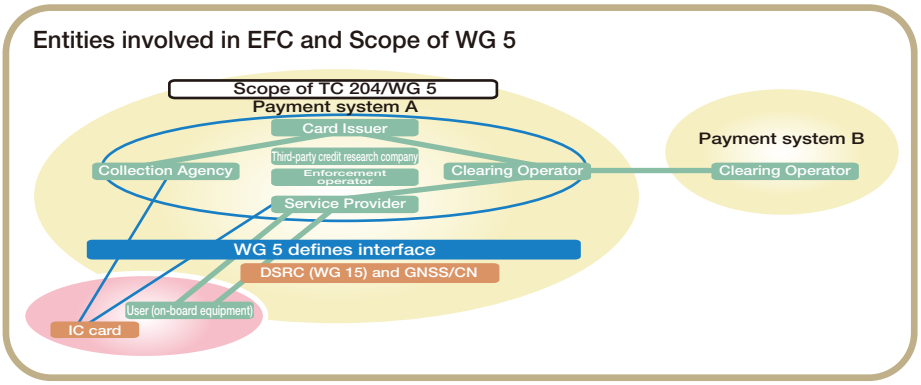
List of WG 5 work items

		Standardization themes	ISO Number	Content
	1	EFC – Application interface definition for dedicated short-range communication	ISO 14906	Prescription of data structures, commands and other factors to ensure the interoperability of 1 EFC applications for DSRC based EFC
★	2	EFC – Test procedures for user and fixed equipment-Part 1 to 2	TS 14907	Part 1 defines procedures and conditions for tests of EFC-related equipment. Part 2 defines conformance tests for on-board equipment, conforming to the EFC application interface definition (ISO 14906).
	3	EFC – Systems architecture for vehicle-related tolling-Part 1 to 3	ISO 17573	Definition of reference architecture for the entire EFC system and prescription of frameworks of various EFC-related conditions
★	4	EFC – Guidelines for security protection profiles	TS 17574	Provision for EFC security establishment in reference to IEC 15408 (IT security evaluation standard)
★	5	EFC – Security framework	TS 19299	Prescribe the framework to develop EFC security system by risk assessment and definition of system model.
	6	EFC – Application interface definition for autonomous systems	ISO 17575	Prescription of data structures, commands and other factors to ensure the interoperability of 6 EFC applications for autonomous systems (GNSS/CN)
★	7	EFC – Interface Definition for on-board Account Using Integrated Circuit Cards	ISO 25110	Interface definition between roadside equipment and on-board equipment using IC cards 7 that enable reading and writing of EFC information and account information on IC cards
★	8	EFC – Compliance Checking of autonomous systems over DSRC	ISO 12813	Checking the correct charging of autonomous EFC OBE by downloading the vehicle data via 8 DSRC initiated by roadside equipment.
	9	EFC – Information exchange between service provision and toll charging	ISO 12855	Describes the information flow between EFC service providers and parties who charge fees.
★	10	EFC – Localisation augmentation communication for autonomous systems	ISO 13141	Describes the communication requirements for enhancing the locating function of OBE for the autonomous system (GNSS/CN) using DSRC
	11	EFC – Evaluation of on-board and roadside equipment for conformity to ISO 12813-Part 1 & 2	ISO 13143	Defines conformity evaluation methods for the interfaces defined in TS 12813 (Compliance check 11 communication for autonomous systems) between OBE and roadside equipment
	12	EFC – Evaluation of on-board and roadside equipment for conformity to ISO 13141-Part 1 & 2	ISO 13140	Defines conformity evaluation methods for the interfaces defined in DTS 13141 (Localization augmentation communication for autonomous systems) between OBE and roadside equipment
	13	EFC – Evaluation of equipment for conformity to TS 17575-1 to 3	ISO 16407 TR 16401 ISO 16410	Conformity evaluation methods for TS 17575 (Application interface definition for autonomous systems) Part 1: Charging, Part 2: Communication and connection to the lower layers, Part 3: Context data
	14	EFC – Charging performance part 1 & 2	TS 17444	EFC performance standard (metrics) and inspection framework will be merged with parts 1 and 2 as ISO 37444, and work has begun on adding EFC using vehicle number plate information.
★	15	EFC – Interface definition between DSRC-OBE and external in-vehicle devices	TS 16785	Interface for extending DSRC OBE to autonomous systems (EFC using GNSS/CN)
★	16	EFC – Investigation of EFC standards for common payment schemes for multi-modal transport services	TR 19639	Scheme for the common use of cards and other media for transport services
★	17	EFC – Investigation of charging policies and technologies for future standardization	TR 21190	Proposing new work items based on research on new toll policy and corresponding technologies that are under consideration for adoption in all countries.
★	18	EFC – EFC support for traffic management	TS 21192	Define the data exchange between each entity relating to the architecture such as creating a common conceptual model for traffic management by charging.
★	19	EFC – Requirements for EFC application interface on common media	TS 21193	In accordance with the proposals in TR 19639, describes the requirement and data definition of common 19 media for allowing common usage among various modes of transportation.
★	20	EFC – EFC Personalization of onboard equipment-Part1 to 3	TS 21719-1 TS 21719-2 DTS 21719-3	Describes a method of setting up EFC on-board equipment: Part 1 defines its framework, Part 2 defines the setup via DSRC, and Part 3 defines the setup via IC card.
★	21	EFC using car number information Pre-study on the use of vehicle license plate information and ANPR technologies	ISO/PWI TR 6026	Technical report for further new proposals on EFC using Automatic Number Plate Recognition (ANPR) technology

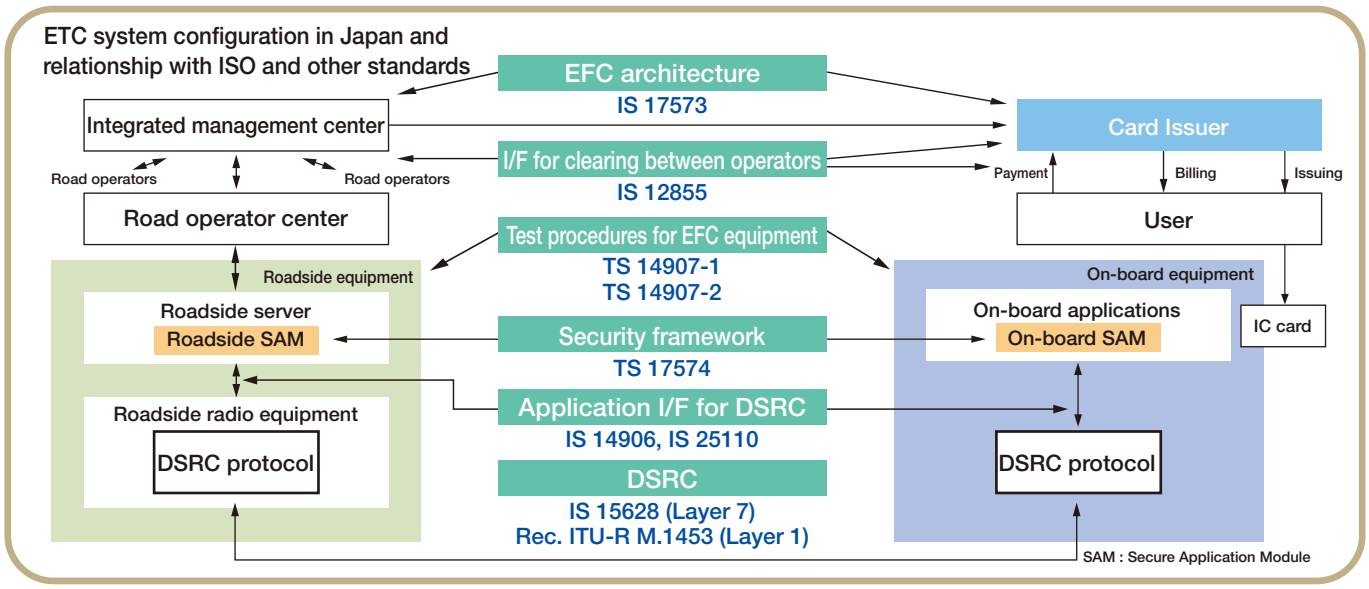
★ Item(s) that Japan is / has been actively working on

Overall Structure of EFC, Scope of WG 5, and DSRC method EFC

EFC-related entities include Card Issuers, Service Providers, Clearing Operators, and Collection Agencies, whose relationship is shown in the Figure on the right. WG 5 is working on the standardization of the EFC application interface (data elements, command definitions, and other factors) both for DSRC and GNSS/CN, which are means of communication between Service Providers and Users, and on the standardization of the test procedures and data security. Work on the standardization of DSRC has been completed by TC 204 WG 16 (former WG 15) and ITU-R SG 5.

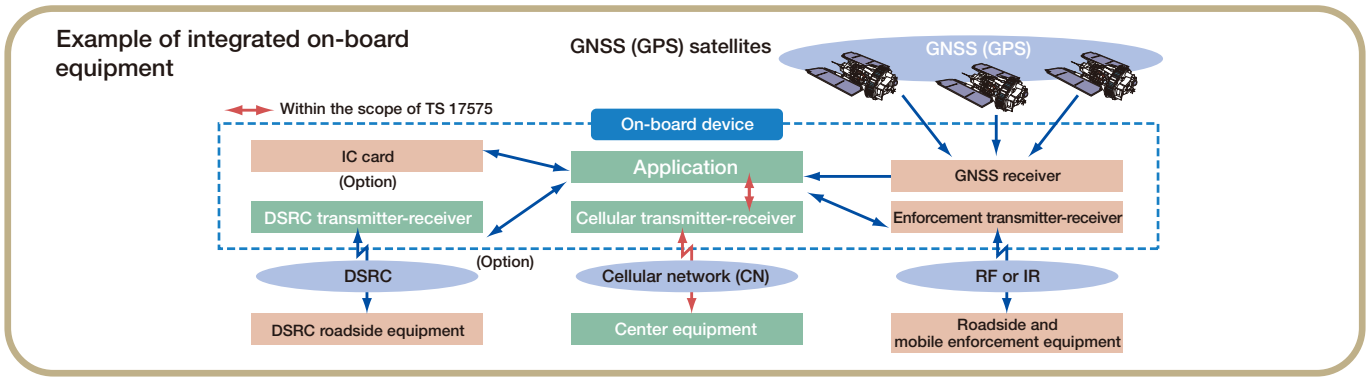


The figure below shows the ETC system configuration in Japan, and the corresponding ISO standards and ITU recommendations



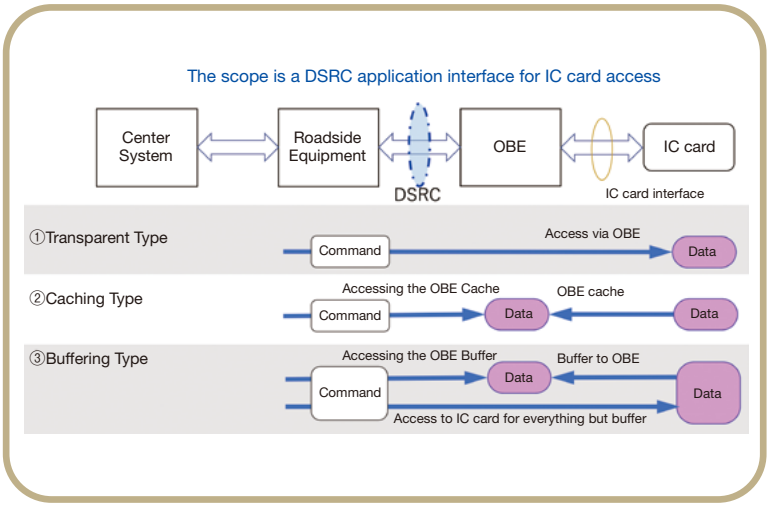
Application Interface Definition for Autonomous Systems (GNSS/CN) (ISO 17575)

The GNSS/CN based EFC was approved as a work item in 1997. The toll collection system for Heavy Goods Vehicles (HGV) in Germany since 2005, and Belgium since 2016 adopted this system. The on-board equipment continuously positions the geodetic coordinates of the present location with the built-in GNSS (GPS) receiver, and executes toll collection referring to tariff data downloaded via the cellular network. Various means of calculating fees, including on-board processing or central processing, are available. A variety of charging methods can be applied, such as zone charging for each virtual charging area entered, and distance-based charging applied to how far the vehicle has traveled. The Figure illustrates integrated on-board equipment using the DSRC method.



Interface definition for IC card-based OBE payments (ISO 25110)

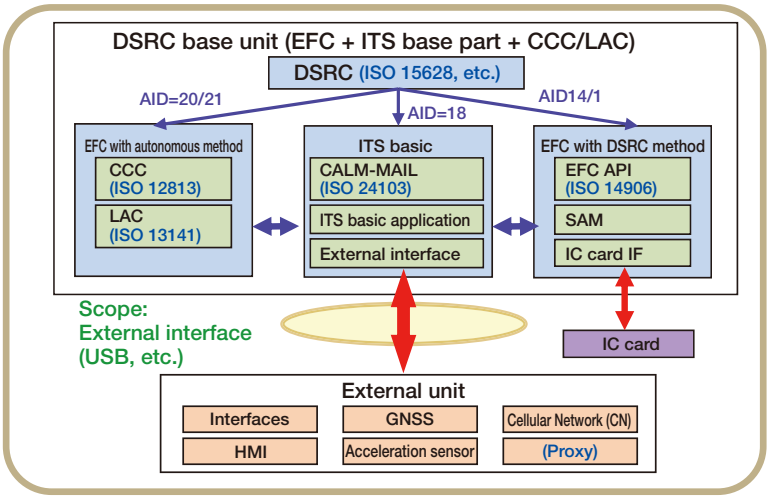
There are two major EFC-related charging methods. One is the central account system predominant in Europe and the U.S., and the other is the on-board account system using IC cards, used in Japan, Korea and other Asian countries. The ISO 25110 application interface defines three types, (1) the transparent type (2) the caching type (3) the buffering type, that enables roadside equipment to access IC cards via DSRC and on-board equipment is modeled on the Japanese and South Korean ETC and other systems. Japanese ETC using the caching type provides a secure data handling mechanism by equipping a SAM (Secure Access Module) on the on-board equipment and retaining storing privacy information from an IC card in the SAM.



Interface definition between DSRC-OBE and external in-vehicle devices (TS 16785)

Defines the application interface between the DSRC OBE and the external OBE when connected to achieve higher functionality and was officially published in 2014.

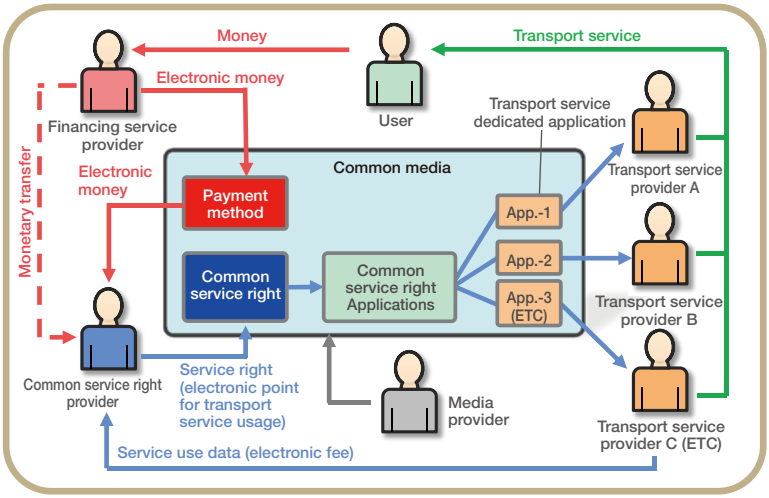
The OBE can also be used as an autonomous EFC OBE by connecting an external onboard device that implements a GNSS receiver module and a cellular communication module to the OBE. Thus, expandability can be provided by configuring the OBE with an external connection interface.



Investigation of EFC Standards for Common Payment Scheme for Multi-Modal Transport Services (TR 19639, TS 21193)

In Asian countries, there is a need to make payments with a single card for public transport, toll road and others. A common platform for inter-operable usage crossing over multiple transport services discussed in Urban ITS and Smart city, like MaaS, is anticipated for big data analysis in transport, for traffic demand management and for provision of incentives to users.

TR 19639 describes research into schemes allowing the use of ETC and/or public transportation cards as common payment media and proposes new work items. TS 21193 specifies the requirements and data definitions for EFC to media that can be shared amongst various types of transportation services.



Charging policy and technology (TR 21190)

While WG 5 has been working on the international standardization of EFC in DSRC and GNSS/CN methods to date, in recent trends in road pricing, new charging policies have been proposed and gradually brought into practical use with new technologies, including (1) toll method through guiding routes using ETC 2.0 in Japan, and (2) toll method using odometers in U.S. In addition, the new technologies have been developed that can be applied to toll charging is under way, including 5th generation cellular and RFID adopted with high driving speeds. This work item warp up research on new toll policies and technologies enabling them to be adopted in many countries who are considering introducing them, and summarized new work items.

Relationship between charging policy and charging technology (Portion applied with charging policy based on new technology becomes a new candidate item)

Charging technology \ Charging policy		Financing of road infrastructure			Traffic management	
		Toll road (ETC)	Inter-city road (Heavy goods vehicle charge)	All road	Urban road (Congestion Charge)	Inter-city road
ANPR: Automatic Number Plate Recognition					London Stockholm	
DSRC		World wide (More than 50 countries)	Austria, Czech Republic Poland, (Slovenia)		Oslo, Bergen, etc. Singapore	
GNSS	Cellular network		Germany, Slovakia, Hungary, Belgium, Russia, Bulgaria		(Singapore)	
	Odometer			USA Road Usage Charge		
	DSRC					Japan Smart route selection
RFID: Electronic tag		North America, South and Central America India, Taiwan, etc.				USA Express lane
WAVE: New DSRC		(South Korea)				
WIM: Dynamic load measuring apparatus		China				

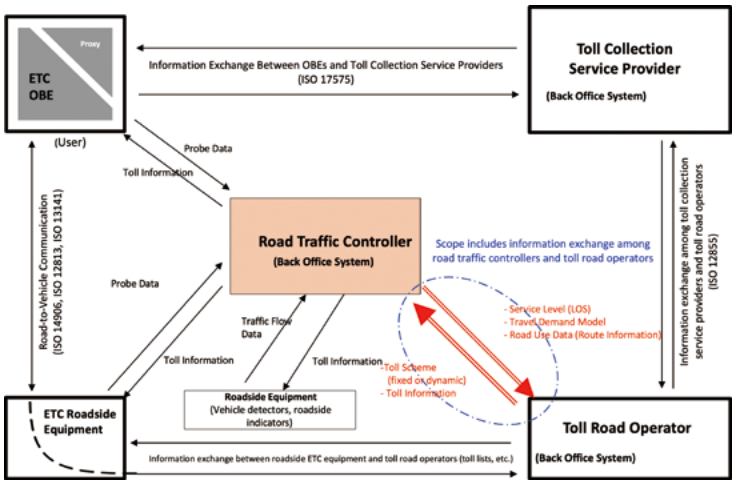
EFC based on existing technology

EFC based on new technology

Note: Countries in parentheses planning to introduce in near future

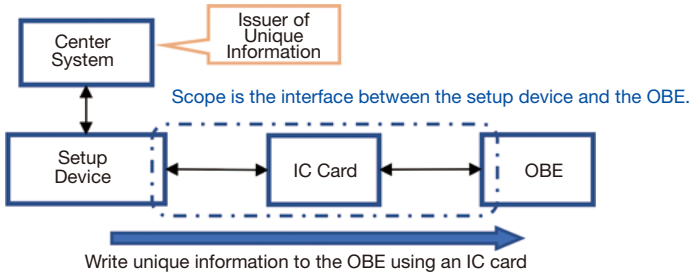
EFC support for traffic management (TS 21192)

This item was approved as a new work item that adding "Road & Traffic Manager" to the traditional EFC operation model and proposing the concept of a "traffic management via EFC support" service in collaboration with Toll Charger. Referring to traffic management such as smart route-selection and tolling discussed in Japan, ERP (Electronic Road Pricing) in Singapore and Express/HOT (High-Occupancy Toll) lane in the U.S., this standard defines the common concept model of traffic management based on traffic-demand-dependent dynamic tolls and the data exchange between Road & Traffic Operator and Toll Charger.



EFC Personalization of On-Board Equipment Using an IC Card (DTS 21719-3)

In order for a user to use on-board equipment, it is necessary to write unique information, such as the on-board equipment ID, to the on-board equipment. In Europe, standardization was also proposed for the unique information to be configured to enable a single OBE to be used for downstream billing across toll roads in multiple countries.Part 1 outlines the personalization of on-board equipment and Part 2 defines how to write unique information via DSRC adopted in Europe. Part 3 defines how to write unique information via IC card, which has been adopted in Japan, South Korea, and China.



EFC using number plate information (PWI 6026)

In Europe, it was decided to add EFC by using vehicle number plate information into European Electronic Toll Service(EETS), and a project team for standardization work was established under the European Commission's budget. Since EFC using vehicle number plate information may be applicable worldwide, Japan and Korea are participating in the drafting process.

WG 7 General Fleet Management and Commercial/Freight

In WG 7, the transport of hazardous goods and freight multi-modal transport have been standardized (a merger of previous WG 6 (General Fleet Management) and WG 7 (Commercial/Freight) agreed upon at the Montreal meeting in November 1999). Specific work items being discussed for standardization include the operational monitoring of commercial freight vehicles, data dictionary and message sets for international multi-modal transport, and commercial freight vehicle monitoring.

List of WG 7 work items

		Standardization themes	ISO Number	Content
	1	General fleet management and commercial freight operations – Data dictionary and message sets for electronic identification and monitoring of hazardous materials/dangerous goods transportation	ISO 17687	Definition of data dictionary and message sets supporting automatic identification, monitoring, and exchange of emergency response data for hazardous materials loaded on vehicles (SWG 7.1)
	2	Electronic information exchange to facilitate the movement of freight and its intermodal transfer – Road transport information exchange methodology	ISO 24533-1 CD 24533-2	Definition of data concept applied to freight multi-modal transport. Includes data exchanging message through transport interface along logistic chains. (SWG 7.2)
	3	Electronic information exchange to facilitate the movement of freight and its intermodal transfer – Governance rules to sustain electronic information exchange methods	TS 17187	Definition of governance rules for electronically conducting organization process inter-connected by business entities for electronic commerce under secure and open environment through a standard framework of the data exchange. (SWG 7.2)
★	4	Freight land conveyance content identification and communication	ISO 26683-1 ISO 26683-2 ISO 26683-3	Definition of application interface profiles and context for land transportation data exchange related to freight identification, package identification, container identification, and freight movement. (SWG 7.3)
★	5	Automotive visibility in the distribution supply chain – Part 1: Architecture and data definitions	ISO 18945-1	Establishes the framework and architecture of data collection, and provides data definition for visibility of vehicles, self-driving construction machines, and agriculture machines in distribution supply chains. (SWG 7.3)
★	6	Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV)	ISO 15638-1 to 25	Definition of collaborative telematics application of regulated commercial freight vehicles. (SWG 7.4)
★	7	Framework that uses TARV as a secure vehicle interface.	PWI 7815-1 PWI 7815-2	Definition of a framework for regulatory bodies to collect data without going through a service provider

★ Item(s) that Japan is / has been actively working on

Data Dictionary and Message Sets for Electronic Identification and Monitoring of Hazardous Materials/Dangerous Goods Transportation (ISO 17687)

Subject to this standardization are the data dictionary and message sets for supporting the exchange of information on hazardous materials as well as automatic identification and monitoring.

Effects of standardization are:

1. Real-time information collection (identification of vehicles, information on hazardous materials)
2. Support for cooperation between control center operators and emergency responders on site (police, firefighters, etc.) when an accident occurs during hazardous material transport
3. Monitoring of physical conditions (temperature and pressure, etc.) during hazardous material transport

In Europe and the United States, intermodal transport involving ships, railways and trucks is common in hazardous material transport. These items destined to be standardized are considered effective in providing one-stop service at borders.

Electronic information exchange to facilitate the movement of freight and its intermodal transfer—Road transport information exchange methodology (ISO 24533) Electronic information exchange to facilitate the movement of freight and its intermodal transfer—Governance rules to sustain electronic information exchange methods (TS 17187)

Work is progressing on the standardization necessary for electronic information exchange between shippers and logistics operators in international multi-modal transport. Since it is difficult to unify the international logistics data standards that differ by country and transport mode, a new concept called Electronic Supply Chain Manifest (ESCM) has been developed.

Freight land conveyance content identification and communication, architecture, reference standards, and monitoring (ISO 26683-1, -2, -3)

The system architecture for cargo management in surface transport aims to standardize application profiles (usage) applied to international multi-modal transport through the combined use of existing international standards and other rules, and to standardize the monitoring architecture for freight tracking. Part 3 has been published on May 10, 2019.

Automotive visibility in the distribution supply chain - Part 1: Architecture and data definitions (ISO 18495-1)

It is intended for the international standardization of monitoring systems encompassing identification (ID) and database (types of data: what, when, where, and how) for the transport of fully assembled vehicles, from delivery from the factory until the time of sale.

Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) (ISO 15638-1 to 25)

This set of standards is applied to the framework for conducting data collection/value information provisioning services assuming a system to provide users (freight operators) with regulatory and operational information through installation of vehicle sensors and GPS reception equipment in regulated commercial freight vehicles and transmission of data generated by these devices to service providers. It includes authentication for private ITS providers. It is also assumed that information regulatory violations be provided by service providers to the regulatory authorities. In Europe and the United States, operational management of commercial vehicles is being conducted through making the adoption of digital tachographs mandatory (use of a next generation tachograph was mandated in Europe on June 15, 2019).

At the April 2015 Hangzhou meeting, Part 20: Weigh in motion (proposed by the EU) and Part 21: Enhancements using roadside sensors (proposed by Japan), at the October 2016 Auckland meeting, Part 22: Vehicle stability monitoring, and at the April 2019 Florida meeting, Part 24: Safety information provision were proposed and approved as new work items and created as ISO standards.

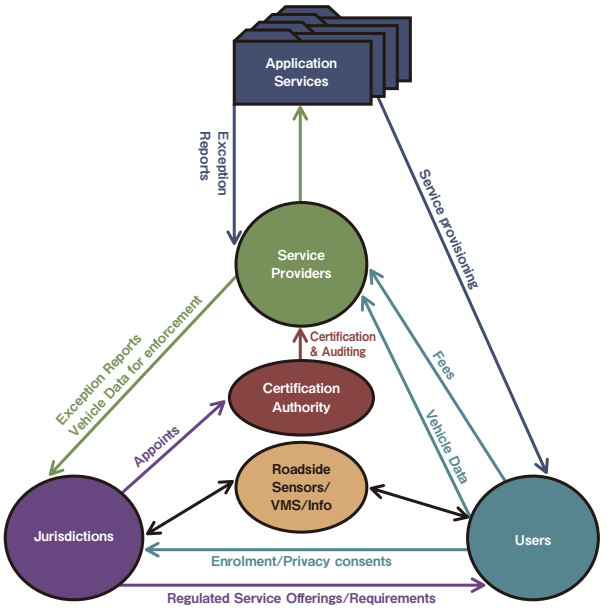
In the future, the ISO 15638 series is supposed to enable driver management, operational management and weight monitoring of heavy vehicles, and stable driving through combination of standards for each Part. The intention is to make it a valuable standard to improve efficiency of urban logistics.

Part 21 is a standard that contributes to the worldwide deployment of the Japanese ETC 2.0 service by standardizing cases of use of onboard and roadside equipment.

Part 22 is a framework for monitoring freight balance and informing the driver of the state of freight to protect heavy vehicles from the risk of rollover accidents. Part 24 provides a variety of information necessary for safe driving.

Part 25 will be a standard for a system for providing clearance information to heavy vehicles, preventing collisions with bridge girders.

Figure Framework diagram of ISO 15638



15638 series

ISO Number	Title
ISO 15638-1	Framework and architecture
ISO 15638-2	Common platform parameters using CALM
ISO 15638-3	Operating requirements, 'Approval Authority' procedures, and enforcement provisions for the providers of regulated services
TS 15638-4	System security
ISO 15638-5	Generic vehicle information
ISO 15638-6	Regulated applications
ISO 15638-7	Other applications
ISO 15638-8	Vehicle access management
TS 15638-9	Remote electronic tachograph monitoring (RTM)
ISO 15638-10	Emergency messaging system/eCall (EMS)
ISO 15638-11	Driver work records (work and rest hours compliance) (DWR)
ISO 15638-12	Vehicle mass monitoring (VMM)
TS 15638-13	'Mass' information for jurisdictional control and enforcement (MICE)
ISO 15638-14	Vehicle access control (VAC)
ISO 15638-15	Vehicle location monitoring (VLM)
ISO 15638-16	Vehicle speed monitoring (VSM)
ISO 15638-17	Consignment and location monitoring (CLM)
ISO 15638-18	ADR (dangerous goods) transport monitoring (ADR)
TS 15638-19	Vehicle parking facilities (VPF)
ISO 15638-20	Weigh-in-motion (WIM) monitoring
ISO 15638-21	Enhancements using roadside sensors (ERS)
ISO 15638-22	Vehicle stability monitoring
NP 15638-23	Tire monitoring
CD 15638-24	Safety information provision
PWI 15638-25	Vehicle tall clearance monitoring (planned)

WG 8 Public Transport and Emergency

WG 8 is responsible for the standardization of public transport. Public transport includes buses, trains, trams and emergency vehicles.

As one specific standardization item, CEN has led the standardization of Interoperable Fare Management Systems (IFMS). IFMS Parts 2 and 3 have been issued as TRs, and Part1 was reviewed from 2014 before being issued as an ISO in 2021.

The Public Transport User Information Part 1 proposed by Japan in autumn 2010, which encompasses the CEN TransModel, the U.S. PTCIP and Japanese standards on passenger information in public transport, was issued as an ISO in the spring of 2014.

Recently, interest in Mobility as a Service (MaaS) has been increasing globally, and MaaS services are also being gradually realized. Therefore, it is necessary to closely watch the situation.

List of WG 8 work items

		Standardization themes	ISO Number	Content
★	1	Data dictionary and message sets for pre-emption and prioritization signal systems for emergency and public transport vehicles (PRESTO)	ISO 22951	Standardization for data dictionary and message sets for traffic signal pre-emption and prioritization for emergency and public transport vehicles
★	2	Public transport – Interoperable fare management system – Part 1: Architecture	ISO 24014-1	Definition of conceptual architecture to establish a public transport fare management system that accommodates multiple operators and services
★	3	Public transport – Interoperable fare management system – Part 2: Business practices	TR 24014-2	Description of the set of rules necessary for installing IFMS based on the architecture specified in Part 1 and the relationship among the rules
	4	Public transport – Interoperable fare management system – Part 3: Complementary concepts to Part 1 for multi-application	TR 24014-3	Standardization for description of business practices within applications in multiapplication environments and interoperability between applications
	5	Public transport requirements for the use of payment applications for fare media	TR 14806	Standardization for IC cards and other payment methods
★	6	Public transport user information – Part 1: Standards framework for public information systems	ISO 17185-1	A comprehensive standard including public transport user information in various countries
	7	Public transport user information – Part 2: Public transport data and interface standards catalogue and cross reference	TR 17185-2	Standardization of public transport user information interfaces and use cases
★	8	Public transport user information – Part 3: Use cases for journey planning systems and their interoperation	TR 17185-3	A standard for use cases for journey planning systems and collaboration among them
	9	Public transport user information - Part 4: Safe journey planning use cases for multimodal travel for vulnerable road users	PWI 17185-4	A standard for travel plans to enable vulnerable road users to travel safely
	10	Emergency evacuation and disaster response and recovery – Part 1: Framework and concept of operation	TR 19083-1	Standardization of evacuation and restoration in emergencies
	11	Account-based ticketing state of the art report	TR 20526	Collection of latest trends in account-based ticketing
	12	Interoperability between IFM systems and NFC mobile devices	AWI 20527	Standardization for interoperability between IFMS systems and mobile equipment using near field communication devices
	13	Common transport service account systems – Part 1: Framework and use cases	DTR 21724-1	Definition of framework and use cases for the account system for public transport payment
	14	Performance testing for connectivity and safety functions of automated driving buses	NP 21734	Standardization pertaining to the connectivity and safety of automated driving buses that communicate with road infrastructure at signalized intersections, crosswalks, bus stops, etc.

★ Item(s) that Japan is / has been actively working on

The Importance of Public Transport

WG 8 has adopted public transport as a standardization subject, as excessive dependence on automobiles for moving passengers and cargos causes serious harm to our society and life, and damages sustainability. Reducing dependence on automobiles requires increasing urban density and making cities more compact, to permit a shift of transport modes from automobiles to walking, cycling and public transport.

Automobiles, however, provide door-to-door transport and comfort, and the out-of-pocket costs borne by drivers are considered to be lower in general than those of public transport.

An effective way to promote a shift to public transport is to enhance its attraction. Information has an extremely important role to play in this respect. The development of ICT has made it possible to select the most appropriate route using information such as public transport routes, transfers, operating situations, expected trip time and fare before starting out and while traveling.

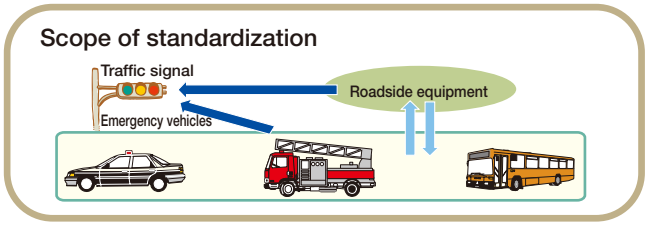
To dramatically improve the attractiveness of public transport, it is necessary to provide every passenger with seamless mobility by utilizing advanced information technologies. The commencement of MaaS operations throughout the world represents the future evolution of public transport.

Sharing of cars and bicycles is recently spreading in many countries. In addition, bus systems such as BRT/BHLS (Bus with a High Level of Service) are actively introduced. WG8 needs to monitor these trends carefully and attentively.

Pre-emption and Prioritization Signal Systems for Emergency and Public Vehicles: PRESTO (ISO 22951)

PRESTO is designed to exchange data efficiently for traffic signal pre-emption and prioritization so that public transport vehicles such as emergency vehicles, buses and trams can pass intersections preferentially over other vehicles. Data are exchanged principally between vehicles and roadside units. The standardization scope includes data dictionaries and message sets in the V2I/I2V communications.

Traffic signals can be controlled by prolonging a green time or shortening a red time based on information about the location, speed, destination and direction of travel of emergency vehicles at intersections so they can pass through them without hindrance. Other vehicles and pedestrians are informed of the presence of the approaching emergency vehicle to avoid a potential collision. This ISO was issued in January 2009.



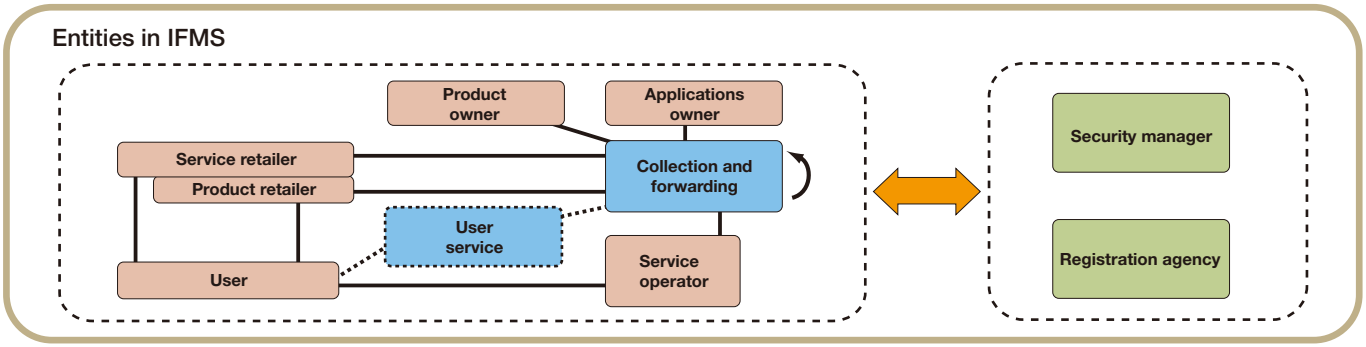
Interoperable Fare Management System: IFMS (ISO 24014)

The Interoperable Fare Management System (IFMS) is a conceptual architecture for the overall coordination of related systems to realize efficient operation and management of fare collection through IC cards and other payment methods in railways, buses and other types of public transport. In Europe, CEN/TC 278/WG 3 is leading the standardization of this system. In view of its significance, WG 8 decided to standardize IFMS in cooperation with CEN, and the PWI proposal for Part 1 was approved in October 2003.

The ISO was published in June 2007. The experts and participants from Japan showed great persistence in negotiating with CEN and succeeded in having Japanese input included in the ISO. The systematic review of Part 1 was completed in 2015.

Following Part 1, the standardization of Part 2 began. However, because its content covered a wide range of topics, they were split into new Parts 2 and 3. Japan served as editor for the new Part 2, in which a set of rules necessary for the actual application of IFMS has been compiled based on the architecture specified in Part 1. Parts 2 and 3 have been issued as TRs.

Following the publication of Parts 2 and 3, the need for revision of Part 1 became apparent. Consequently, Germany and Japan have embarked on this task cooperatively and an ISO standard was issued in 2021.



Public Transport User Information (ISO 17185)

Regarding information related to public transport, it was agreed in April 2007 that the standardization of a reference model be started based on the TransModel established by CEN. As part of the preparation, it was agreed to prepare catalogs of public transport in member countries, but this was postponed for a year due to budgetary constraints.

However, preparing catalogs of public transport information in individual countries takes a lot of time and effort, but works out limited practical value. Therefore, a comprehensive standard including information for users of public transport in member countries was proposed by Japan. In addition to the European Trans-Model and American PTCIP, this standard also includes related Japanese standards.

"Public transport user information Part 1: Framework" was proposed at the Jeju meeting in autumn 2010, and it was published as an ISO in spring 2014. The standardization of Parts 2 and 3 was performed in parallel, and they were published as a TR. Part 4 is also in the process of standardization.

Performance testing for connectivity and safety functions of automated driving bus (NP 21734)

This is a standardization proposed by the Republic of Korea which pertains to performance testing for the connectivity and safety of automated driving buses. Its purpose is to establish a standard for test procedure for connectivity and safety in operating automated driving buses that communicate with roadside infrastructure at signalized intersections, crosswalks, bus stops, and critical points in bus routes.

Initially, it was planned to establish one standard but the content of the standard was diverse, so at the Florida meeting in April 2019 it was decided to divide the original standard into the following three parts.

• Part 1 prescribes the framework and operation scheme of public transport using automated driving buses and defines the functions and requirements for providing a transport service using them. The elements of the system include automated driving buses, transportation infrastructure, monitoring centers, and passengers.

• Part 2 focuses on connectivity and safety requirements necessary for ensuring the reliability of public transport using automated driving buses. It standardizes performance testing methods and procedures in order to operate automated driving buses safely as public transport.

• Part 3 prescribes use cases to support automated driving buses. This part will be used to measure and improve the effectiveness of public transport supported by automated driving buses.

Part 1 and Part 2 are aiming for ISO and Part 3 for a TR.

There was a possibility this proposed standard could overlap with the low speed autonomous driving system service architecture that Japan has proposed to WG19. Adjustments were made to successfully resolve this issue at a web conference in the spring of 2020.

WG 9 Integrated Transport Information, Management and Control

WG 9 is working on the standardization of traffic management (traffic information and control, etc.) Specifically, it is working on the systematization of information and standardization of communication systems between traffic management centers, between centers and roadside modules, and between roadside modules, to enable efficient data exchange and to provide information to outside organizations.

List of WG 9 work items

		Standardization themes	ISO Number	Content
	1	Data interfaces between centers for transport information and control systems – Part 1: Message definition requirement	ISO 14827-1	Definition of message forms between centers for transport information and control systems
	2	Data interfaces between centers for transport information and control systems – Part 2: DATEX-ASN application	ISO 14827-2	Definition of a DATEX-ASN-based communication protocol between centers for transport information and control systems
★	3	Data interfaces between centers for transport information and control systems Part3: Data interfaces between centers for intelligent transport systems (ITS) using XML (Profile A)	ISO 14827-3	Definition of an XML-based communication protocol between centers for transport information and control systems
	4	Data interfaces between centers for transport information and control systems Part3: Data interfaces between centers for intelligent transport systems (ITS) using XML (Profile B)	NP 14827-4	Definition of an XML-based communication protocol between centers for transport information and control systems
★	5	Data exchange involving roadside modules communication	ISO 15784-1, 2, 3	Application profile of communication between roadside modules
	6	Integrated transport information, management and control – Data quality in ITS systems	TR 21707	Definition of data quality for ITS
	7	Interface protocol and message set definition between traffic signal controllers and detectors (IPMSTSCD)	ISO 10711	Definition of interface and message set between vehicle detectors and traffic signal controllers
★	8	The use of simulation models for evaluation of traffic management systems – Input parameters and reporting template for simulation of traffic signal control systems	TR 16786	Specification of input parameters and report templates in evaluating signal control systems through simulation
★	9	Definition of data elements and data frames between roadside units and signal controllers for cooperative signal control	TS 19082	The definition of a use-case, requirements and data concepts for traffic signal control, incorporating probe data
	10	Data interfaces between centers for transport information and control systems – Platform independent model specifications for data exchange protocols for transport information and control systems	TS 19468	Platform independent model specifications for data exchange protocols for transport information and control systems
	11	Roadside modules SNMP data interface	ISO 20684-1, 2 3 to 7, 10	Definition of application interface using SNMP between roadside modules and the center
★	12	Roadside modules AP-DATEX data interface	DIS 22741-1, 2, 10	Definition of application interface using DATEX-ASN between roadside modules and the center

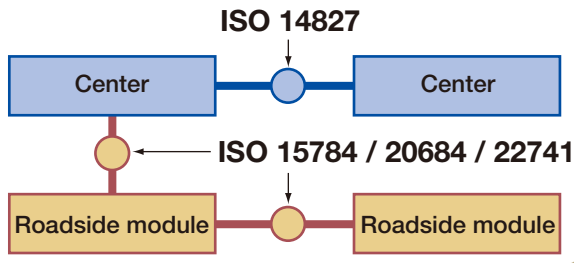
★ Item(s) that Japan is / has been actively working on

Scope of standardization

The scope (center-to-center, centers-to-roadside) of standardization that WG 9 is working on is shown in the Figure. Centers refer to transport management centers. Roadside modules include signal control devices, information boards and sensors installed along roads.

Ensuring interconnectivity is one advantage of promoting the standardization of information and communication between centers as well as centers and roadside modules. It also reduces the risks involved in purchasing modules by procurers, and in development by module suppliers.

Scope of standardization



Definition of data elements and data frames between roadside units and signal controllers for cooperative signal control (TS 19082)

Recently, in addition to vehicle detectors, road-to-vehicle communications are making it possible to collect traffic information (probe data). Under the circumstances, Japan made a proposal for standardizing data usable for signal control to facilitate the construction of a signal control system based on this information.

This proposal was approved as a DIS in 2019, but firstly issued as a TS in 2020. Preparation are underway to upgrade the TS to an ISO.

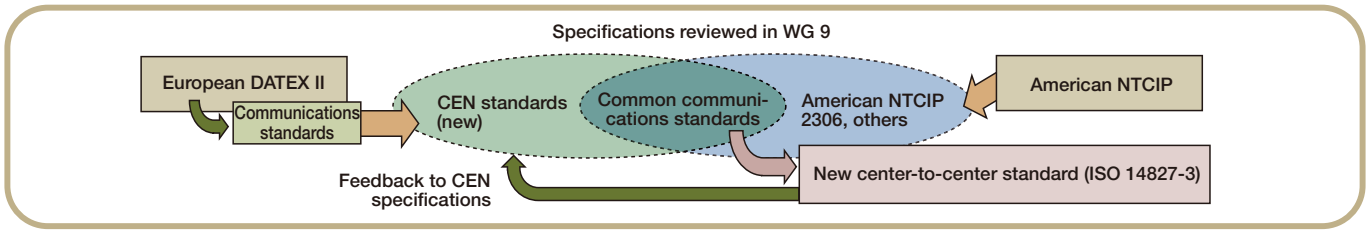
Communication between Centers (ISO 14827, TS 19468)

Communication between centers is aimed at information exchange between traffic management centers, in which information collected by one transport management center is exchanged with neighboring centers, enabling the implementation of extensive transport management. WG 9 stipulates the definition forms of messages and the protocol for the exchange of messages of communication between centers.

Firstly, ISO 14827 Part 1 and Part 2, which specify the application layer communication specification called DATEX-ASN as a protocol, were published as ISO standards in 2005. Preparations are underway in Japan to abolish Part 1 and revise Part 2 to ensure consistency with subsequently established European standards.

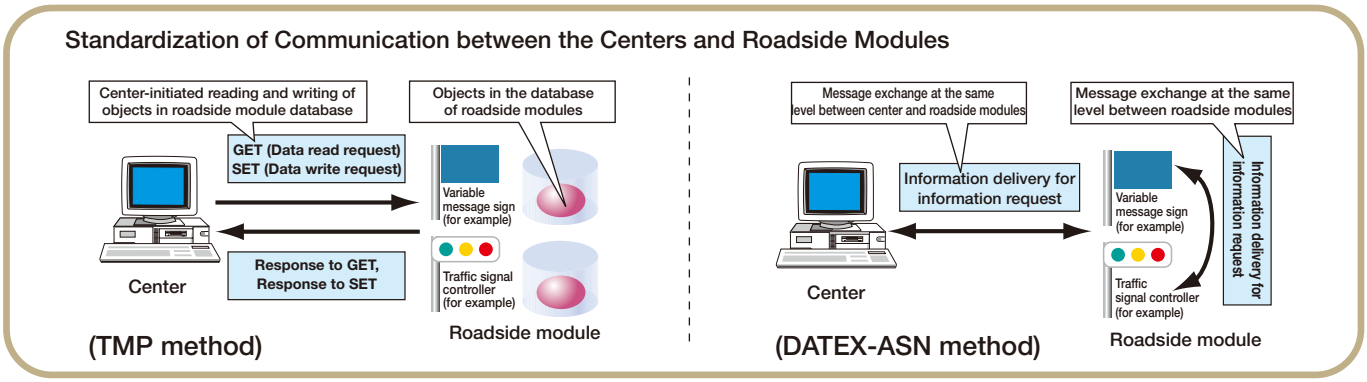
Moreover, Part 3, in which Japan led the development, defined messaging rules using an XML-based protocol in a form compatible with both the European DATEX II and the American NTCIP standards for communication between centers. It was published as Part 3 in January 2019.

In Europe, regulations for platform-independent communications based on DATEX II are being specified as TS 19468. In accordance with this TS, discussions have started on a profile using XML-based SOAP as Part 4 of ISO 14827.



Communication between Centers and Roadside Modules (ISO 15784)

Communication between centers and roadside modules refers to the exchange of information between the central modules of a transport management center and modules installed along roads, as well as between different roadside modules. WG 9 prescribes communication by specifying an array of underlying standards for the upper layer 3 of OSI, and formulating methods of using them as an application profile. Specifically, the group has defined Part 2, which specifies TMP (Transportation Management Protocols) formulated as part of NTCIP (National Transportation Communication for ITS Protocol), a communication standard in the ITS field in the U.S., and Part 3, which specifies DATEX-ASN of ISO 14827-2, along with their use of an international standard for intertraffic-management-center communications. Each part has been issued as an ISO document.



Communication Interface between Centers and Roadside Modules (ISO 20684, DIS 22741)

This item is aimed at standardization of the data set used between the transport management center and roadside modules or between roadside modules using the application profile defined in ISO 15784.

The ISO20684 series led by the United States using the SNMP method and the ISO22741 series led by Japan using the DATEX-ASN method are being developed in parallel. The ISO 20684 series has been published in two parts: Part 1 (overview) as IS and Part 2 (basic management) as TS, and the detailed functions are being studied in Parts 3 to 7. The ISO 20684 series, part 1 (overview), was approved as DIS in 2020. Korea proposed the additional standardization of communication with visual message signs, and part 10 of 20684 was published as a TS in 2021.

Interface Protocol and Message Set Definition between Traffic Signal Controllers and Detectors (ISO 10711)

The scope of this item is to standardize message sets for information from vehicle detectors to generate signal control parameters.

The standard is classified into two methods: one is bulk transmission of every item simultaneously, and the other is individual transmission in some separate groups. South Korea proposed this item in 2006, and Japan actively joined the standardization work, focusing on incorporating the separate transmission method for data sets in the draft. Consequently it was approved as an ISO and published in 2012.

WG 10 Traveler Information Systems

Traveler information systems, subject to standardization by WG 10, constitute a core part of ITS. This working group has work items designed to study data dictionaries and message sets to provide information to drivers through various communication media, such as FM broadcasting, DSRC, and digital broadcasting. Recently, the Transport Protocol Experts Group (TPEG) has stepped up its UML modeling activities.

List of WG 10 work items

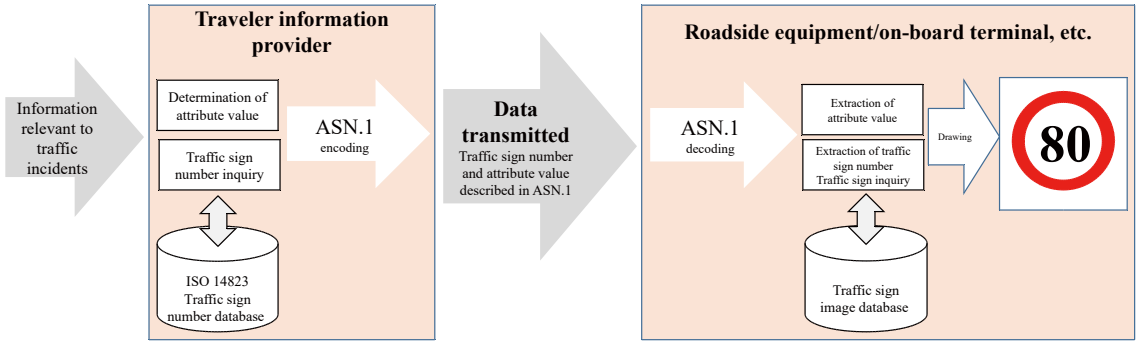
		Standardization themes	ISO Number	Content
	1	TTI messages via traffic message coding	ISO 14819-1	Coding protocol for the RDS-TMC
			ISO 14819-2	Event and information codes for the RDS-TMC
			ISO 14819-3	Location referencing for the RDS-TMC
			ISO 14819-6	Encryption and conditional access for the RDS-TMC
★	2	Intelligent transport systems – Graphic data dictionary	ISO 14823	Specification for road traffic signs and designs code data dictionary codes
			TR 14823-2	Example of road traffic signs and designs data dictionary codes transmission message description
	3	Traffic and Travel Information via Transport Protocol Experts Group	TS 18234-1	TPEG1 binary version; Introduction, numbering and versions
			TS 18234-2	TPEG1 binary version; Syntax, semantics and framing structure
			TS 18234-3	TPEG1 binary version; Services and network information
			TS 18234-4	TPEG1 binary version; Road Traffic Message (RTM) application
			TS 18234-5	TPEG1 binary version; Public Transport Information (PTI) application
			TS 18234-6	TPEG1 binary version; Location referencing applications
			TS 18234-7	TPEG1 binary version; Parking information
			TS 18234-8	TPEG1 binary version; Congestion and travel time application
			TS 18234-9	TPEG1 binary version; Traffic event compact
			TS 18234-10	TPEG1 binary version; Conditional access information
			TS 18234-11	TPEG1 binary version; Location Referencing Container
			TS 24530-1	TPEG XML version; Introduction, common data types and tpegML 1
			TS 24530-2	TPEG XML version; Location referencing
			TS 24530-3	TPEG XML version; Road traffic message
			TS 24530-4	TPEG XML version; Public Transport Information
			TS 21219-1	TPEG2 UML version; Introduction, numbering and versions
			TS 21219-2	TPEG2 UML version; UML modeling rules
			TS 21219-3	TPEG2 UML version; UML to binary conversion rules
			TS 21219-4	TPEG2 UML version; UML to XML conversion rules
			TS 21219-5	TPEG2 UML version; Service framework
			TS 21219-6	TPEG2 UML version; Message management container
			TS 21219-7	TPEG2 UML version, Location referencing container
			TS 21219-9	TPEG2 UML version; Service and network information
			TS 21219-10	TPEG2 UML version; Conditional access information
			TS 21219-14	TPEG2 UML version; Parking information application
			TS 21219-15	TPEG2 UML version; Traffic event compact
			TS 21219-16	TPEG2 UML version; Fuel price information application
			TS 21219-18	TPEG2 UML version; Traffic flow and prediction application
			TS 21219-19	TPEG2 UML version; Weather information
			TS 21219-21	TPEG2 UML version; Geographic Location Referencing
			TS 21219-22	TPEG2 UML version; OpenLR Location Referencing
			TS 21219-23	TPEG2 UML version; Road and multimodal routes application
			TS 21219-24	TPEG2 UML Version: Light encryption for TEPG
			TS 21219-25	TPEG2 UML Version: Electromobility charging infrastructure
			TS 21219-26	TPEG2 UML Version: Vigilance location information

Note: TTI: Traffic and Travel Information, RDS-TMC: Radio Data System-Traffic Message Channel
★ Item(s) that Japan is / has been actively working on

Graphic Data Dictionary (ISO 14823)

This work item involves the standardization of a graphic data dictionary (GDD) of pictograms, including road traffic signs and designs.
This is intended to display pictograms corresponding to transmitted GDD codes on variable information boards or on-board devices. As pictograms vary from country to country, only the codes and their attributions (time, distance, direction, vehicle width/height, etc.) they represent, rather than the actual pictograms or designs, are subject to standardization. Japan took the lead for this work item, which was published as TS in 2008. Later, the standard was revised at the strong request of the European members of WG 18 DT 8.3. The group implemented major revisions in collaboration with WG 1. The standard was published as an ISO in 2017 but in response to requests for modifications from each country, the group is currently proceeding with revision work. Furthermore, the group plans to compile examples of codes and attributes described in ASN.1 as TR (14823 Part 2).

Example of the flow of data and processing with respect to IS 14823 (in the case of variable speed restrictions)



TTI Messages Using Broadcasting-Type Digital Media (TS 18234-1 to 11, NP/DTS/TS 21219-1 to 26, TS 24530-1 to 4)

TPEG is a proposal to standardize a method of providing traffic information using high-speed digital data broadcasting.

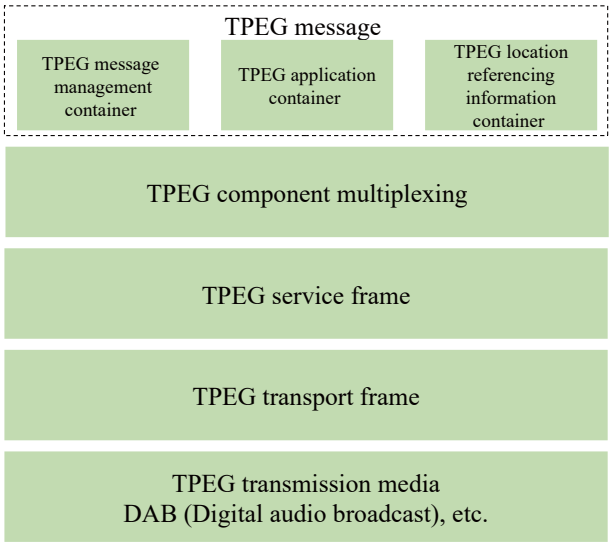
TPEG standardization has progressed in the binary and XML categories, with UML currently being advanced for the next-generation TPEG. Further, official liaison has been established between WG 10 and the Traffic Information Service Association (TISA), a European organization engaged in the actual preparation of drafts for TPEG. While TISA is energetically working on those drafts, actual systems making use of TPEG are becoming more widespread, particularly in Europe and North America.

TPEG messages are comprised of the TPEG message management container which manages the application's generation time and version, the TPEG application container of the traffic event information (TPEG-TEC) and TPEG parking lot information (TPEG-PKI), etc., and the TPEG location referencing container concerning the location information for the events.

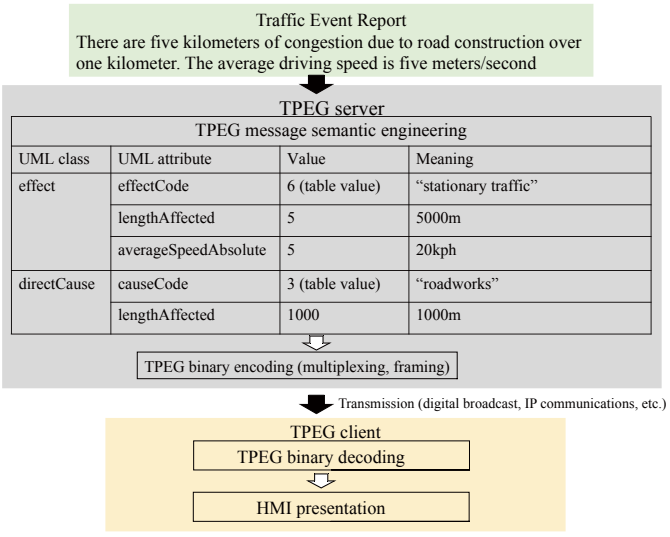
The figure shows examples of generation of traffic congestion information utilizing TPEG-TEC (TPEG event compact).

When a traffic event report ("There are five kilometers of congestion due to road construction over one kilometer. The average driving speed is five meters/second") is transmitted to the TPEG server, binary data that has undergone semantic encoding, multiplexing, and framing in accordance with the UML specifications of TPEG-TEC is sent to the client via digital broadcast and IP communications, and after it is decoded the event information is displayed to the user.

Regarding TPEG, in the future, there are plans to proceed with information gathering, to cooperate with the domestic and foreign parties concerned, and to promote the presentation of comments and counter-proposals.



Frame structure of TPEG



Example of traffic information provision data flow using TPEG

WG 14 Vehicle/Roadway Warning and Control Systems

WG 14 is working on the standardization of driving support systems and automated driving systems to reduce driver workload, improve convenience, raise awareness of danger, prevent accidents/mitigate damage and reduce CO2 using advanced technologies. Vehicles equipped with systems such as Adaptive Cruise Control (ACC) and Forward Vehicle Collision Mitigation Systems (FVCMS)—standards created by WG 14—are available on almost all new vehicles in many countries.

Chaired by Japan, WG 14 includes many participating countries and is internationally recognized as one of the most active groups in TC 204.

List of WG 14 work items

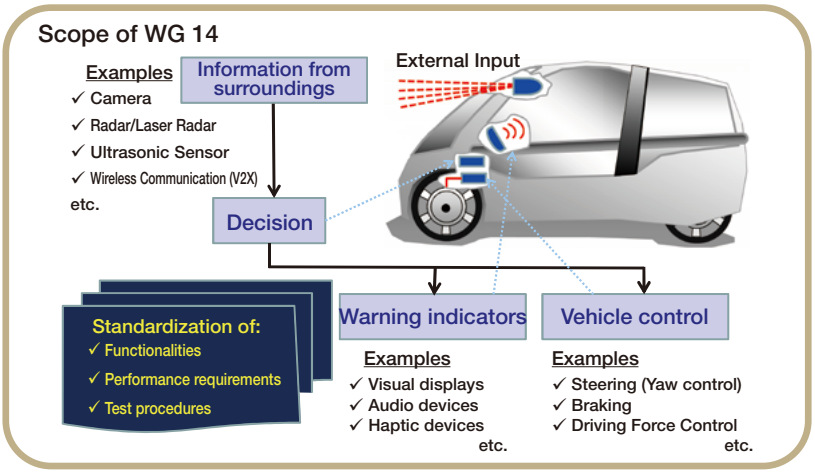
		Standardization themes	ISO Number	Content
	1	Adaptive Cruise Control systems (ACC)	ISO 15622	System for maintaining a certain distance from the vehicle ahead Consists of classification according to the existence of a clutch or active braking, and specification of control strategy, and driver intervention characteristics Revised to include ISO 22718 LSF (annulled) and ISO 22179 FSRA (annulled).
	2	Forward vehicle collision warning systems (FVCWS)	ISO 15623	System for preventing rear-end collisions by activating a warning whenever the vehicle in front is too close and prompting the driver to maneuver to avoid collision Consists of specification of detection range and performance, as well as evaluation methods concerning the vehicle ahead
★	3	Traffic Impediment Warning Systems (TIWS)	TS 15624	System that identifies obstacles in roads ahead of the vehicle through roadside sensors, and informs the driver using roadside message boards Has been established as TS as the infrastructure depends on unique factors that vary from one country to another
	4	Manoeuvring Aids for Low Speed Operation (MALSO)	ISO 17386	System to inform the driver of obstacles found at the rear or corners of the vehicle when backing up and turning at low speed Specification consists of classification based on detection areas, and specifications of system operation conditions, and test methods
★	5	Lane departure warning systems (LDWS)	ISO 17361	System to warn the driver of an actual or possible departure from a lane due to driver's inattention. Consists of specification of lane departure definition, warning conditions, and test methods
	6	Lane change decision aid systems (LCDAS)	ISO 17387	System to inform the presence of a vehicle in a blind spot or a vehicle approaching from behind when a driver is trying to change lanes Consists of classification based on areas covered, and specifications of warning conditions, and test methods
	7	Forward vehicle collision mitigation systems (FVCMS)	ISO 22839	System that automatically applies emergency braking to mitigate collision damage if there is a risk of collision with the vehicle ahead Operational concepts, system requirements, and evaluation procedures are specified
	8	Extended-range backing aid systems (ERBA)	ISO 22840	System to provide information on obstacles at the rear of the vehicle when backing up for a relatively long distance. Consists of specification of the obstacles concerned, detection area and system operation conditions, in comparison with MALSO
	9	Cooperative intersection signal information and violation warning systems (CIWS)	ISO 26684	System based on roadside and vehicle cooperation that displays current traffic light information on on-board equipment and uses it to activate a warning system if the driver is about to ignore a red light Specifies basic functions and information contents
	10	Curve speed warning systems (CSWS)	ISO 11067	System alerting the driver, using a navigation map for example, if a safe speed is exceeded as the vehicle approaches a curve Specifies system definition and required items
	11	Lane keeping assistance systems (LKAS)	ISO 11270	System that recognizes the lane markings and automatically controls steering to help keep the vehicle in it Specifies system definition and requirements
★	12	Assisted Parking System (APS)	ISO 16787	System that detects parking spaces and provides automatic steering while parking Specifies system definition and requirements
★	13	External hazard detection and notification systems (HNS)	ISO 18682	Specification of fundamental concepts for notifications and warnings in cooperative and autonomous systems
★	14	Pedestrian Detection and Collision Mitigation Systems (PDCMS)	ISO 19237	System that automatically applies emergency braking to mitigate collision damage if there is a risk of colliding with a pedestrian ahead Operation concepts, performance requirements, and evaluation procedures are specified
★	15	Report on standardization for vehicle automated driving systems (RoVAS)	TR 20545	A technical report with a broad view of automated driving functions, with items to standardize spanning many fields.
★	16	Road Boundary Departure Prevention Systems (RBDPS)	ISO 19638	The system will control the vehicle's braking and steering to prevent departure from the road boundary.
	17	Cooperative Adaptive Cruise Control (CACC)	ISO 20035	The system maintains a suitable distance to the vehicle ahead using V2V and V2I communication with multiple vehicles and the infrastructure.
★	18	Partially Automated Parking System (PAPS)	ISO 20900	The system controls both the longitudinal and lateral movement of the vehicle during parking maneuvers. The driver remains in the car in Type 1, and remotely supervised by the drive outside the car in Type 2.
	19	Emergency Electronic Break Light systems (EEBL)	ISO 20901	The system warns the driver against danger caused by emergency braking of forward vehicles on the upcoming road.
★	20	Partially Automated Lane Change Systems (PALS)	ISO 21202	The system recognizes lane markings and conditions around the vehicle through sensors, and changes lanes automatically upon receiving instructions or confirmation from the driver.
	21	Partially Automated In-lane Driving Systems (PADS)	ISO 21717	The system automatically controls the vehicle in longitudinal and lateral directions within the lane.
	22	Bicyclist detection and collision mitigation systems (BDCMS)	ISO 22078	System that automatically applies emergency braking to mitigate collision damage if there is a risk of colliding with a bicyclist ahead. Operation concepts, performance requirements, and evaluation procedures are specified.
	23	Low-Speed Automated Driving (LSAD) Systems for Predefined routes	ISO 22737	System that, in the limited operational design domain, automatically operates vehicles in low speed.
	24	Taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles	ISO/SAE PAS22736	Public available specifications describing taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles. ISO and SAE work collaboratively on revision of draft of SAE issued standard.
★	25	Automated Valet Parking System (AVPS) - Part 1: System Framework, requirements for automated driving, and communication interface	CD 23374-1	Defines a series of communication specifications for searching for parking facilities with available spaces, making reservations, and calling parked vehicles, as well as performance requirements and test methods for Level 4 automated driving in parking facilities.
★	26	Collision Evasive Lateral Manoeuvre system (CELM)	AWI 23375	System using in-vehicle sensors that detects an object to be avoided and controls the lateral movement of the vehicle to avoid colliding with the object.
	27	Vehicle to Vehicle Intersection Collision Warning system (VVICW)	PRF 23376	System using vehicle-to-vehicle communications that warns the driver if the vehicle is predicted to collide with another vehicle at an intersection in the direction that the vehicle is heading.
★	28	Motorway Chauffeur Systems - Part 1: Overall Structure and Necessary Requirements (MCS-1)	AWI 23792-1	Stipulates the overall framework of systems for Level 3 automated driving on limited-access highways (Part 1) and functional requirements and test procedures for automated driving within a lane.
★	29	Motorway Chauffeur Systems - Part 2: Discretionary Lane Change (MCS-2)	PWI 23792-2	Adds functional requirements for lane changing off systems for Level 3 automated driving on limited-access highways and stipulates a test method for it.
	30	Minimal Risk Maneuver (MRM)	AWI 23793-1 PWI 23793-2	A function to automatically achieve a minimal risk condition (MRC) when an automated driving system cannot continue to operate a vehicle. Part 1 stipulates the framework and common requirements. Part 2 stipulates the requirements for road shoulder shunting systems.
★	31	Truck Platooning Systems (TPS)	CD 4272	Specifies functions for joining and leaving a platoon, functions for platoon maintaining control and communication information, and evaluation and testing methods for systems that manage platoon driving (multiple trucks maintaining a certain distance while driving in the same lane).
	32	Automated Braking during Low Speed Maneuvering (ABLS)	AWI 4273	Requirements and test method for braking operations to prevent contact with obstacles while driving at speeds of approx. 10 km/h (comments are being submitted for 10 km/h or more) or less for the purpose of parking.
★	33	Remote assist system for Low-Speed Automated Driving (LSAD) system equipped vehicle — Performance requirements and test procedures	PWI 7856	Specifies requirements and test methods for mechanisms to support automated vehicles equipped with low-speed automated driving systems (LSADs), as standardized by ISO 22737, through remote driving or remote assistance.

★ Item(s) that Japan is / has been actively working on

WG 14 is broad in scope, as it covers standalone/cooperative warnings and control systems, including vehicle control, sensing of the surrounding environment, communications, and presenting information to drivers, and the group has issued 26 international standards to date. We have 24 currently valid standards, and 9 currently under development.

WG 14 has also established collaborative relationships with standardization bodies including ETSI TC ITS*[1], SAE DSRC TC*[2], SAE ORAD TC*[3], and ISO/TC 22/SC 33*[4].

*1 European Telecommunications Standards Institute Technical Committee of ITS
*2 Dedicated Short Range Communication Technical Committee
*3 On-Road Automated Driving Technical Committee
*4 Road vehicles - Vehicle dynamics and chassis components

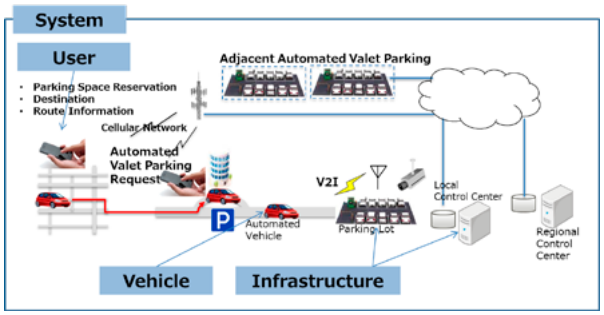


CD 23374-1 Automated Valet Parking System (AVPS)

There are two major elements in an automated valet parking system. The first is the interface between the user and the service provider for searching for and reserving facilities where parking is possible, and retrieving the parked vehicle, etc. The second is automatic operation of the vehicle between the location where the user gets on/off and the parking spot.

Since multiple subsystems are necessary to materialize these functions, early development of standards for the communications content and division of roles will contribute to establish overall interoperability, increase convenience for users, and encourage promote spread of the systems.

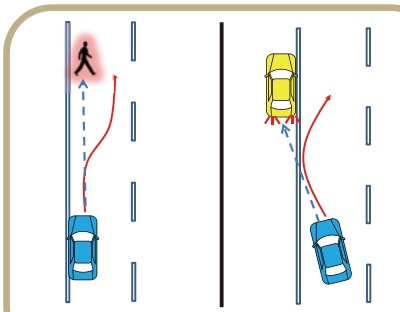
Spread of these kinds of systems in society are expected to reduce the number of accidents in parking lots, to utilize narrow spaces effectively, and to contribute to reducing the energy consumed by parking spot search and the accompanying unnecessary traffic jams, etc.



Proposing country: Japan and Germany

AWI 23375 Collision Evasive Lateral Manoeuvre Systems (CELM)

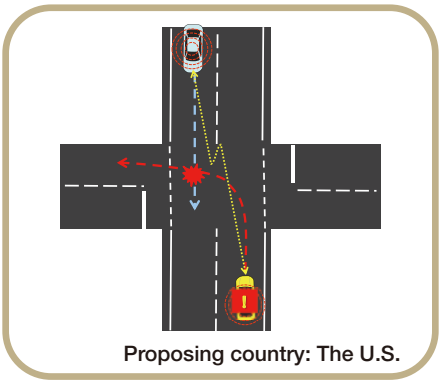
In recent years collision mitigation systems which detects vehicles and pedestrians, and lane departure prevention systems, which detects lanes markings on roads, have become widely prevalent in the market. This standard defines a system that controls the lateral movement of the vehicle to avoid a collision with an object (pedestrian, vehicle, artificial structure such as guard rail, etc.) that is difficult to avoid by these safety systems. It is classified into Type 1 in which the systems operate automatically and Type 2 which supports the evasion operations of the drivers.



Proposing country: Japan

DIS 23376 Vehicle-to-Vehicle Intersection Collision Warning System (VVICW)

Vehicles have been increasingly equipped with a function that continually transmits the location, speed and braking status of the vehicle using wireless communication technology. This standard specifies a system that warns the driver when its vehicle predicts a collision at an intersection with a vehicle turning to an oncoming vehicle or with a vehicle coming from the side direction road, using vehicle wireless communication technologies.



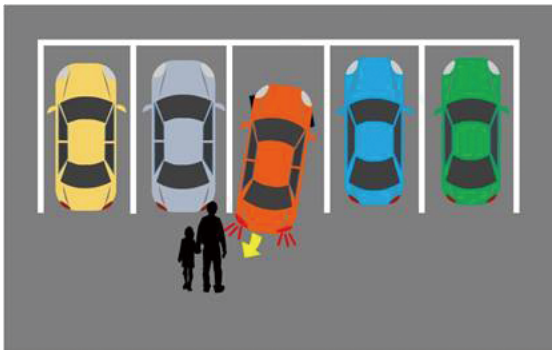
Proposing country: The U.S.

AWI 4273 Automatic braking at low speed (ABLS)

PWI 4273 stipulates the performance requirements and test conditions for an automatic braking system primarily for avoiding or reducing collisions with pedestrians and surrounding objects at low speeds (approx. 10km/h or less (we have submitted a comment that we will test at speeds over 10km/h)).

ABLS uses sensors and other means to detect the position and movement of the subject object, judge the possible risk of collision, and automatically apply appropriate braking to avoid or reduce a collision.

This standard specifies the minimum requirements and testing procedures. It will coordinate with TC 22/SC 33/ WG 16 and will also define test objects.

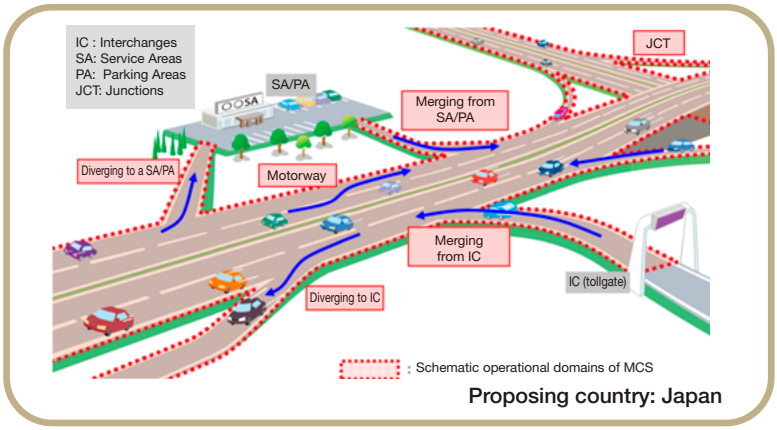


Proposing country: Germany

AWI 23792-1 Motorway Chauffeur Systems (MCS)-Overall configuration and common requirements (MCS Part 1)

PWI 23792-2 Motorway Chauffeur Systems-Lane change (MCS Part 2)

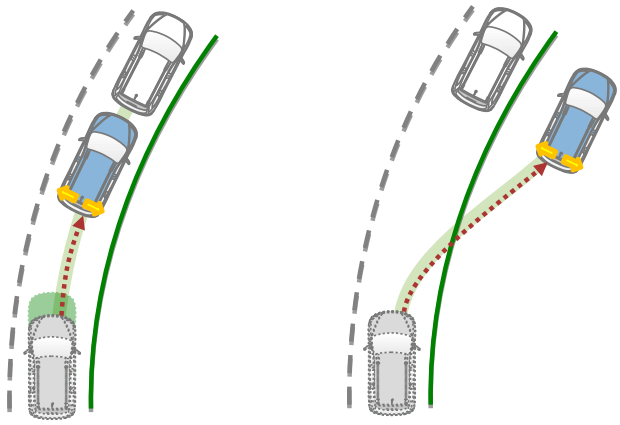
Practical application of Level 3 automated driving systems on motorways is imminent. On the other hand, it is expected that for the time being automated driving systems will be provided with limited capabilities such as operation under specified conditions taking into account the weather and traffic flow, and driving within single lanes. In addition to this, Level 3 systems assume the existence of a fall back ready users who can take over the driving when there is an emergency, and it is important for the user to correctly understand the conditions of the system operation. This standard anticipates a multiple part configuration. Part 1 stipulates the overall configuration and common requirements along with performance requirements and test procedures for automated driving within a single lane. Part 2 adds performance requirements for lane changes to be added in the future, and stipulates the test procedures for these. Performance requirements for lane changes and diverging and merging, etc. are planned to be added in the future.



Proposing country: Japan

AWI 23793-1, PWI 23793-2 Minimal Risk Maneuver (MRM) for Automated Driving systems

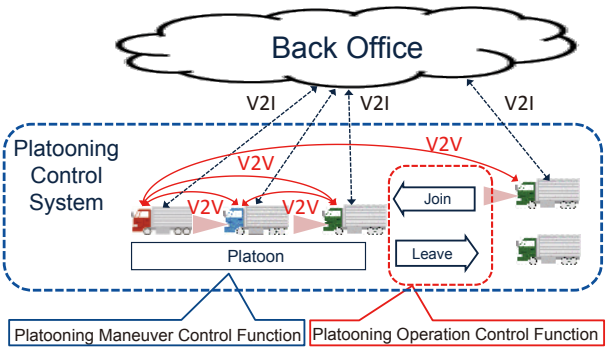
Level 4 or above (and specified Level 3) automated driving systems are required to achieve the MRC (minimal risk condition) automatically when there is a system failure or when the vehicle deviates from the operational design domain. The action that should be taken (MRM = Minimal Risk Maneuver) differs depending on the extent of the system failure, and the environment in which the vehicle is placed, etc. Each part is subject to standardization, with Part 1 describing the MRM classification framework and the requirements and test procedures for basic emergency stops and in-lanes stopping, and Part 2 defining the requirements and test procedures for the MRM to automatically pull over the vehicle to road shoulders. Since multiple different controls are expected for Part 2 and beyond, the standardization of Part 1 currently has priority, and the scope of work for Part 2 and beyond is currently being discussed.



Proposing country: South Korea

CD 4272 Truck Platooning Systems (TPS)

Discussions are underway in individual countries, including Japan, on a “vehicle platooning system” in which trucks drive in a line while maintaining their distance between each other because of its advantages such as the effective use of roads for the increased number of trucks using them, a reduced driver load, and greater fuel efficiency by maintaining a constant speed and distance between vehicles. Thus, in advance of the introduction of the system in each country, this standard introduces the functional requirements of the join and the leave operations of the truck platooning system, the functional requirements of platooning maneuver control to maintain the platoon, and the communication information required between the trucks in the platoons and between the trucks and back offices. The requirements for the evaluation and testing methods for these functional requirements are also described.

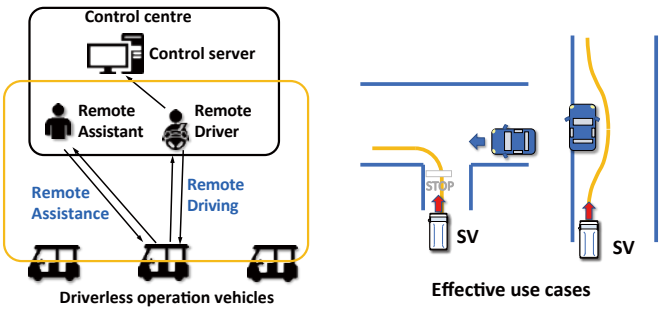


Proposing country: Japan

PWI7856 Remote Assist System for Low-Speed Automated Driving Systems (RS-LSAD)

Remote human intervention to support automated driving systems without a driver on board is an effective way of enabling the continuous operation of automated mobility services and is beginning to be used in countries worldwide. This standard specifies requirements and test procedures for a system that supports vehicles equipped with Low-Speed Automated Driving (LSAD) systems standardized by ISO 22737 using remote driving or remote assistance as defined by ISO PAS22736.

The standard will promote the introduction of automated mobility services into society and contribute to solving various transportation issues, such as providing means of transportation for areas lacking public transportation.



Proposing country: Japan

WG 16: Communications

WG 16 is involved in standardizing the communication systems used in ITS. This working group is holding deliberations on ITS Station Systems used in ITS communication and the DSRC inherited from the now disbanded WG 15 (Dedicated Short Range Communications), in addition to probe data systems.

List of WG 16 work items

		Standardization themes	ISO Number	Content
★	1	Wide Area Communication - Protocol Management Information	ISO 15662	Defines a checklist for ITS applications in wide area communication systems between service centers and user terminals. Japan is taking the lead in preparing a draft standard
	2	Station and communication Architecture	ISO 21217	Describes the architecture that forms the basis of the overall ITS communication system using ITS station, and specifies the station concept, function outline, communication scenario, etc.
	3	ITS Station Management	ISO 24102	Specifies management of all management entities in ITS station, and management functions for communication between different media
	4	Hybrid communications - Access technology support	ISO 21218	Specifies interfaces for third layer connections between different ITS station communication media, and interfaces for connecting to communication interface management entities
	5	CALM 2G., CALM 3G	ISO 21212 ISO 21213	Standardization of interfaces for receiving ITS services via 2nd and 3rd generation mobile communications. References existing mobile telephony standards and specifies a framework that complies with CALM.
	6	CALM IR	ISO 21214	Standardization of interfaces for receiving ITS services via infrared. Japan's optical beacon is outside of its scope
	7	ITS-M5	ISO 21215	Standardization of interfaces for receiving ITS services via CALM M5 5 GHz band. Uses IEEE 802.11p as a base
★	8	CALM MM	ISO 21216	Standardization of interfaces for receiving ITS services via millimeter waves
★	9	CALM MAIL CALM Media Adapted Interface Layer	ISO 24103	Specifies media conversion for the use of ASL (Application Sub-Layer; ARIB STD-T88 and ITU-R M.1453- 2) functions with DSRC that comply with ISO 15628 (DSRC L7)
	10	CALM ITS using Public Wireless Networks - General Requirements	ISO 25111	Specifies interface requirements for receiving ITS services using Mobile Broadband Wireless Access (MBWA)
	11	CALM WiMAX	ISO 25112	Standardization of interfaces for receiving ITS services using WiMAX (IEEE 802.16)
★	12	CALM HC-SDMA	ISO 25113	Standardization of interfaces for receiving ITS services using HC-SDMA (iBurst, etc.)
	13	CALM Applications using Satellite	ISO 29282	Use of satellite communication for ITS
★	14	CALM IEEE 802.20	ISO 29283	Standardization of interfaces for receiving ITS services using IEEE 802.20
	15	CALM - Using broadcast communications	ISO 13183	Standardization concerning management interfaces and session connections required to receive broadcast communication in the CALM environment
	16	LTE	ISO 17515	Standardization of the use of LTE (Long Term Evolution) for ITS, and standardization of D2D and LTE-V2X communications
	17	CALM 6LowPAN	ISO 19079	Standardization for conformity between 6LowPAN, the Personal Area Network (PAN) network layer equivalent of short-range wireless networks, and CALM
	18	CALM CoAP	ISO 19080	Standardization for conformity between CoAP, a simplified, HTTP-like high level machine-to-machine (M2M) protocol, and CALM
★	19	IPv6 Networking	ISO 21210	Standard for functionality that achieves a seamless communication environment (handover between identical media, media switching, etc.) using IPv6
★	20	Non-IP networking	ISO 29281	Standardization of concepts, mechanisms and interfaces for non-IP communications in CALM
	21	Communication protocol messages for global usage	TS 16460	Method for interoperation and coexistence between WAVE (Wireless Access in Vehicular Environments) and CALM FAST
★	22	Application Management	ISO 24101	Specification of mechanisms and conformance test to add, modify, or delete ITS applications using ITS Station
★	23	DSRC - DSRC application layer	ISO 15628	Interface for roadside-to-vehicle communication equivalent to communication protocol Layer 7 (including some functions equivalent to Layers 3 to 6)
★	24	Vehicle Probe Data for Wide Area Communications	ISO 22837	Standardization of core data elements and typical probe messages for probe data services
★	25	Basic Principles for Personal Data Protection in Probe Vehicle Information Services	ISO 24100	Standardization of basic rules for the protection of personal information in probe data services
	26	Probe Data Reporting Management	TS 25114	Examination of commands for directing uplink conditions to probe vehicles
★	27	Event based Probe Vehicle Data	TS 29284	Standard concerning event-based probe data
★	28	Criteria for Privacy and Integrity protection in Probe Vehicle Information Systems	ISO 16461	Readjustment of anonymity requirements and evaluation criteria in probe data systems
★	29	Service Architecture of Probe Vehicle Systems	ISO 19414	Standardization of a service framework to examine the definition of service areas, use of common services and centralization of services in probe data systems Work item proposed by Japan
★	30	Pre-emption of ITS communication networks	TR 18317	Method for securing ITS communication networks during an emergency
	31	CALM Security considerations for lawful interception	TR 11766	Identification of the definition, architecture and mechanisms for lawful interception in ITS. Examination of elements (interfaces) for common use and general procedure for LI. TR (technical documents) issued
	32	Data retention for law enforcement	TR 11769	Identification of data retention methods associated with lawful interception. Examination of data types and schemes for retention TR (technical documents) also issued
	33	ITS Safety and emergency messages using any available wireless media - Data registry procedures	ISO 24978	Standardization of message data registry used for vehicle collision notification via wireless communications
	34	Optical camera communication	ISO 22738	V2X communications using visible light communications
★	35	Use cases for sharing of probe data	TR 4286	Describes usage cases in which probe data such as ETC 2.0 is shared by various services
	36	Lower layer protocols for usage in the European digital tachograph	ISO 4426	Lower layer standard for usage in European digital tachographs that use DSRC
	37	Bluetooth	PWI 7865	Regulations on the use of Bluetooth at ITS Stations
	38	LoRa	PWI 7869	Regulations on the application of LoRa/LoRaWAN at ITS Stations

★ Item(s) that Japan is / has been actively working on

Protocol Management Information (ISO 15662)

Shows the information items necessary for data exchange relying on long-range communications in ITS applications. This information serves as meta-information (attribute information) for messages defined by the TC 204 WGs, and functions as a checklist when creating systems that process those messages. It was issued as an ISO in 2006.

- Selection of a communications system (Response speed, directivity, use environment, service area, service time, band and connection cost)
- Application identifier (Message ID, message number and message transmission time)
- Address (Sender and destination)
- Priority (Interruption processing and blocking control)
- Security (Mutual authentication, data authentication and hiding)
- Execution of application (Reasonable time, timestamp and objective range)

Architecture

Since around 2000, WG16 has developed a number of international standards based on the “CALM (Communications Access for Land Mobiles)” concept, which enables continuous handover while freely using various wireless communication media in ITS. The “CALM” name is currently being removed in conjunction with document revisions, but the concept is being developed with ITS Station as its core.

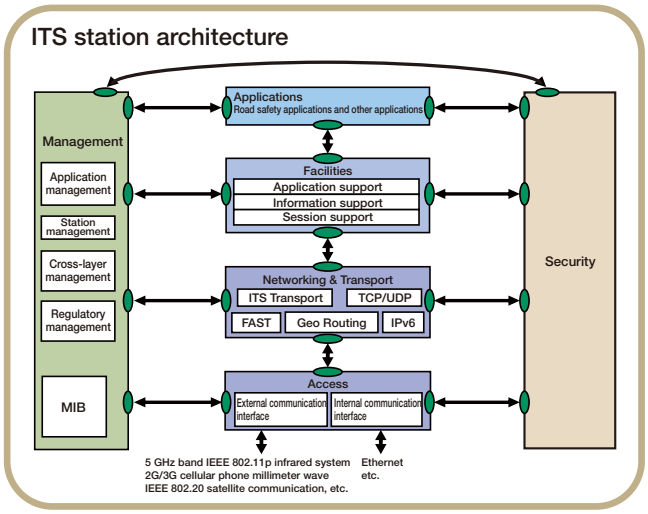
Station/Communication Architecture (ISO 21217)

The Station/Communication architecture standard (ISO 21217) specifies the ITS station and reference architecture for communication, and plays an important role as the core ITS communication standard that uses ITS station.

ITS communication system consists of four subsystems: roadside equipment, on-board equipment, personal devices and the central system. Subsystems include an ITS station, which necessary for communications. The ITS station is configured in accordance with the reference architecture shown in the Figure on the right.

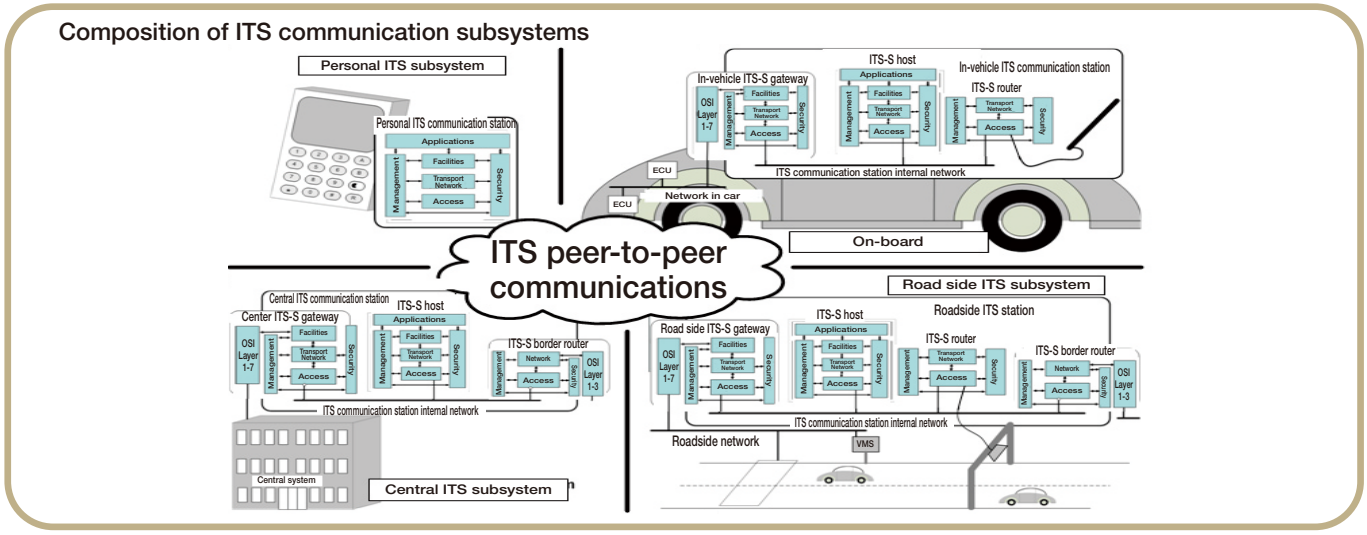
ITS stations feature various communications formats. The architecture standard divides them into 16 communications classes, depending on whether or not 1) multihop communications are used, 2) IPv6 or a non-IP protocol is used for the network layer, 3) handover is conducted, and 4) there is an Internet connection.

Handover, the functional feature that defines CALM, is performed not only between identical types of communication media but also between different ones. Handover is one of the functions that characterize this standard.



ITS Station Management (ISO 24102)

This was made an ISO in 2010 with the aim of organizing all aspects of management entities and communications between media. When it was later revised, ITS station communication functionality was stipulated in detail, the document was subdivided into 6 parts and examined, and five were issued as ISOs by 2016. The three newly added items will be deliberated at WG 18 from 2019.



Media (Lower Layer)

Multiple media can use ITS station, with more to be added based on future technological advances or changes in demand.

MSAP (ISO 21218)

Standardization work focusing on service access point specifications acting as interfaces between different communication media, the upper layer, and the management entities. It was issued as an ISO in 2008, and later renamed (Hybrid communications - Access technology support).

ITS- M5 (ISO 21215)

Among existing ITS communication media, wireless LAN technology-based M5 is expected to play a central role.

In 2004, work on IEEE 802.11p was launched as an official IEEE 802.11 task group. Using this as a base, functional parts adapting it for use with ITS Station were added, and an ISO was issued in 2010. Descriptions were added, and renamed (Localized communications -- ITS-M5) in 2018.

IR (ISO 21214)

Standardization work was led by Austria and Germany, and an ISO was established in 2006. It is used to check for fraudulent practices in systems using GNSS/cellular (GNSS/CN) for heavy vehicle charges. It clarifies characteristics of the standard that uses a method different from the optical beacon already in wide use in Japan. A new revision was published in 2015.

MM (ISO 21216)

At the Chengdu meeting in 2002, an editor from Japan was elected. The physical layer was determined based on examining relevant system case studies and investigating millimeter-wave communications and application characteristics. It was made an ISO in 2012. Revisions have been discussed since 2015.

2G, 3G (ISO 21212, ISO 21213)

This is a standard for interfaces for the use of 2nd and 3rd generation mobile communications for CALM. This was established as an ISO standard in 2008.

MAIL (ISO 24103)

Following the development of DSRC as ITS 5 GHz band media, 5.8 GHz band DSRC is used in many regions including ARIB STD-T75 in Japan (standardized as ISO 15628).

The method of using DSRC as CALM communication media was standardized as CALM MAIL (Media Adapted Interface Layer) by referring to ARIB STD-T88 (ASL: Application sub-layer), and was issued as an ISO standard in 2009. DSRC, which is already used as ITS communication, can be applied to ITS station to enable use of a wider range ITS stations.

ITS using public wireless networks

Since around 2005, wireless broadband communication, which allow IPbased high-speed, high volume data process, has been gaining attention. An examination of CALM-MWB aimed at making use of its performance and functionality in the ITS field has been launched. In 2007, the name of the item was changed to “CALM-ITS using public wireless networks” to allow a broader, more comprehensive examination of wireless systems.

- General requirements for using public networks (ISO 25111)
  CALM ITS using public wireless networks - General requirements (ISO 25111)
- Mobile wireless broadband using IEEE 802.16e using IEEE 802.16g (ISO 25112)
  Mobile wireless broadband using IEEE 802.16e/IEEE 802.16g (WiMAX) (ISO published in 2010)
- Mobile wireless broadband using HC-SDMA(ISO 25113)
  Mobile wireless broadband using ANSI ATIS HCSDMA (iBurst) (ISO 25113 published in 2010)
- Mobile Wireless Broadband applications using Communications in accordance with IEEE 802.20ISO 29283
  ITS-CALM Mobile wireless broadband using IEEE 802.20 (625k-MC mode/Wideband mode)
  (ISO published in 2011)

Satellite (ISO 29282)

Standardization for using satellite communications in ITS stations, which started based on a study of the European SISTER project. It was published as an ISO in 2011.

Broadcast (ISO 13183)

The U.K. proposed standardization for an interface to use broadcast communications (DAB, DVB, etc.) with ITS stations. It was published as an ISO in 2012.

LTE (ISO 17515)

Standardization is being conducted to adapt LTE (E-UTRAN) 3.9th generation mobile communications to ITS station. As a first step, Part 1, which concerns the standardization of general usage, has been published. The standard for ad hoc communication of D2D (Device-to-Device) was issued as Part 2, and the standard on its application to V2X communications was published as Part 3. The base refers to the 3GGP standard.

Optical camera communication (NP 22738)

This is designed to communicate by receiving the blinking state of a light source, such as LED, through an optical camera. This communication method uses the blinking pattern of a light source, and a similar technology has also been adopted in Japan.

Bluetooth (PWI 7865)

Proposed by France in 2021 due to requiring regulations on the use of Bluetooth at ITS Stations.

LoRa (PWI 7869)

Proposed by France in 2021 as part of a standardization proposal for applying LoRa/LoRaWAN at ITS Stations.

Network

Network (ISO 21210)

This standard will provide functionality to achieve a seamless communication environment (handover between identical media, media switching, etc.) using ITS station with IPv6. It will take into consideration the Internet and IPv6.

Media selection through CALM CME

A CME (CALM System Management Entity) standard for functionality was studied that selects appropriate media by comparing the application’s media requirements with media properties and characteristics. The results of the CME study will be transferred to ISO 24102 for conformity with non-IP communications.

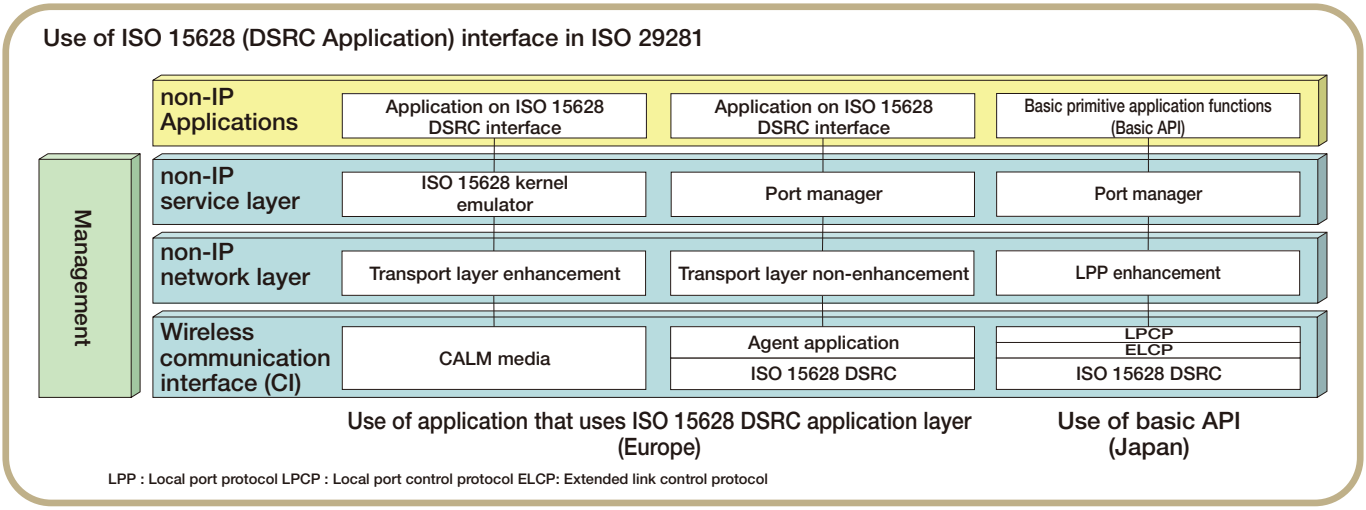
Non-IP networking (ISO 29281)

CALM non-IP (ISO 29281)

The CALM FAST subsystem was proposed as a PWI at the Cape Town meeting in 2006, and subsequently renamed to CALM non-IP communication mechanisms. The standardization plan is under examination in the context of the operating conditions and mechanisms for roadside and onboard equipment required to provide immediate and reliable roadside-tovehicle as well as vehicle-to-vehicle communications

using CALM. The examination assumes non-IP communication concepts and mechanisms other than Internet-based network communications. In that context, it also emphasizes the inclusion of existing systems, such as the CEN and Japanese DSRC systems, to ensure that the effective use of such systems is taken into consideration.

Japan's DSRC and the basic API is the Japanese DSRC usage system described in ARIB STD-T88 (Association of Radio Industries and Businesses), DSRC basic application interface specifications (ITS Info-Communications Forum) and joint research into next generation road service provision systems (National Institute for Land and Infrastructure Management, Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and 23 private companies). By positioning this as an ITS station-related international standard, it puts Japanese technology in the global spotlight, and is expected to ease coordination between countries in terms of technological cooperation and the adoption and deployment of technology. First issued as an ISO in April 2011, it was reissued in two parts in April 2013.



Dedicated Short Range Communication (DSRC)

Dedicated Short Range Communication (DSRC)

Short-range data communication used in ITS applications such as ETC is called Dedicated Short Range Communication (DSRC). The actual operating range is covered by the OSI (Open Systems Interconnection) seven-layer model communication protocol. Standardization of the radio communications protocol corresponding to Layer 1 was conducted by ITU-R, and the recommendation, which includes Japanese and European protocols, has been approved. ISO is focused on standardization of Layer 7.

In parallel with international standardization work, the standardization of DSRC was promoted in member countries and regions. Europe adopted the 5.8 GHz passive DSRC (CEN DSRC) as a standard (EN), while the 5.8 GHz active DSRC standard (ARIB STD-T75) was established in Japan. There are also IR-based DSRC systems. Many countries have been considering adopting DSRC, with some exceptions like Italy installing their own local systems. Korea and China have been working on DSRC standardization based on the Japanese system.

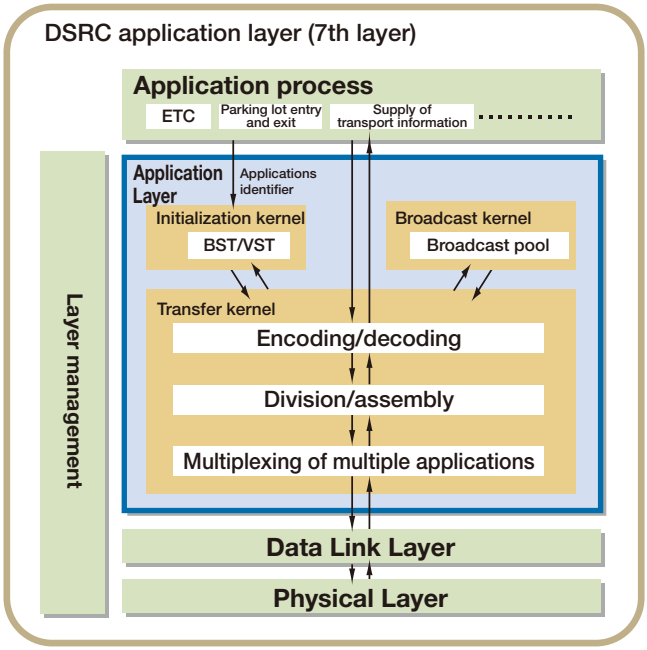
In Japan, the ASL (Application Sub Layer) standards and basic application interface technical specifications have been positioned above the 7th layer.

DSRC application layer (ISO 15628)

In DSRC, Layers 3 to 6 are usually omitted so that vehicles moving at high speeds can communicate directly with road side equipment within a limited communication range. The functions required by these layers are included in the application layer. Various applications are available through DSRC, and an application entity identifier (AID) is stipulated in the application layer. Roadside or on-board application processes specify the AID to communicate with the opposite (on-board or roadside) process via layers at or below the application level. Communication functions are performed mainly by the transfer kernel. These functions include information encoding/decoding, division/assembly of fixed frames and multiplexing/subdivision of data from multiple applications.

WG 15 (disbanded in 2014) incorporated requests from member countries and regions, and Japan took the lead in creating the draft. The ISO standard was published in 2007. A systematic review vote subsequently conducted in 2010 resulted in a decision to make editorial revisions, which were published in 2013.

WG 16 will take the task of maintaining the standard over from the former WG 15.



Communication lower layer of European digital tachographs (ISO4426)

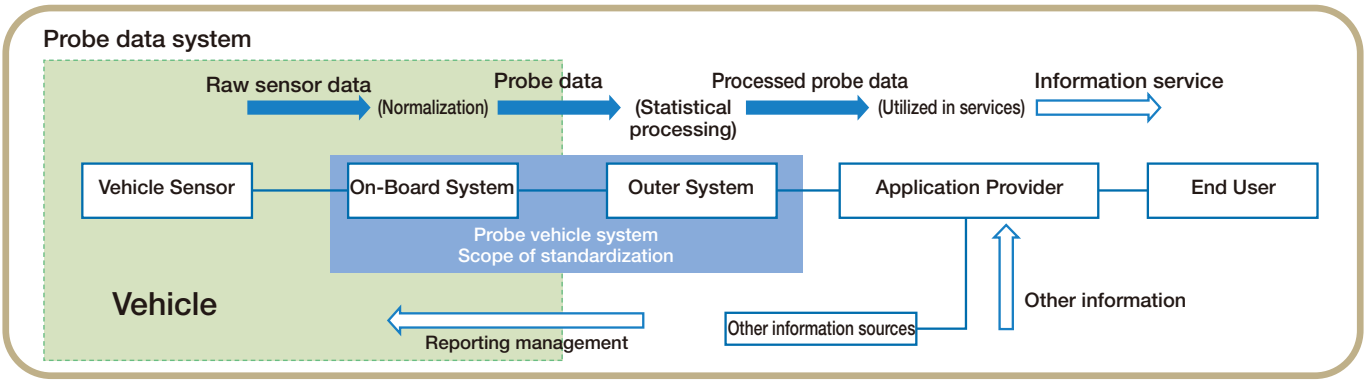
Communication lower layer standard for use in European digital tachographs that use DSRC. Proposed in 2019, this standard was issued in 2021.

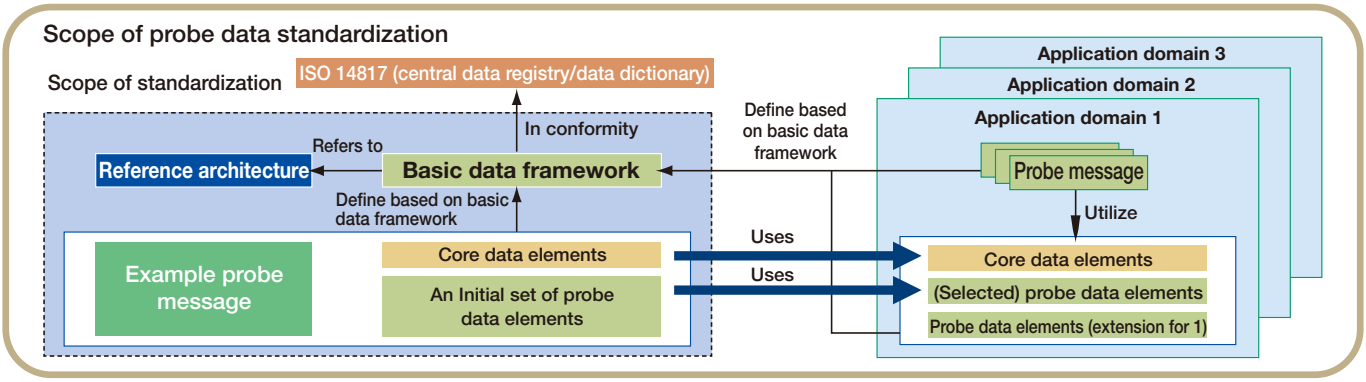
Probe Data

What is probe data standardization?

A system consisting of a group of vehicles that uses medium-to-wide area wireless communications to collect and transmit various types of data, and of center functions that statistically process that data to acquire information on traffic, road, and environmental conditions, is called a probe vehicle system. Probe data refers to the data sent to centers and other external systems by on-board systems. Speed and other basic data elements in probe data are known as probe data elements, and a set of multiple data elements is a probe message. Probe messages always contain time and location stamps.

SWG 16.4 is working on the probe information system and chaired by Japan. It is in charge of standardization for the probe data itself, standardization for the instructions on probe data reporting management, standardization for the architecture of probe data, and also personal data protection in probe data services.





Vehicle probe data for wide area communications (ISO 22837)

For probe data, standardization of the items below has been established. It was published as an ISO standard in 2009.

- Basic framework: Specifies the methods to define probe data elements and probe messages. Expansion and revision of the standard will be performed in accordance with this framework.
- Reference architecture: Defines the structure of the probe data system covered by this standard and the semantic structure of probe data.
- Core data element: Defines a group of probe data elements showing the time and location stamps included in all probe messages.
- Initial set of probe messages: Defines a group of typical probe messages.

Event-based Probe Data (TS 29284)

Event-based congestion probe data obtained after sensor value-based processing and evaluation by on-board systems was studied.

Probe data reporting management (TS 25114)

Reporting management is a set of instructions regarding transmission of probe data to groups of vehicles. It includes:

- Instructions to start and stop transmitting probe data
- Specification of the type of probe data to be transmitted
- Adjustment of the threshold value to determine the necessity of transmission

Transmitting these instructions from the center to vehicles makes it possible to control the unnecessary transmission of data and obtain detailed reports on what data is desirable to achieve effective data collection.

This TS was published in 2008.

Basic principles for personal data protection in probe vehicle information services (ISO 24100)

The following are defined as personal data handled by probe vehicle information services: contract registration information with probe data suppliers, communication IDs, passwords for certification, communication logs and personal data included in probe data itself.

To enable probe data suppliers to provide data without undue concern, the strict observance of personal data protection laws is being complemented by the preparation of guidelines to be followed by stakeholders and the standardization of design guidelines necessary for that purpose. This was established as an ISO in 2010.

Evaluation standards for probe privacy (ISO 16461)

Unified standards of anonymity and security for the probe data system will be established, and the infrastructure for secure use by information suppliers will be developed. Mutual recognition and interconnection between probe information systems are defined. This was established as ISO in 2018.

Probe services architecture (ISO 19414)

Concerning probe information systems, the Japan-proposed PWI aiming to standardize the service framework by examining clarification of the service field as well as sharing and centralization was published in 2020.

Shared probe data (TR 4286)

This TR describes usage cases of probe data sharing for using probe data. Also describes Japanese ETC 2.0 usage cases, and was proposed by Japan in 2019, before being issued in 2021.

Application Management

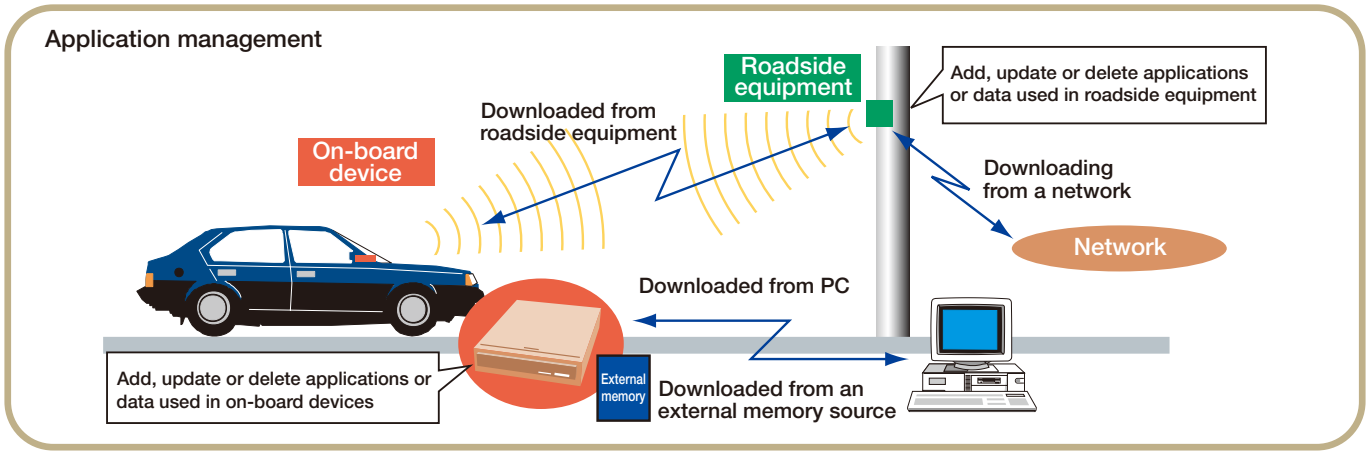
Application management (ISO 24101-1)

This item examines methods for installing applications on equipment featuring ITS communications functionality (roadside equipment or on-board devices that execute ITS applications). Standardization work on mechanisms, structures and methods for adding, updating, or deleting applications is then conducted.

Methods for managing, installing, updating and uninstalling applications, as well as structures for application management security, were standardized, issued as an ISO standard in 2008.

Application Management - Conformance Test (ISO 24101-2)

After the completion of ISO 24101-1, standardization efforts turned to items related to compliance tests. TTCN-3 (Testing and Test Control Notation Version 3) is used for the description of test procedures. This was established as an ISO in 2010.



Pre-emption of ITS Communication Networks

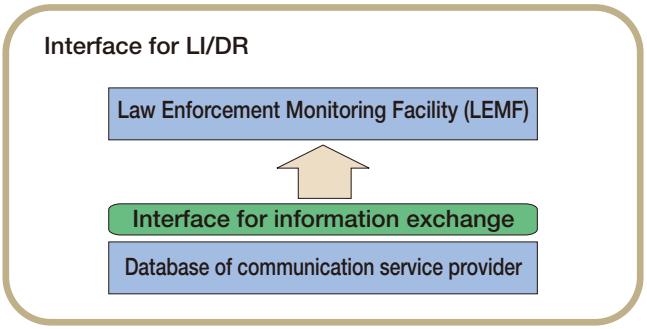
In the wake of the Great East Japan earthquake, this SWG launched a study on securing emergency communications in the event of a disaster, particularly in terms of road traffic. Chaired by Japan, this item worked on possible basic requirements with the close examination of use cases. Disaster recovery pre-emption (TR 18317) compiled use case scenarios and communication requirements, and issued as a TR in 2017.

Lawful Interception/Data Retention

Lawful Interception/Data Retention

Europe has worked on standardizing mechanisms to intercept communications sent through such means as cellular phones, e-mail, or the Internet, as well as to track vehicles, as countermeasures against terrorism. ETSI has already established LI/DR study groups to work on standardization. Further, the ISO provided a discussion forum for international cooperation that includes countries outside of Europe. WG 16 analyzed threat at ITS field and CALM, and compiled the definition, architecture and methods of legitimate interception, and data retention methods associated with the legitimate interception.

Two work items (TR 11766/TR 11769) that include information on conditions in individual regions were published as TRs.



eCall

Standardization of the following items started in 2005.

- Emergency Call using Cellular Network (NP 24977)
- Automatic Crash Notification using Any Available Wireless Media - Data Registry (NP 24978)

The title of item ISO 24798 was subsequently changed to “ITS Safety and Emergency Notifications using any Available wireless Media - Data Registry”, as its contents cover the specifications and operation of the registry for emergency notification messages. Discussions continued under the new title and the item was published as an ISO 24978 standard in 2009. As of 2015, installation of eCall in new vehicles will become mandatory in Europe.

WG 17 Nomadic Devices in ITS Systems

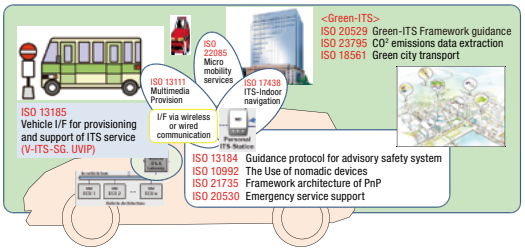
WG17 oversees the establishment of standards for ITS services that use nomadic devices such as smartphones and portable navigation devices (PNDs), which are becoming popular worldwide.

To use information that cars have, WG17 promotes the standardization of application interfaces, safety support system guidance protocols, information services for travelers with nomadic devices, and green ITS for transport, which considers CO_2 emissions.

The figure on the right shows the work items subject to standardization in WG17, organized by group. WG17 considers nomadic devices as key ITS devices that connect people and modals, and is examining how to contribute the realization of services that can provide various conveniences.

Overview of standardization proposals under discussion by WG 17

Scope of tasks: standardization of ITS that makes use of nomadic devices



List of WG 17 work items

	Standardization themes	ISO Number	Contents
1	Use of nomadic and portable devices to support ITS service and multimedia provision in vehicles	TR 10992	Defines use cases to support ITS services and multimedia contents tor nomadic and mobile devices used in vehicles.
2	Use of nomadic and portable devices to support ITS service and multimedia provision in vehicles – Part 2: Definition and use cases for mobile service convergence	TR 10992-2	Definition and use case of platforms intended for various nomadic devices and Cloud utilizing services.
3	Vehicle interface for provisioning and support of ITS services – Part 1: General information and use case definition	TR 13185-1	Part 1 of the provisioning of ITS services related to vehicle interface. Defines general information and use cases for Vehicle ITS Station Gateway (V-ITS-SG)*
4	Vehicle interface for provisioning and support of ITS services – Part 2: Unified gateway protocol (UGP) requirements and specification for vehicle ITS station gateway (V-ITS-SG) interface	ISO 13185-2	Part 2 of the provisioning of ITS services related to vehicle interface proposed by WG 17. Defines requirements and specification of protocols for Vehicle ITS Station Gateway (VITS-SG).
5	Vehicle interface for provisioning and support of ITS Services – Part 3: Unified vehicle interface protocol (UVIP) server and client API specification	ISO 13185-3	Part 3 of the provisioning of ITS services related to vehicle interface. Defines the specification of UVIP, a type of application interface protocol, between nomadic devices as clients to vehicle information interface like Vehicle ITS Station Gateway (V-ITS-SG)*.
6	Guidance protocol via personal ITS station for advisory safety systems – Part 1: General information and use case definitions	TR 13184-1	Part 1 of the guidance protocol for safety support systems making use of the personal ITS station. Defines general information and use cases.
7	Guidance protocol via personal ITS station for advisory safety systems – Part 2: Road guidance protocol (RGP) requirements and specification	ISO 13184-2	Part 2 of the guidance protocols for safety support systems making use of the personal ITS station. Defines requirements and specifications of protocols (RGP).
8	Guidance protocol via personal ITS station for advisory safety systems – Part 3: Road guidance protocol (RGP) conformance test specification	ISO 13184-3	Part 3 of the guidance protocols for safety driving support systems making use of personal ITS stations. Stipulates guidelines for validation test suites for protocols (RGP).
9	The use of personal ITS station to support ITS service provision for travellers – Part 1: General information and use case definitions	ISO 13111-1	Defines use examples for provisions of ITS services intended for travelers to nomadic and mobile devices.
10	Use of nomadic and portable devices to support ITS service and multimedia provision in vehicles – Part 2: General requirements for data exchange between personal ITS station and other ITS stations	DIS 13111-2	Defines data exchange requirements and specifications for provisions of ITS services intended for travelers to nomadic and mobile devices.
11	Indoor navigation for personal and vehicle ITS station – Part 1: General information and use case definition	ISO 17438-1	Part 1 of the indoor navigation standardization jointly prepared by WGs 3, 8 and 18. Defines general information and use cases.
12	Indoor navigation for personal and vehicle ITS stations – Part 4: Requirements and specification for interface between Personal/Vehicle and Central ITS stations	ISO 17438-4	Part 4 of the indoor navigation standardization jointly prepared by WGs 3, 8 and 18. Defines the requirements and specification for interfaces between nomadic devices and ITS stations.
13	Urban mobility applications via nomadic device for green transport management –Part 1: Requirements for interface between ITS stations	ISO 18561-1	Defines general information and use cases in the aim of TR publication for route planning and management of Green (low CO2 emissions) transportation using nomadic devices in designated areas and road sections during international events such as the FIFA World Cup or the Olympic Games.
14	Intelligent transport systems - Framework for green ITS (G-ITS) standards – Part 1: General information and use cases definitions	TR 20529-1	Framework for using ITS to reduce CO2 emissions. Includes the concept of G-ITS, use examples, and guidelines.
15	Framework for Green ITS standards – Part 2: Integrated mobile service application and use case definition	FDIS 20529-2	Framework for using ITS to reduce CO2. Includes integration of mobile services and use example definition.
16	Information for emergency service support via Personal ITS station – General requirements and technical definition	ISO 20530-1	Requirements and technical definitions for sending automobile emergency information (such as on crashes) via nomadic devices
17	Framework architecture for plug & play (PnP) functionality in vehicles utilizing nomadic devices	TR 21735	Defines general information and use cases with the aim of TR publication for frameworks to manage the addition and deletion of automobile function using nomadic devices (plug & play).
18	Nomadic device service platform for micro mobility – Part 1: General information and use cases definition	TR 22085-1	Defines general information and use cases for a service platform using nomadic devices to utilize micro mobility with one or two passengers.
19	Intelligent transport systems – Collection of agent behavior information and sharing between ITS stations	PWI 22087	Aims to establish a framework for collecting environmental information and driving behavior data via nomadic devices to enable AI used in autonomous driving to learn them, and sharing the data with surrounding vehicles
20	Intelligent transport systems - Network based precise positioning infrastructure for land transportation – Part 1: General information and use cases definition	NP 22086-1	Aims to establish precise (about 20 - 30 cm accuracy) positioning infrastructure using a DGPS system with four ground-based reference stations based on the results from experimental tests in South Korea.
21	ITS - Network based precise positioning infrastructure for land transportation – Part 2: Functional requirements and data interface via nomadic device	NP22086-2	Aim to develop functional requirements and data interfaces for GPS systems using ground-based reference stations.
22	Vehicle interface for provisioning and support of ITS Services – Part 4: Unified vehicle interface protocol (UVIP) conformance test	ISO 13185-4	Aim to develop functional requirements and data interfaces for GPS systems using ground-based reference stations.
23	Nomadic device service platform for micro mobility – Part 2: Functional requirements and data set definitions	DIS 22085-2	Functional requirements and definition of used data sets for a service platform using nomadic devices to utilize micro mobility with one or two passengers.
24	Nomadic device service platform for micro mobility – Part 3: Data structure and data exchange procedures	DIS 22085-3	Data structure and replacement procedure for a service platform using nomadic devices to utilize micro mobility with one or two passengers.
25	Indoor navigation for personal and vehicle ITS stations – Part 2: Requirements and specification for indoor maps	NP 17438-2	Requirements and specifications for an indoor map as Part 2 of the indoor navigation standardization jointly prepared by WGs 3, 8 and 18.
26	Indoor navigation for personal and vehicle ITS stations – Part 3: Requirements and specification for indoor positioning references	NP 17438-3	Requirements and specifications for indoor location referencing as Part 3 of the indoor navigation standardization jointly prepared by WGs 3, 8 and 18.
27	Extracting trip data via nomadic device for estimating CO_2 emissions - Part 1: Fuel consumption determination for fleet management	DIS 23795-1	This specification stipulates estimating fuel consumption for managing the platooning of trucks, etc. through a nomadic device by comparing the speed while the vehicle is driving to the operation of a virtual vehicle.
28	Extracting trip data via nomadic device for estimating CO_2 emissions - Part 2: Information provision for eco-friendly driving behavior	CD 23795-2	As the necessary information for measuring carbon dioxide emissions relating to driving behavior, it stipulates the provision of information of different events (speed, rapid acceleration/deceleration, idling, fuel cut, eco-driving, etc.) from a nomadic device.
29	Urban mobility applications via nomadic device for green transport management - Part 2: Trip and modal choice applications and specification	CD 18561-2	Defines the transport mode selection application and specifications as Part 2 of trip planning and management regarding green (low CO2 emission) movement using nomadic devices in designated areas and road sections during international events such as the Olympics.
30	ITS -Urban mobility applications via nomadic device for green transport management –Part 3: Mobility integration service applications using hybrid V2X	PWI 18561-3	Specifies the mobility advancements based on the premise of a communication system called Hybrid V2X, including travel planning and management related to green (low CO2 emission) mobility using nomadic devices.
31	ITS – System requirements and Interfaces for seamless positioning between indoor & outdoor based on the personal ITS station – Part 1: General information and use cases	PWI 6029-1	The goal is to specify an interface for location positioning that can be used seamlessly outdoors and indoors.

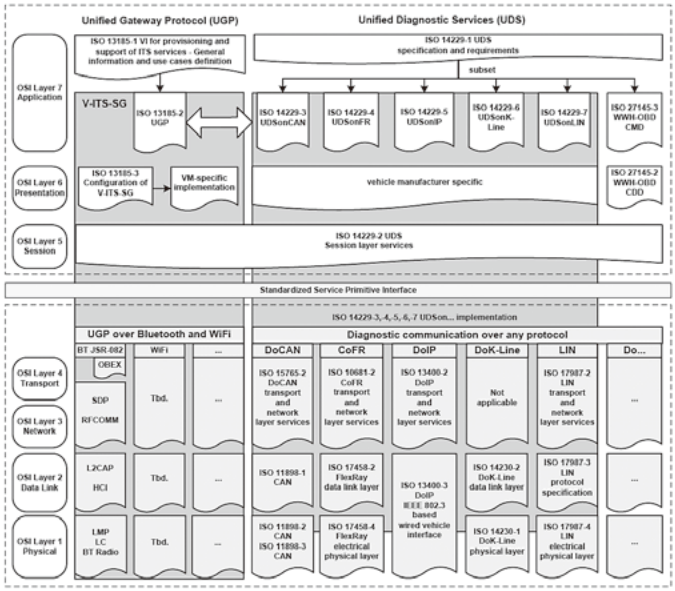
* V-ITS-SG: Information gateway of vehicles that comply with ITS Station architecture proposed by WG 17

Vehicle Interface for the Provisioning and Support of ITS Services (ISO 13185-1 to 4)

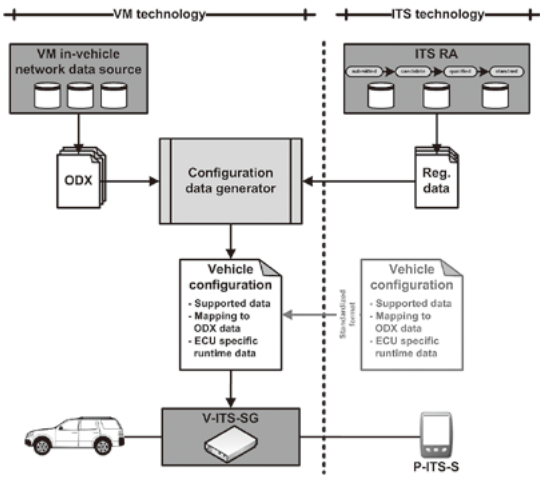
This is a standardization proposal for gateways to allow applications in nomadic devices to use vehicle information. Discussion on this item was conducted in collaboration with TC 22/SC 3/WG 1 (Road vehicles/Electrical devices/Serial data communications, current TC 22/SC 31) that is in charge of standardization for vehicles.

Four parts are planned. Currently, Part 1 (general information and use cases) has been published as a TR, and Part 2 (protocol requirements) as an IS. Structural requirements for which standardization had previously been planned as Part 3 were discussed at a joint working group (JWG) with TC 22. It was put on the ballot as a new work item at the JWG, but turned down in 2014. As a result of follow-up discussions with people involved in TC 22 and TC 204, the policy not to use the term "gateway" is likely to be agreed. On the other hand, a standard proposal for API of vehicle interface server/client model was newly proposed as Part 3 and was issued as an IS in 2018. Furthermore, a standardization proposal for conformance testing was proposed as Part 4 in 2017.

Relationship between ISO 13185 and other vehicle information standards



Sample ISO 13185 V-ITS-SG configuration image process



Indoor navigation for personal and vehicle ITS stations (ISO 17438-1 to 4)

ISO 17438 series is a standardization item on the use of mobile devices to provide guidance indoors. As indicated in the title ("for personal and vehicle ITS stations"), seamless integration of nomadic devices with onboard devices (e.g., telematics or navigation) is assumed to be general information.

Use examples are defined in Part 1.

In addition to representing indoor spaces using four layers (background, space, network, and POI*), maps incorporating additional information such as opening hours are also being considered. This standardization item will be dealt with in the TC in joint consultation with the relevant WGs. Part 1 was issued as an IS in 2016, and currently, the WG17's aim is regulations on the requirements and specifications for indoor maps in Part 2, the requirements and specifications for indoor location referencing in Part 3, and the requests and specifications for the interface between the terminal and the center in Part 4.

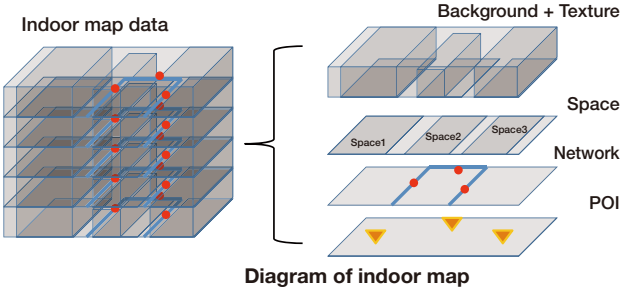


Diagram of indoor map

*POI: Point of Interest

ISO 23795-1 to 2 Extracting trip data for estimating CO_2 emissions

The proposed standard for estimating CO_2 emissions of vehicles using a portable device consists of two parts. Part 1 is the method of estimating by comparing the speed and consumption cycle of virtual vehicles that have accumulated on the network side with actual vehicle speeds. Part 2 stipulates information on different events related to driving acts (speed, rapid acceleration/deacceleration, idling, fuel cut, eco-driving etc.) as the information necessary for estimating CO_2 emissions. Through these estimations, we intend to make possible the development of an application that fleet business owners, logistics business owners, public transportation business drivers and eco-driving leaders can use to estimate the energy consumption and the equivalent amount of gasoline or diesel of a specified standard vehicle. We are aiming for IS publication in 2022.

WG 18 Cooperative ITS

Cooperative ITS integrates vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-infrastructure (I2I) communications, and simultaneously supports extensive ITS services via the communications system.

List of WG 18 work items

		Standardization themes	ISO Number	Contents
	1	Globally unique identification	ISO 17419:2018	Specification of unique identifiers to be used in cooperative ITS
	2	Data exchange specification for in-vehicle presentation of external road and traffic related data	TS 17425:2016	Data exchange specification for in-vehicle presentation of external road and traffic related data
	3	Contextual speeds	TS 17426:2016	A data exchange standard for in-vehicle presentation of regulated and recommended speeds according to road conditions
	4	ITS station facilities for the transfer of information between ITS stations	TS 17429:2017	Prescribes ITS station facilities for the transfer of information between ITS stations
	5	ITS station facility services — Part 1: Communication profile handler	PRF/TS 21176	Revised and divided TS 17429 into 3 parts
	6	ITS station facility services — Part 2: Facility services handler	AWI TS 17429-2	
	7	ITS station facility services — Part 3: Content subscription handler	AWI TS 17429-3	
	8	Local dynamic map	ISO 18750:2018	Standard for Local Dynamic Map (LDM)
	9	Using V2I and I2V communications for applications related to signalized intersections	TS 19091:2019	Road-to-vehicle communication messages (SPaT, MAP) for applications related to signal-controlled intersections
	10	Dictionary of in-vehicle information (IVI) data structures	TS 19321:2020	A data structure dictionary for in-vehicle information (IVI) applications
	11	ITS station security services for secure session establishment and authentication between trusted devices	TS 21177:2019 CD 21177	Specify ITS station security services for establishing and authenticating secure sessions between trusted devices
	12	Position, velocity and time functionality in the ITS station	TS 21176:2020	Prescribes ITS station functionality that provides information on the position, speed, and time
	13	Global transport data management (GTDM) framework	TS 21184:2021	Standard for a data dictionary used in the secure connection between an in-vehicle ITS station and the vehicle's information system
	14	Communication profiles for secure connections between trusted devices	TS 21185:2019	Standard for ensuring the security of communications between vehicles and ITS stations
	15	Guidelines on the usage of standards — Part 1: Standardization landscape and releases	TR 21186-1:2021	Guidelines for relations and application method of standards relating to collaborative ITS
	16	Guidelines on the usage of standards — Part 2: Hybrid communications	TR 21186-2:2021	
	17	Guidelines on the usage of standards — Part 3: Security	TR 21186-3:2021	
★	18	Automated valet parking systems (AVPS) — Part 2: Security integration	PWI 23374-2	Standard for integrated security of Automatic Valet Parking Systems (AVPS)

★ Item(s) that Japan is / has been actively working on

Background behind the establishment of WG 18

In October 2009, Mandate M/453 on the standardization of cooperative ITS was released by the European Commission (EC), and standardization tasks were assigned to ETSI TC ITS and CEN/TC 278.

CEN/TC 278 then established WG 16 as the group in charge of cooperative ITS, with standardization being performed in cooperation with TC 204. According to the resolution adopted at the September 2009 Barcelona plenary meeting, WG 18 was established in TC 204 as a counterpart to the CEN work group.

Roles and tasks of WG 18

Based on the requirements of M/453 and the needs of road managers and road companies in Europe, WG 18 has been developing standards for advanced and trial deployment of infrastructure-related applications such as safety applications around intersections, probe information, and provision of road traffic-related information. At the same time, standards are being developed for ITS station functionality, which is the information infrastructure that supports cooperative ITS.

With the publication of the immediate results of M/453 as Release 1 and the end of EU funding for development, WG 18's activities have slowed down. Subsequently, with funding budgeted to develop standards for cooperative ITS security, emphasis is now shifting to developing a set of standards for security.

Outline and major established standards

The following describes an overview of the major standards established by WG 18.

Local Dynamic Maps (LDM)

Local Dynamic Maps (LDM) are databases being studied in Europe for use in ITS, which feature superimposed location referencing and dynamic information. In ITS station architecture, they are a function of the facility layer, and are mainly used for safety applications.

Their fundamental structure consists of temporary information concerning congestion, traffic obstacles, the weather, and other factors, with information on dynamic objects, targets and objectives (including current signals) acquired mainly through communication with ITS stations and sequentially layered on the location referencing information.

The state-of-the-art Local Dynamic Maps concepts (TR 17424) report, which consolidates the various LDM concepts that have mainly been studied by various European development organizations, was issued as a TR. Also, the definition of a global concept for Local Dynamic Maps (ISO 18750) defines completed concept based on the above TR, and was published as IS in 2018.

For the time being, the group is studying only LDM concept definitions. Concrete database structures, APIs, and other implementation specifications remain issues to study at a future date.

In-Vehicle Signage

In-vehicle signage, which displays a range of road traffic information in vehicles in response to road traffic operator intent, is a system similar to the VICS and ITS spot services used in Japan to provide simplified graphic information.

"Data exchange specification for in-vehicle presentation of external road and traffic related data (TS 17425)" compiles functional requirements of In-vehicle Signage and requests for communications messages, and it was issued as a TS in 2016.

In future, in reference to this, new work items are scheduled to start that incorporate the outcome of advance cooperative ITS deployment plans in the EU, such as SCOOP@F led by France or ITS Corridor led by the Netherlands, Germany, and Austria.

SPaT, MAP, SRM and SSM

Using SPaT, MAP, SRM and SSM signal control to develop safety/environment applications for areas around intersections requires sending information on current signal conditions and related information on areas around intersections.

This work item specifies topology information on the locations of stop lines, the configuration of intersections, and other factors, as well as communications (messages) for priority control information concerning public transport and emergency vehicles (SRM and SSM). In April 2013, work on the use of V2I and I2V communications for applications related to signalized intersections (TS 19091) items began. The result was issued as a TS in 2017.

In-vehicle Information

In-vehicle Information (IVI) is a concept that expands and encompasses In-vehicle Signage (TS 17425) and Contextual Speeds (TS 17426). Even though it describes systems for transmitting road sign and speed limit information from the roadside to the vehicle, this work item covers only the message structure. Specifics of applications will be stipulated in their respective standards. Work on this item was launched in April 2013 as "Dictionary of in-vehicle information (IVI) data structures" (TS 19031). It was issued as a TS in 2015.

Secure connections between in-vehicle ITS communication station and vehicle information systems

Standardization of the system for acquiring information from various sensors built into the vehicle based on connection between onboard ITS devices and vehicle information systems has been controversial since the launch of ITS standardization, and it has yet to be realized due to differences in outlook between stakeholders. Finally at the October 2015 Potsdam meeting the conclusion was reached that the study would be launched in a form in which its use is limited to applications allowing for a very short delay, such as collision prevention applications based on communication between vehicles.

Security services at ITS stations for establishing secure sessions and rapid authentication (PRF TS 21177) and "Communication profile for secure connection between ITS stations and vehicles" (PRF TS 21185) are specifications for ensuring security of communication between vehicles and ITS stations. "Data dictionary of vehicle-based information for C-ITS applications, the Global transport data management (GTDM) framework" (AWI TS 21184) is a specification for the data dictionary used in communication.

Integrated Security for Automatic Valet Parking System (AVPS) (PWI 23374-2)

This standard describes the integrated security of AVPS, which is currently being standardized by WG 14, a group led by Japan and Germany.

Since the AVPS is a form of cooperative ITS realized through collaboration between parking facilities and vehicles, this work item is also one of WG 18's per the policy that discussions regarding the security of cooperative ITS should be centralized in this group. However, in reality, WG 14, WG 16, and WG 18 will be working together.

Identifying and studying potential work items

As stated earlier, in the context of the search for use cases as not yet standardized as cooperative ITS applications and the compilation of requirements, Japan is taking the lead in bringing forward new items for potential standardization.

It was decided to adopt the viewpoint of road operators, who are both developers and users of cooperative ITS, and work is proceeding in coordination with the World Road Association (PIARC). In 2016, the details of TC 204 activities were presented to an SC (TC 2.1: road network operations) studying ITS in PIARC through outreach activities. In addition, to discover future items for potential standardization, gap/overlap analysis was applied to information on cooperative ITS-related programs that are studied by PIARC or road administrators in various countries.

WG19 Mobility Integration

The creation of WG 19 was resolved at the TC 204 plenary meeting held in autumn 2018 in Budapest, and is positioned in ISO/TC 204 as a joint working group with CEN/TC 278/WG 17. The primary purpose and work items of this working group is defining international standard for mobility integration but it does not include the work items that fall into the scope of existing working groups. WG19 acts collaboratively and works on the items that cannot be performed by other working groups.

The scope of the working group is broad, including not just urban but also inter-urban mobility. The WG 19 meeting in Florida in April 2019 determined the first work item to be third item in the table below, and subsequently created new work items for which it is conducting specific standardization.

To realize a society that utilizes automated driving systems in urban areas in order to solve population concentrations and mobility issues and provide mobility in sparsely populated areas, city administrators need tools/guidelines to tackle these issues. The working group aims to engage in activities to defining international standards that should be used and referred to for the implementation of ITS technology utilization for urban administration policies to improve the urban environment. Specific work on standardization started from the Brussels meeting in June 2019 until the Washington D.C. meeting in December 2019, in which face-to-face meetings were conducted. Standardization work has been conducted by holding frequent web conferences. The meetings switched to online due to the COVID-19 pandemic, and deliberations on standardization for each work item has been conducted through frequently held online meetings.

List of WG19 Work Items

		Standardization Theme	ISO Number	Content
★	1	1 ITS- Role model of smart city ITS service application	TR 4445	Japanese proposal The role model for realizing smart city ITS service applications is summarized in TR
★	2	LSAD system service architecture	DTS 5255-1 PWI/TR 5255-2 PWI/TS 5255-3	Japanese proposal Compilation of service architecture that includes infrastructure support for low-speed automated driving systems
★	3	Intelligent transport systems – Mobility integration – Gap and overlap analysis of ISO/TC 204 work programme for mobility integration	DTR 23797	Gap and overlap analysis of standards relating to mobility integration and compilation of report.
★	4	Intelligent transport systems - Management for Electronic Traffic Regulations (METR) - Part 1: General concept and architecture/ connected rules of the road	PWI/TR 24315-1	Compilation of TS for concept and architecture for storage of road signs and regulatory information as static and dynamic electronic data. Comprised of 3 parts
★	5	Intelligent transport systems - Urban ITS - Models and definitions for new modes	PWI/IS or TS 24310	Compilation of definition and specifications for new transport mobility models, including shared mobility Work is temporarily on hold
★	6	Intelligent transport systems - Location referencing harmonization for Urban ITS - Part 1: State of the art and guidelines	PWI/IS or TS 24309-1	Compilation of specifications for transformation and harmonization of location referencing technologies as used in urban environments.
★	7	Intelligent transport systems - Location referencing harmonization for Urban ITS - Part 2: Transformation methods	PWI/IS or TS 24309-2	Compilation of specifications for transformation and harmonization of location referencing technologies as used in urban environments.
★	8	Intelligent transport systems – Urban ITS - Air quality management in urban areas	PWI/IS or TS 24312	Compilation of specifications for air quality management of exhaust gases in urban areas. Work on this specification has been cancelled and the specification has been removed.
★	9	Intelligent transport systems - Urban-ITS - 'Controlled Zone' management using C-ITS	PWI/IS or TS 24311	Compilation of specifications for 'controlled zone' management using vehicular access management in urban areas.
★	10	Intelligent transport systems – Architecture to Support Vehicle Automation	PWI/IS or TS 24318	Compilation of specifications for architecture, including infrastructure to support vehicle automation as a form of mobility.
★	11	Mobility Integration - Vulnerable users and light transport	PWI/ TR 24317	Compilation of specifications for safety information relating to pedestrians and light modes of transport.
★	12	Intelligent transport systems –Development of data standards for the parking sector	PWI 24321	Compilation of specifications for electronification of parking lot information. Harmonization with existing standards is an issue Work has been suspended and this item has been transferred to AWI/TS 5206-1
★	13	Mobility Integration concept	DTR 4447	TR that acts as a bridge between European MaaS and North American MOD
★	14	Ground-based automated mobility system	PWI/TS 4448	Defines roadside operations for automated vehicles Comprised of 11 parts
★	15	Parking – Part 1: Core data model	AWI/TS 5206-1	International standardization of industry APDS standards
★	16	ITS data management, access and mobility issues Governance using secure interfaces - High level specifications & supporting information resource	DTS 5616	Communication & data standards guidebook. Online collection of links.
★	17	Digital infrastructure service role and functional model	PWI/TR 7872	Japanese proposal Compiling a service that provides digital infrastructure information to ITS service providers
★	18	ITS data aggregation role and functional model	PWI XXXX	Japanese proposal Compiling a service that aggregates ITS data needed by ITS service providers.
★	19	Enterprise view	PWI/TR 7878	Norway Proposal: Compile role models for MaaS, MOD, and IFMS
★	20	Multimodal pricing	PWI/TR 7874	US Proposal: Compile multimodal payment rules

★ Item(s) that Japan is / has been actively working on

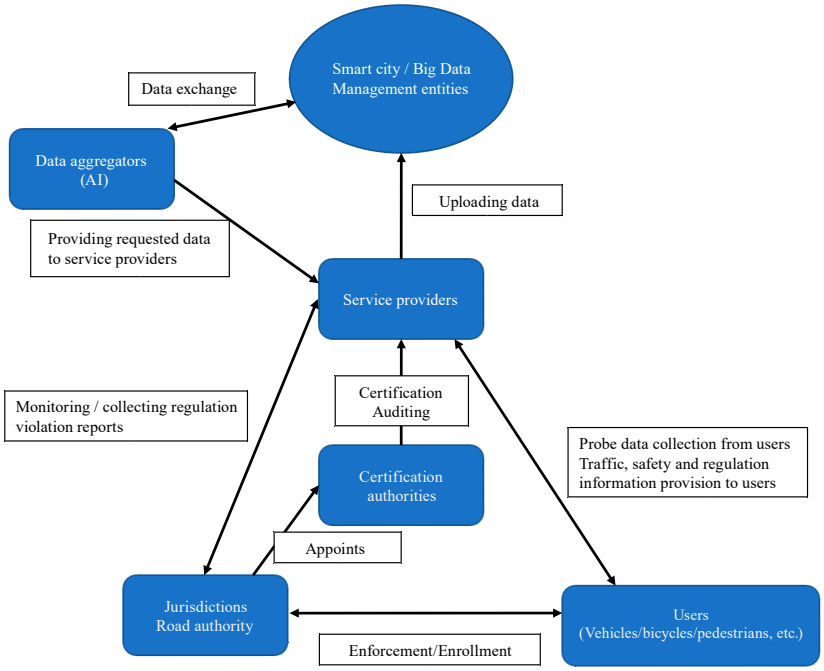
Role Model for Smart City ITS Service Applications (TR 4445)

At the Singapore meeting in October 2019, Japan proposed the "Role Model for Smart City IT Service Applications," it was approved as a new work item, and international standardization work started. In approving this work item, Japan's efforts such as ETC 2.0 road information collection role model can be standardized internationally, and it realizes an environment where Japan's various frameworks and architectures for ITS services can be proposed.

WG19 aims to develop the international standard specifications necessary to solve the issues related to mobility integration in urban and inter-urban environments that other existing WGs are not overseeing. In line with that objective, the new proposal submitted to WG19 expands on this objective while referring to the WG7-formulated monitoring system architecture (ISO 15638) for commercial vehicles and organizes the core frameworks for smart cities that utilize transportation-related big data in order to introduce ITS service applications. The core of service providers' role is to provide mobility integration

information services for mobility users. Service providers' service provision functions are monitored by a certification authority to prevent data tampering and to ensure security. The certification authority is founded on strict conditions and is inspected by the administrative body overseeing enforcement and by road authorities. Mobility integration ITS application users (vehicles, motorcycles, pedestrians, etc.) sign user service provision agreements with service providers and utilize various ITS service applications, and, in addition to gaining the convenience of mobility, also receive important information, such as safety information, for realizing a safe and secure society. Probe information, such as user location information, is collected by each service provider. Data collected by service providers is gathered by data management organizations in possession of smart city big data, and it is then utilized in a privacy-protected manner. This data can be utilized for a variety of smart city services by sharing data and data collecting entities, furnishing the necessary data for ITS services from service providers and in the timings and formats required by service providers. The use of this role model to understand the position of various ITS business use cases and to develop business models is being considered.

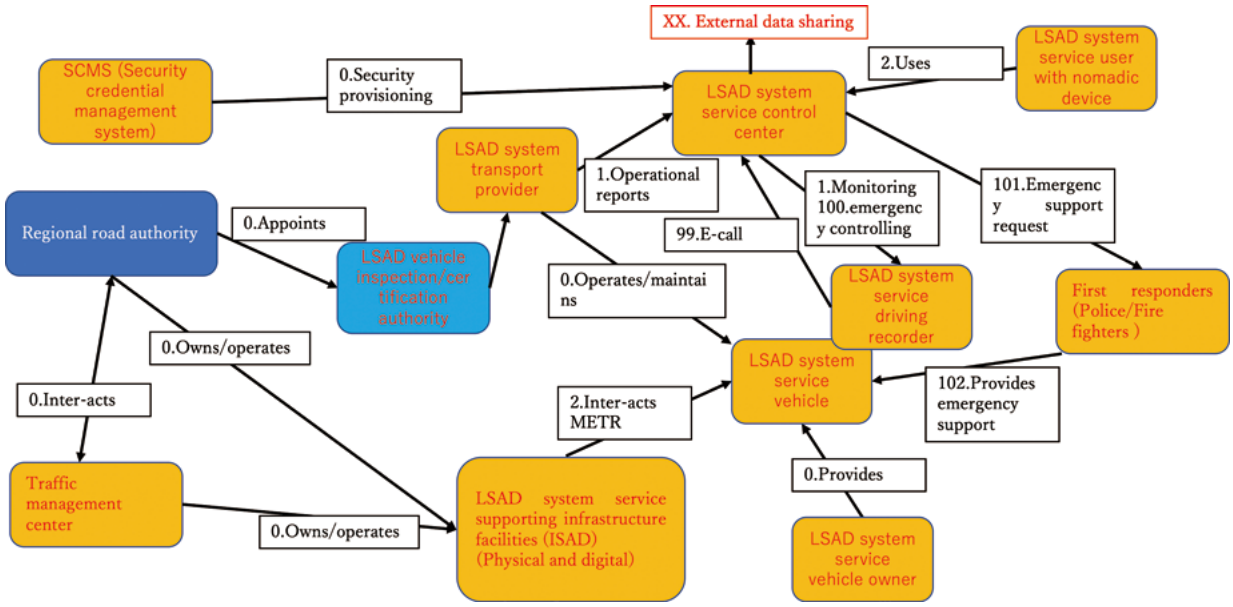
A draft concept for smart city core architecture



System services role function model for LSAD driving systems (DTS 5255-1)

This new work item proposed by Japan at the online international meeting in April 2020 and approved as PWI, specializes in studying, analyzing, and explaining the basic requirements of the architectural model of the service application in order to introduce low speed automated driving (LSAD) services as a new mobility in urban and sparsely populated areas. It is positioned as the basis of various automated driving usage cases and it is believed it can be useful in the development of automated driving business models. Standardization of the service architecture is necessary to promote the introduction of low-speed automated driving services as a new mobility that is used as a means of moving people and goods in urban and mountainous areas. There are various pilot projects using LSAD being implemented around the word, including Japan, and international standardization has been proposed based on the results of those projects. The work item defines the overall service architecture, including infrastructure and road facilities (driving monitoring platform, emergency response platform, operation management platform, user service platform for online reservations and payments, infrastructure platform for automated driving support, etc.). Part 1 describes the overall architecture of LSAD movement support for "people and goods" (clarifying that there is no overlap with WG 8 by including infrastructure and logistics services). Part 2 extracts the issues by analyzing the functional gaps, and Part 3 formulates the system components that should be standardized internationally.

DTS 5255-1 LSAD System Service Role Functional Model



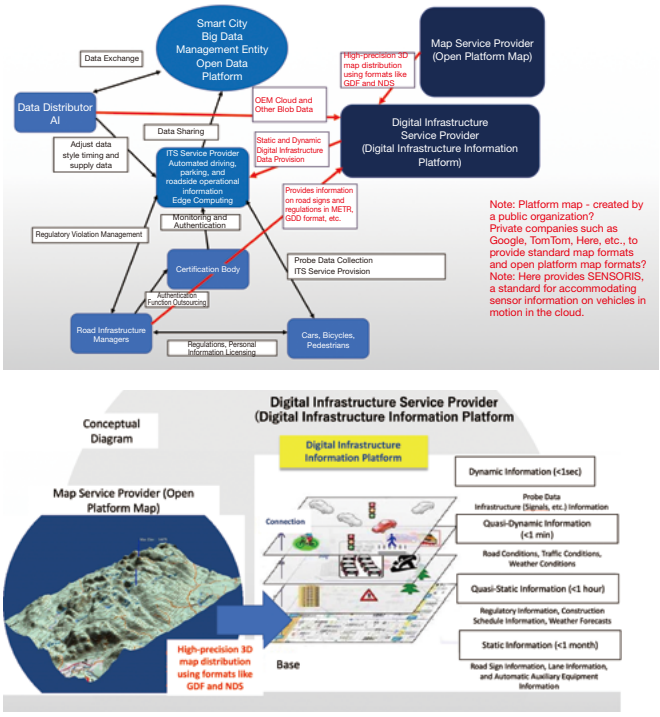
Operational physical layerData flow

Source: ISO/TS204/WG19

Role Functional Model for Digital Infrastructure Services (DTR 7872)

This work item was newly proposed by Japan and approved as PWI at the WEB International meeting in December 2020. It aims to compile the digital infrastructure information services needed for service providers to provide parking information, roadside operation information, Management for Electronic Traffic Regulations (METR), and other services necessary to solve issues related to mobility integration in urban and interurban environments into a TR. The Road Bureau of the Ministry of Land, Infrastructure, Transport and Tourism has begun to consider the need to provide electronic information on infrastructure facilities to realize a society with automated driving. It is also considering the need for high-precision three-dimensional maps to enable automated driving. Given this situation, Japan has proposed this international standardization to strengthen its position further and contribute to TC204's international standardization work. Furthermore, this proposal adds a new Digital Infrastructure Service Architecture role to the basic role model work item ISO/TR4445, a Japanese proposal. This action aims to clarify the roles required for the deployment of ITS mobility service applications that require digital infrastructure support.

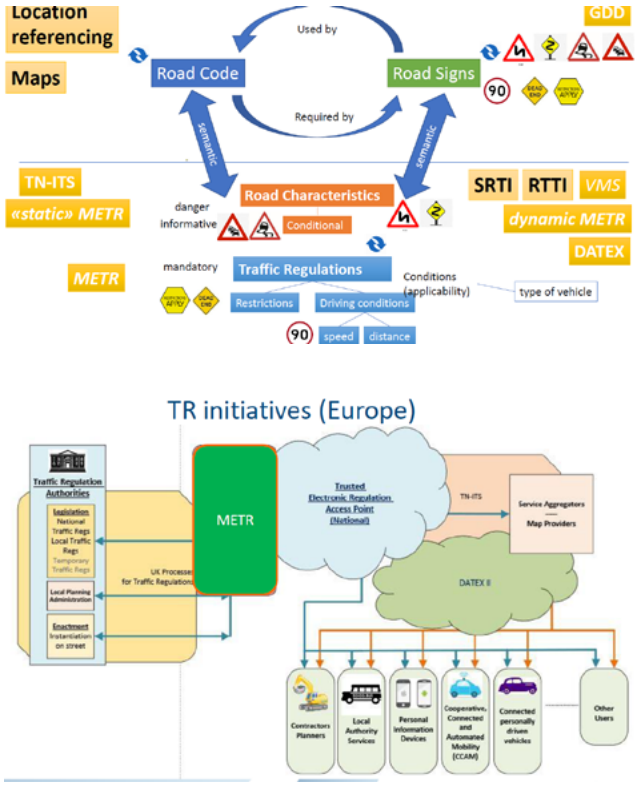
ITS Digital Infrastructure Service Architecture Role Model Diagram (Draft)



Source: ISO/TS 204/WG 19

Management of Electronic Traffic Regulations (PWI 24315-1)

This work item, newly proposed by the UK and approved as PWI at the April 2019 International meeting, aims to compile the necessary electronic traffic regulation information services needed for service providers to offer the Management for Electronic Traffic Regulations (METR) services required for solving the challenges associated with mobility integration in urban and interurban environments. In Europe, DATEX II and TN-ITS are working together to put together a CEN standard. There is also a movement led by the United States to put together a METR concept in the form of a workshop. As shown in the figure on the right, METR is associated with various standardization activities and is being carefully worked on.



Source: ISO/TS204/WG19

Parking information core data and models (AWI TS 5206-1)

This work item was newly proposed by the UK and approved as NP at the international meeting in April 2020. It was achieved by requesting that the Alliance for Parking Data Standards (APDS) utilize the shared terminology and definitions they created for the parking industry data using UML, creating an international standard. This TS covers both ISO and intra-European activities. It has been decided that the APDS standard will be incorporated into the European DATEX II standard. It is associated with various standards.

Vulnerable Road Users, Standards Gap Analysis for New Mobility (PWI 24317)

Newly proposed and approved as PWI at the April 2019 International meeting, this work item will address micro-mobility devices (e.g., e-scooters, etc.), power or power-assisted vehicles (e.g., e-bikes, power wheelchairs, etc.), and full-power vehicles (e.g., motorcycles, mopeds, etc.) in light power and active mode C-ITS. Work will be performed to standardize mobility integration to support all travelers using active light modes of transport. The gap assessment will focus on collaborative ITS for planning, managing, and traveling end-to-end trips for all users, including people with disabilities. Use cases from Japan are being provided to cooperate in its formulation.

Roadside operations for automated vehicles to utilize the roadside for unloading and loading/unloading passengers (PWI TR/TS 4448)

This work item, newly proposed by Canada and approved as PWI at the October 2019 International meeting, summarizes automated vehicles for curb and sidewalk operations, joint use of automated and non-automated vehicles, and movement of people and goods. In all, 11 multi-part structures will be developed for terminology, taxonomy, classification, architecture, a hierarchy for identifying curb and sidewalk suitability, deployment of advanced automation and access, curb or sidewalk metrics that permit operation of automated vehicles or devices, and mixed environments with human-operated ones.

Source: ISO/TC204/WG19 document

Working groups that have been discontinued

TC 204 has responded precisely to changes in the technological, social and business environment relating to ITS, and where it has implemented necessary revisions to working groups and their activities.

Below is a list of working groups that have been discontinued, including the contents that these groups dealt with, and the situation relating to changes made.

Working Groups that have stopped activities

WG Name	Main Activities	Change in Situation
WG2 Quality and Reliability	Considerations on standardization for quality and reliability relating to systems.	Effectively disbanded in 1998.
WG4 Automatic Vehicle and Equipment Identification	Considering automatic identification systems for cars or freight using on-board devices or simple media.	Disbanded in 2018
WG6 General Fleet Management	Considerations on standardization for general items relating to fleet management.	Integrated with WG7 in 1999 (General Fleet Management and Commercial/Freight)
WG11 Route Guidance and Navigation Systems	Considering data contents and communications methods relating to route guidance and navigation systems.	No activities since May 2004 and therefore effectively disbanded.
WG12 Parking Management	Considerations on standardization for parking lots.	Disbanded in 1998.
WG13 Man-Machine Interface	Considerations on standardization for the human factor and the machine interface.	Forum for activities transferred to TC 22 (Road Vehicles) in 1995 and disbanded under TC 204.
WG15 Dedicated Short-Range Communications	Considering standardization of dedicated short-range communication methods for roadside unit-to-vehicle	Disbanded in 2014. WG16 (Communications) has taken over responsibility for maintenance of already developed standards.

International standardization efforts enabling the realization and spread of automated driving and smart mobility services- initiatives in Japan

In recent years, there has been increased activity surrounding the development of technologies and rules relating to smart mobility services (such as CASE and MaaS), which transcend the traditional automotive and ITS fields. ITS's actions towards international standardization including strengthening cooperation with related organizations in Japan and collaborating with government-led initiatives. In addition to introducing initiatives by the Society of Automotive Engineers of Japan (JSAE) 's Automated Driving Standardization Coordination Group, we have asked the ITS and Automated Driving Promotion Office, Automotive Division, Manufacturing Industries Bureau, Ministry of Economy, Trade and Industry (METI) for writing about government-led initiatives such as the Study Group on Automated Driving Businesses and related demonstration projects being performed by METI and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). Moving forward, the results of these actions will be connected to international standardization initiatives.

Initiatives of the Automated Driving Standardization Coordination Group

1) Cooperation between TC204 and other entities such as TC22

Standardization of driving assistance systems called ADAS (Advanced Driving Assist System) has been conducted by ISO/TC204/WG14 for many years. This work has led to standards for control specifications and warnings for various driving assistance systems, including ACC (Adaptive Cruise Control System) and LKAS (Lane Keep Assist System) being established. In addition, the category of this standardization has been expanded to include automated driving in line with the evolution of control systems.

However, in 2014, ISO/TC22 was reorganized. As a result, some working groups (WG) that had been working on the standardization of core systems in automobiles started to work on the future standardization of ADAS and automated driving systems (ADS). Therefore, there is a need to avoid overlapping scopes and coordinate standardization initiatives between the two technical committees and the standardization being performed by each technical committee. Therefore, the JSAE established the Automated Driving Standardization Coordination Group (hereinafter referred to as the Coordination Group) to solve these issues. (See Figure 1)

Standardizing automated driving involves combining various technical fields, such as vehicle control specifications, evaluation methods, communication, safety, and driver behavior. It is expected that themes of standardization related to both TC22 and TC204 will be proposed and developed in the future. The viewpoint that there is a need to exchange information on the standardization trends between the two TCs and cooperation amongst items being developed in Japan to the formation of the Coordination Group. The Coordination Group consists of chairpersons and experts from domestic mirror committees of the ISO initiatives of TC204/WG3 (ITS geographic data), WG14 (Vehicle/roadway warning and control systems), WG16 (Communications), WG18 (Cooperative systems), and TC22/SC31 (Data communication), SC32 (Electrical and electronic components and general system aspects), SC33 (Vehicle dynamics and chassis components), and SC39 (Ergonomics), as well as chairs and experts from national mirror committees. The Coordination Group does not discuss specific standards. Instead, it uncovers specific issues arising between the SCs and the WGs and establishes task forces to discuss these issues. It will also formulate a standardization strategy for future automated driving in Japan.

Furthermore, increased activity amongst initiatives related to and surrounding standardization means that standardization strategies that reflect the needs of the automobile industry as seen in international standards must be considered. Additionally, trends have also been seen towards international standardization activities other than ISO. There is also a need to collaborate with UNECE/WP29 standardization activities and ITU-T, which handles international standards related to telecommunications. Therefore, a system of collaboration was established with the Safety and Environment Standardization Subcommittee and the Automated Driving Subcommittee (Japan Automobile Manufacturers Association), the Automated Driving Standardization Research Center (JASIC: Japan Automobile Standards Internationalization Center), JASPAR, the SIP International Collaboration WG, and the ITU-T domestic deliberative body (TTC: Telecommunication Technology Committee).

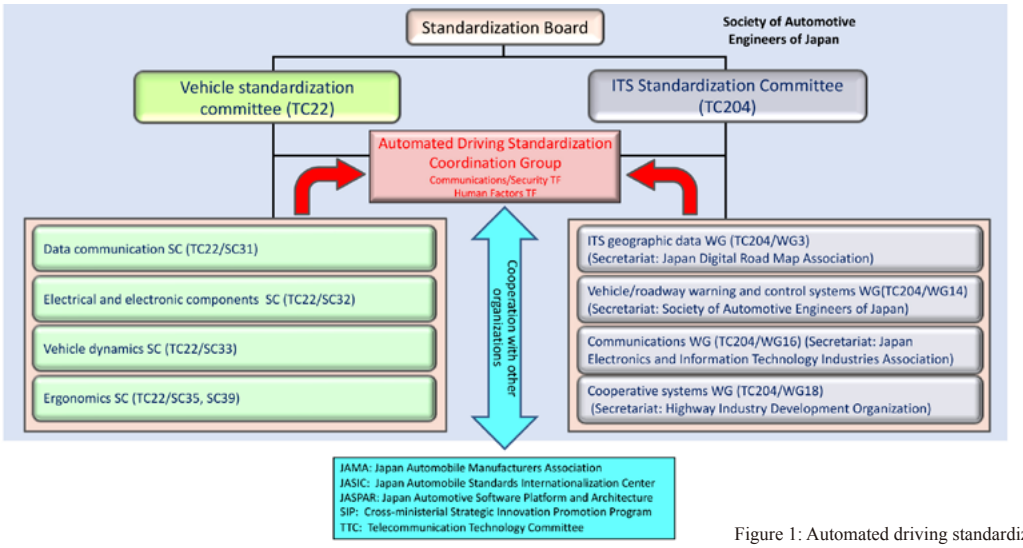


Figure 1: Automated driving standardization system

2) Representative task forces in the Coordination Group

(1) Communications, Security Task Force

When this TF was established, a standardization map was created for communications and security, the direction of Japan's standardization items were discussed, and standardization items for which Japan would take the lead were formulated. These actions were followed by consultations with JASPAR and JAMA. Based upon these discussions, Japan proposed OTA standardization (Over the Air) at TC22/SC32. Furthermore, proposals for amendments to the standard were made with the TTC to ensure consistency between the content of this standard with the communication security standardization being considered at ITU-T/SG17 (Security). Additionally, the content of the standards considered by ITU-T/SG16 (multimedia) and ISO are being cross-checked. Japan is seeking to collaborate with both international standardization organizations on the content of the draft.

(2) Human Factors Task Force

TC22/SC39/WG8 is engaged in standardization activities for the DMS (Driver Monitor System), a Japanese proposal. This work item is closely related to the Motorway Chauffeur System (MCS), an automated driving system for expressways under development by TC204/WG14. Experts from both WGs are collaborating on the state transition of the MCS, for example, examining requirement specifications for the DMS from the system side and the requirement specifications for the system from the human factors side. As such, the standardization of automated driving requires a combination of technologies. Therefore, consistency among single standardization items is crucial, and coordination by TFs is essential.

3) Coordination of standards and regulations in automated driving

As mentioned above, the UNECE/WP29 standardization initiatives for automated driving in Japan are being discussed at the Automated Driving Standardization Research Center established at JASIC. To ensure that there is no contradiction between standards and regulations, a system is being built to provide information on trends in standardization and trends in regulations related to automated driving and to examine guidelines for formulating standards and regulations. (See Figure 2)

The role of the Automated Driving Standardization Research Center is to develop an overall strategy for the development of international regulations for automated driving and to oversee the following initiatives:

- Consideration of how to respond to discussions at the UN/World Forum for Harmonization of Vehicle Regulations (WP29)
- Collaboration and outreach with governments, manufacturers, and research institutions in major countries
- Cooperation with standardization activities (METI/ISO)

In the past, the development of regulations involved referring to the ISO standards, with the regulations providing detailed provisions. However, as developments surrounding automated driving technology accelerate and standards and regulations are discussed in parallel, it has become difficult to follow this traditional process. In light of this, the collaborative initiatives between the Coordination Group on Standardization of Automated Driving and the Automated Driving Standardization Research Center take this situation into account. Furthermore, the groups share information on the scope and progress of each other's initiatives to ensure consistency amongst standards and regulations being discussed in parallel.

In addition, a task force for collaboration on standards and regulations has been set up under the Automated Driving Standardization Research Center to discuss the management of the items discussed in the standards and regulations, as well as to call together experts directly involved in the formulation of the standards and regulations as necessary. The task force also examines whether there are any discrepancies between the items stipulated in drafts. For example, in TC22, a draft SaFAD (Safety First for Automated Driving System) for verifying automated driving safety was proposed by Germany, and a new TC22/SC32/WG13 was established to commence standardization initiatives. This draft covers a wide range of topics, from concepts relating to safety verification to V&V (verification and validation), and includes provisions that span between ISO and TC. SaFAD's approach to verifying the safety of automated driving is based on the idea that due to the complexity of these systems, changes over time, and the uncertainty associated with this, it is impossible to guarantee perfect reliability or safety for a given level of reliability. Therefore, there is still some risk of accidents occurring. To address the issue of how to handle this residual risk in a way that is consistent with standards and regulations, SaFAD experts from TC22/SC32 and regulations experts came together to share items stipulated by SaFAD, discuss Japan's policy of response, review the draft, and prepare comments from Japan, before determining a final policy for a response.

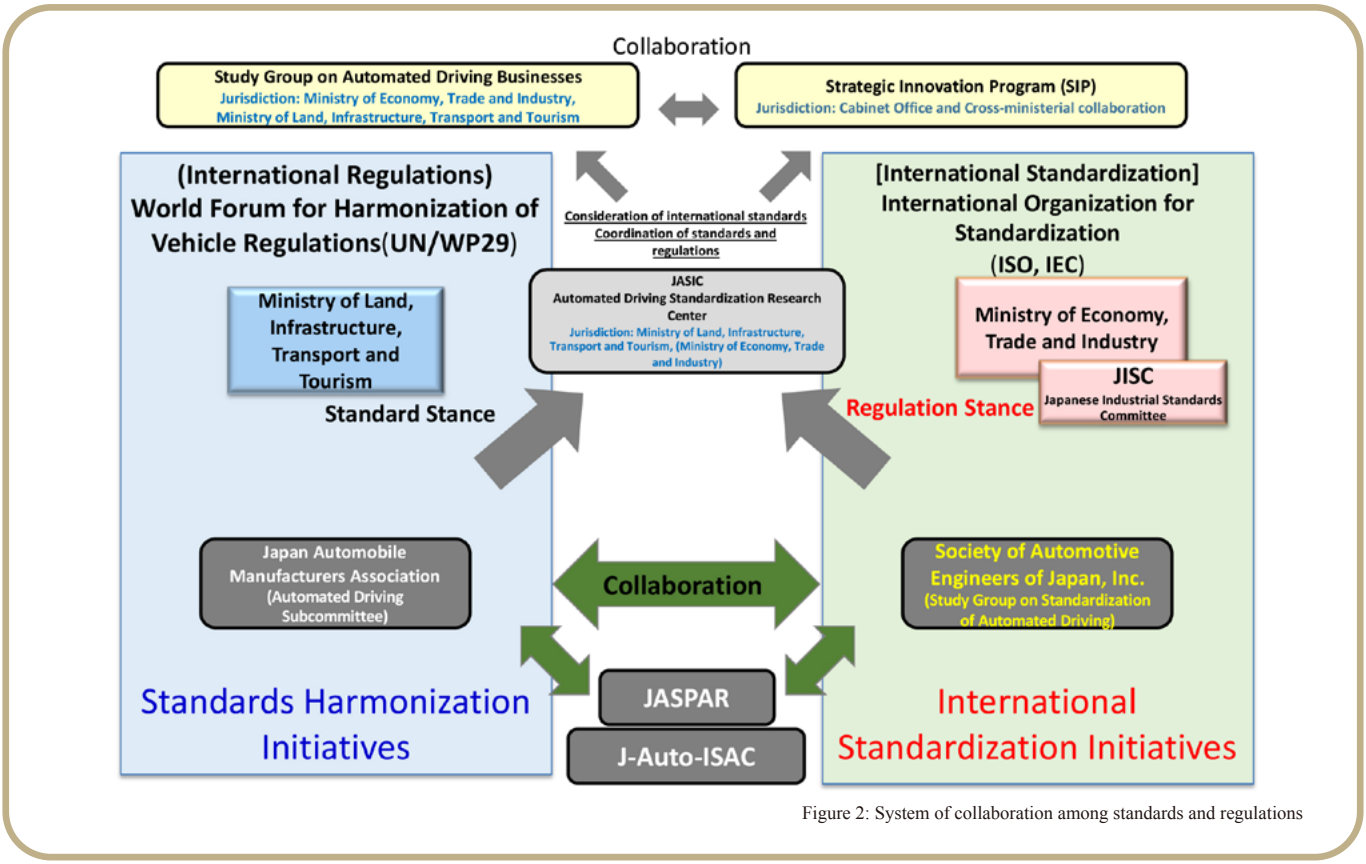


Figure 2: System of collaboration among standards and regulations

As mentioned above, the standardization of automated driving must take into account combinations of varied technologies. Therefore, the continuance of the Coordination Group is essential for managing consistency of standardized items amongst ISO/TC, collaborating with ITU-T, another international standardization organization, and harmonizing mutual regulations with WP29, which formulates regulations.

Government-led initiatives (Authored by ITS and Automated Driving Promotion Office, Automotive Division, Manufacturing Industries Bureau, Ministry of Economy, Trade and Industry)

1) Study Group on Automated Driving Businesses

The Study Group on Automated Driving Businesses was established in February 2015 under the sponsorship of the Director-General of the Manufacturing Industries Bureau of the Ministry of Economy, Trade and Industry and the Director-General of the Road Transport Bureau of the Ministry of Land, Infrastructure, Transport and Tourism, with participation from automakers, suppliers, and experts. The group promotes the commercialization of automated driving under an all-Japan framework of industry, academia, and government. Over the past six years, the group has been investigating and analyzing issues related to the commercialization of automated driving in accordance with technological developments and the development of institutions related to automated driving. It has also been promoting necessary measures such as creating a future vision, identifying issues, promoting initiatives in areas of cooperation, and promoting demonstration projects.

The FY2020 Study Group on Automated Driving Businesses discussed projects to be undertaken over the next five years, based on the results of demonstration projects to date, intending to implement unmanned (Level 4) automated driving services in society at large.

2) Efforts and results of the demonstration project to date

(1) Verification of last-mile automated driving

Local governments, regional transportation businesses, and residents in rural areas, etc., have high anticipations for unmanned automated driving services as a means of reducing operating costs, solving driver shortages, and contributing to the safe and smooth transport of the elderly, etc. To realize mobility services that meet these needs, the "Research, Development, and Demonstration Project for Societal Implementations of Advanced Automated Driving, MaaS.: Demonstration for Societal Implementations of Terminal Transportation Systems Utilizing Automated Driving, etc. in Dedicated Spaces" was launched in September 2016. On December 22, 2020, Eiheiji, one of the demonstration areas, began testing Japan's first unmanned automated transport service that utilizes a remote automated driving system. The vehicles were upgraded with additional sensors, and on March 5, 2021, the system was approved as Japan's first remotely monitored and operated automatic operation system (Level 3). On March 25 of the same year, an unmanned automated transport service was launched that used a remote automated driving system which received Level 3 approval.

One remote driver operates three unmanned automated vehicles.

Remote monitoring and inspection room

Japan's first Level 3 remote automated driving demonstration

(2) Truck convoy driving verification experiment

Japan's truck logistics companies have high expectations for convoy driving from the perspective of improving management efficiency, dealing with driver shortages, and enhancing safety. There is a severe shortage of drivers in the industry. As the average age of drivers steadily increases, shortages are recognized as a problem that will affect the future survival of the industry. There is a particular need to save human resources by driving in convoys, especially for long-distance trunk line transportation (between Tokyo and Osaka) at night when it is most challenging to secure drivers. These systems are also expected to save energy by improving fuel efficiency and to be more versatile than existing methods such as mechanical towing.

The project was launched in August 2016 as the "R&D and Demonstration Project for Societal Implementation of Advanced Automated Driving, MaaS: Demonstration for Societal Implementation of Truck Convoy Driving." It aims to make unmanned rear-vehicle convoy driving technologies a reality based upon the needs above and potential benefits. To confirm that the system operates appropriately in actual driving environments, a long-term demonstration was conducted from June 2020 to February 2021 using the experimental vehicle built in FY2019 to realize unmanned convoy driving technologies on expressways. On February 22, 2021, based on a long-term demonstration that ran from June 2020 to February 2021, the system was tested at Hamamatsu SA and Enshu Morimachi PA on the Shin Tomei Expressway (approx. 15 km each way), with the driver's seats of the vehicles behind the leading truck unmanned. Based on the results of this demonstration, efforts are also underway to standardize a system that makes effective use of roads, reduces fuel consumption, and reduces the burden on drivers through driving in convoys.

Unmanned rear vehicles in a convoy (Shin Tomei Expressway, February 22, 2021)
For safety reasons, the front passenger seat of the following vehicle is occupied by monitoring personnel

3) Efforts in areas of cooperation

For Japan's automobile industry to secure and strengthen its international competitiveness, the Study Group on Automated Driving Businesses also identified ten issues that are difficult for companies to develop and demonstrate on their own in terms of resources and technology. The group has also been promoting efforts to create cooperation in this area. A process chart for each of these ten issues has been established, and initiatives to solve them have been promoted. These actions have yielded steady results. Specifically, in safety assessments, the data obtained has been used to develop international regulations for Level 3 (ALKS) and has contributed to the type designation and launch of the world's first vehicle equipped with Level 3 functions. Additionally, Japan-led initiatives for ISO standards are also being performed. To develop human resources in the field of software, including in the vital field of cyber security, automated driving was added to the Certification Program for Fourth Industrial Revolution Skills Courses . This decision was based on results from skill standards, the automated driving IT human resources strategies, and a survey of human resources needs in the automobile industry. In fiscal 2020, in light of verification experiments being conducted throughout Japan that aim to realize and enable the spread of unmanned automated driving services, issues to be addressed in an area of cooperation focusing on service vehicles were examined. To enable implementers of demonstration experiments to be able to conduct experiments safely and smoothly with understanding and cooperation from stakeholders in the community, and to aim for commercialization of these services, a list of issues that the implementers should focus on, including the state of Japanese safety reports, were compiled.

Area of Cooperation	Status of Efforts (Status of Initiatives in FY2020 and Policies for Subsequent Years)
I. Mapping	Aim to rapidly develop high-precision maps in line with market availability to improve the performance of vehicle location estimates and recognition. Expressway maps were completed by FY2018, with maintenance and ongoing provision of updated data begun. Study and preparation for the development of maps for directly controlled national roads is underway for local streets. Specifically, the verification and evaluation of specifications for the Tokyo waterfront area will be completed by the end of FY2019. The expansion policy for areas to be mapped will be decided by 2021. A U.S. company (Ushr) that develops and owns high-precision 3D maps was acquired in February 2019 using capital raised from INCJ and others. Will continue to promote cost reductions through international expansions, automatic mapping, etc.
II. Communication Infrastructure	To achieve advanced automated driving as quickly as possible, aim to improve safety not only through autonomous vehicle technologies, but also through linkage to communication infrastructure technologies. In FY2017 use cases were established, and infrastructure adaptations and demonstration sites were determined. Specifications and design requirements were established in FY2018 in collaboration with related organizations. Starting in FY2019, 29 organizations, including domestic and overseas automobile manufacturers, participated in the Tokyo Waterfront Area Field Operational Test to sequentially develop and verify the communication infrastructure needed to provide signal information, etc. Moving forward, discussions on international cooperation and standardization will be promoted, along with sharing of experimental results through industry-academia collaboration.
III. Recognition Technologies IV. Decision-Making Technologies	To improve development efficiency, a test course was constructed that can reproduce real-world driving environments. In the second phase of the Cabinet Office SIP data will be collected to contribute to examining the minimum necessary infrastructure indices and the performance of recognition and decision-making technologies for Level 3 and 4 automated driving through field operational tests in the Tokyo waterfront area, etc. under the university-based open research system, and relevant indices and performance will be determined.
V. Ergonomics	Based on the basic concept of driver physiological and behavioral indices and driver monitoring systems, the verification of large-scale demonstration experiments from the first phase of the Cabinet Office SIP in 2017-18 will continue to be promoted along with the development of driver monitoring systems. Based on the efforts from the second phase of the Cabinet Office SIP, the international standardization of various requirements, etc., is being promoted with a view to usage worldwide. These efforts will be continued.
VI. Safety	Evaluation methods for vehicle systems and other equipment at the time of failure, performance limits, and misuse will be established. In FY2018, a handbook was created making relevant findings and case studies broadly available to the public. Utilization will be promoted in FY2019 and beyond. The Service Car Cooperation WG has compiled a list of items to be noted by verification experiment implementers, such as the state of the Japanese version of the Safety Report and guidelines for safety assessments. The aim is for implementers to conduct experiments safely and smoothly with the understanding and cooperation of relevant parties in the community, working towards commercialization.
VII. Cyber Security	Working to standardize development and evaluation methods to improve the efficiency of safety-related development work. In FY2017, set minimum standards to be met, proposed international standards, and formulated industry guidelines. In FY2019, the evaluation environment (testbed) established during the FY2018 project was used for research and other purposes at the National Police Academy. Further utilization was promoted in FY2020. Moving forward, information sharing systems will be strengthened and frameworks for cyber and physical security measures will be considered. JAMA and JAPIA took lead in establishing a general incorporated association, J-Auto-ISAC, in February 2021, to act as a framework for information sharing.
VIII. Human Resources for Software Development	To solve the problem of software developer shortages - particularly in cyber security, a core area of this field - the discovery, securing, and training of relevant human resources is being promoted. In FY2017, a survey was conducted on software skill classification and organization, along with finding, securing, and training human resources. In FY2018, a standard for skills related to automated driving software was developed. In FY2020, the field of automated driving will be added to the certification system for the Certification Program for Fourth Industrial Revolution Skills Courses based on the skill standards. Moving forward, courses will be certified and expanded. Additionally, competitions will be held to test automatic driving recognition accuracy on test roads and in virtual environments. These competitions will be promoted as international events.
IX. Social Acceptability	Issues will be organized specific to automated driving related to victim relief, pursuit of responsibility, and investigation of causes in the event of an accident. For civil liability, in FY2019, liability for property damage and software updates was discussed, and in FY2020, issues related to PL Law instructions and warnings were organized.As part of efforts to promote user understanding and foster acceptance of automated driving technologies, the opinions and understanding of the public will be confirmed through world cafés, questionnaires, etc. Furthermore, symposiums, etc., will be used to provide awareness of what the public should be informed of and actions that need to be implemented. In FY2020, parallel studies were conducted with the Service Car Cooperation WG to organize best practices on how to disseminate information according to regional characteristics and user attributes. In addition, in March 2021, METI and MLIT, along with the Cabinet Office SIP will collaborate to hold a regional automated driving summit to share regional issues. These efforts will be continued.
X. Safety Evaluations	To enable the practical use of automated vehicles, it is necessary to develop new safety evaluation methods that incorporate the idea that automated driving systems will be operating vehicles in addition to the conventional approach to safety that assumes that the driver will be operating the vehicle. Traffic flow scenarios were created for expressways with proposals made to ISO international standards in cooperation with other countries, contributing to the establishment of international and national standards for ALKS. A mechanism to continuously develop scenarios and safety evaluation methods for general roads was also considered. Additionally, the Cabinet Office SIP is creating a simulated evaluation environment for the vast amount of safety evaluations required for the development of automated vehicles. The scenario DB will continue to be expanded, and international harmonization activities will be promoted.

”Status of efforts in areas of cooperation”

However, six years have passed since identifying the ten areas of cooperation, and the business environment surrounding automated driving has changed significantly. In addition to automobile manufacturers, IT companies are also participating in these projects, with competition related to development intensifying. Most recently, the societal implementation of automated driving services has been advancing overseas, with the US, China, and other countries beginning to offer Level 4 unmanned automated cabs (with remote monitoring) as services for general users. This change indicates that automated driving is moving from technology development to societal implementation, albeit to a limited extent. However, diverse driving environments and operating conditions, along with safety requirements, meaning it is becoming clear that it will be challenging to achieve general-purpose automated driving quickly. Even overseas, there are no examples of countries that have set clear targets for when Level 5 fully automated vehicles will be realized. Most only set a target of 2030 or later.

Despite the enormous cost and time required for technology development, the market is still limited in the early stages, and there are aspects to it that can be described as a battle of strength. In addition to the effects of Covid-19, overseas ventures are also undergoing business restructuring. For example, in 2020, major delivery companies were acquiring startup companies that develop automated driving in the US.

Amid these automated driving developments, it is hoped that continued efforts will be made to promote the ten areas of cooperation and deepen and expand them. At the same time, attention will be paid to the distinction between competition and cooperation, enabling Japan to maintain and strengthen its international competitiveness in this field. It is, therefore, vital to address the following five issues, which will also be examined in the RoAD to the L4 project (see below), from a cross-sectional perspective as future issues in these areas of cooperation.

i) ODD Categorization
Measures for smooth horizontal deployment to other regions are being considered through categorizing ODDs, modularizing sensor configurations, and patterning risk assessment methods accordingly.

ii) How humans should be involved in remote monitoring
Examine how humans should be involved in remote monitoring, etc., in case of emergencies, and how systems such as HMI should be linked to people.

iii) How to divide roles amongst parties involved in Level 4 services
Duties such as operation, maintenance, and inspection, which have traditionally been the responsibility of drivers, will be examined to determine how the roles should be shared among the parties involved.

iv) Commonalization/standardization of sensors, data formats, etc.
Consideration will be given to commonalization and standardization of technologies for ADAS, other means of transportation, and sensor and data formats with infrastructure.

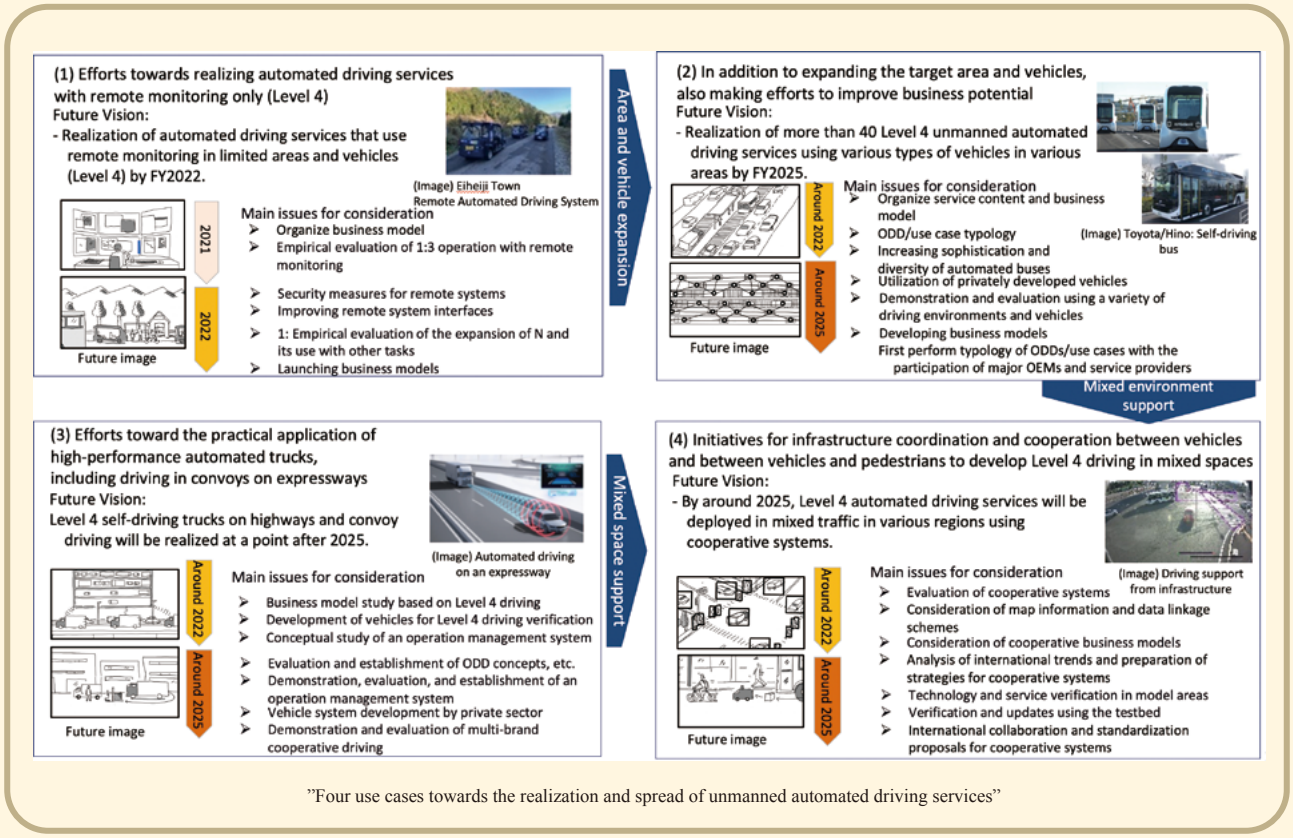
v) Mechanisms for coordination with infrastructure
Consideration of mechanisms for coordination with infrastructure, including support for Level 4 driving via infrastructure-based sensors, along with maintenance and revenue models.

Five issues related to deepening and expanding areas of cooperation

4) Research, development, and societal implementation of advanced mobility services such as automated driving level 4 (RoAD to the L4)

The Ministry of Economy, Trade and Industry (METI) and Ministry of Land, Infrastructure, Transport and Tourism (MLIT) demonstration projects, as described in "Past Demonstration Project Efforts and Results." have achieved the government's goals of realizing unmanned automated driving services in limited areas by the end of 2020 and realizing unmanned rear-vehicle convoy driving technologies on expressways by the end of 2020. However, these services and technologies are currently limited to a small number of technologies, services, and regions, and further efforts are needed to deploy full-scale automated driving services. Therefore, in June 2021, the "Research, Development and Societal Implementation of Advanced Mobility Services for Automated Driving Level 4 and Advanced Mobility Services (RoAD to the L4)" project was launched. This new project will carry out a consistent approach from research and development to demonstration experiments and implementation in society. It aims to realize and spread advanced mobility services such as automated driving level 4. The following four use cases proposed by the Study Group on Automated Driving Businesses will be the project's primary focus. Under the supervision of the project coordinator (National Institute of Advanced Industrial Science and Technology), efforts towards level 4 driving will be made while mutually collaborating on common issues such as data utilization, collaboration, and evaluation from the user's perspective. The project will see vehicle developers and all related businesses in Japan, such as communications and systems businesses, collaborating to address common issues, such as the development of business environments, and promoting standardization and other efforts towards implementation in society.

For Japan's automobile industry to lead the world and actively contribute to solving social issues such as reductions in traffic accidents, it will be vital to utilize the results of the future efforts of the Study Group on the Automated Driving Businesses and the RoAD to the L4 Project in proposals relating to international standardization initiatives, etc., and to contribute to the creation of international standards that will serve as the basis for promoting efforts in areas of cooperation.



”Four use cases towards the realization and spread of unmanned automated driving services”

[Source]

- Report by the Study Group on Automated Driving Businesses
  https://www.meti.go.jp/shingikai/mono_info_service/jido_soko/index.html
- Research, Development and Societal Implementation of Advanced Mobility Services for Automated Driving Level 4 and Advanced Mobility Services (RoAD to the L4) Project
  https://www.meti.go.jp/policy/mono_info_service/mono/automobile/Automated-driving/RoADtotheL4.html

Introduction to Related Standardization Activities

Standardization activities in ISO/TC268

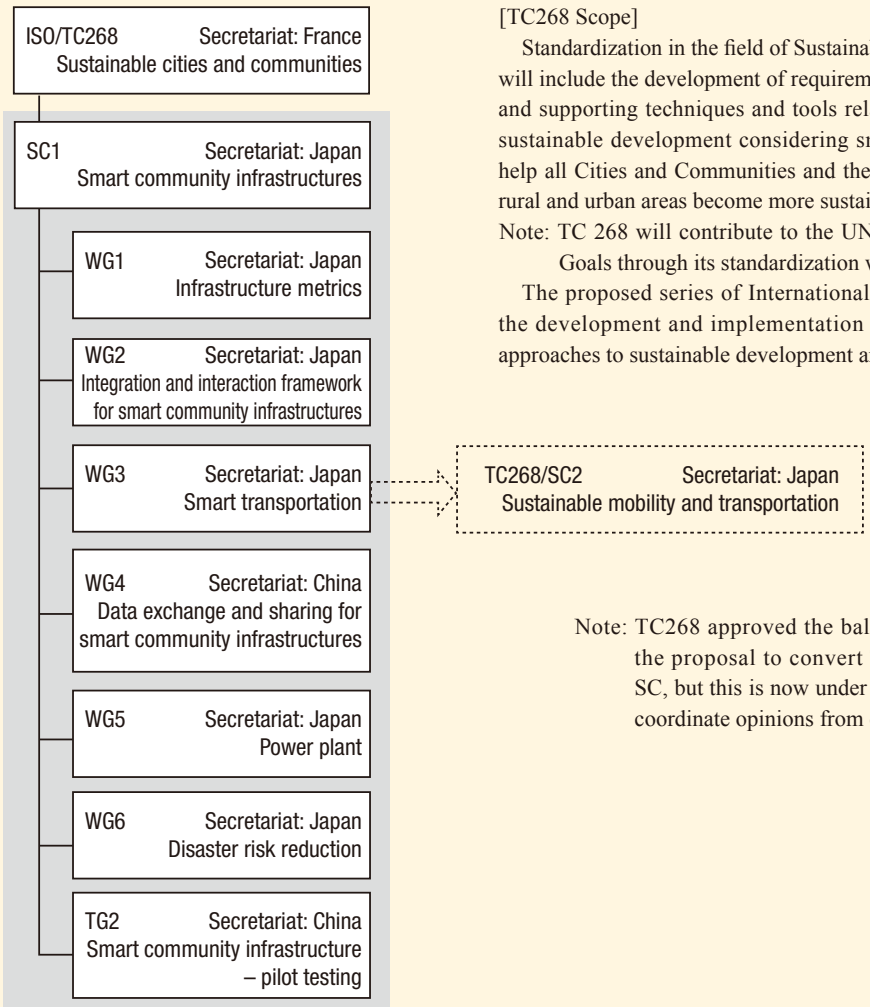
In February 2012, ISO/TC268 (Sustainable Cities and Communities) was established, and international standardization activities in the field of sustainable cities and communities are proceeding.

TC268/SC1 (Smart community infrastructures)/WG3 (Smart Transportation) proposed to establish a new subcommittee in February 2020 to standardize infrastructures, services, and organizational issues in mobility and transportation options for cities and communities, including new technologies such as electricity, hydrogen, and automated driving. The proposal to establish a new SC was approved at the SC1 general meeting in November and TC268 general meeting in December. In the meantime, at the TC204 general meeting in October, the chairman of TC268 proposed a liaison agreement after establishing the new subcommittee. TC204 expressed concern about the overlap of scopes. However, the chairman replied that there was no overlap of scope with other TCs.

The ballot for establishing TC268/SC2 was held and approved in May 2021, but it is still under discussion by the ISO Technical Management Board (TMB) to coordinate opinions from various countries.

A TC268/SC2 domestic correspondence organization will be established with the Japanese Standards Association as its secretariat in Japan. In addition, at the request of JISC, there are plans to select members from the Vehicle Standardization Committee (TC22 Domestic Correspondence Organization) and the ITS Standardization Committee (TC204 Domestic Correspondence Organization) of the Society of Automotive Engineers of Japan to the TC268/SC2 Domestic Correspondence Organization, with future collaboration between the organizations expected.

ISO/TC 268/SC 1 Organizational structure



[TC268 Scope]

Standardization in the field of Sustainable Cities and Communities will include the development of requirements, frameworks, guidance and supporting techniques and tools related to the achievement of sustainable development considering smartness and resilience, to help all Cities and Communities and their interested parties in both rural and urban areas become more sustainable.

Note: TC 268 will contribute to the UN Sustainable Development Goals through its standardization work.

The proposed series of International Standards will encourage the development and implementation of holistic and integrated approaches to sustainable development and sustainability.

Note: TC268 approved the ballot in May 2021 based on the proposal to convert TC268/SC1/WG3 into an SC, but this is now under discussion by ISO/TMB to coordinate opinions from each country.

ITS Standardization at CEN/TC 278

The CEN (European Standards Committee)/TC 278 is a European technical committee responsible for ITS which was established in 1992 before the creation of ISO/TC 204. Previously known as Road Transport and Traffic Telematics (RTTT), it was renamed as ITS at the TC 278 plenary meeting in March 2013. At CEN, standards are usually prepared according to the following procedure.

They are first formalized as technical specifications (TS), and then are subject to review before finally either becoming a European standard (EN) or being cancelled. Technical standards developed in European standard organizations such as CEN, are in principle, optional. However, the binding power of Directive 98/34/ EC - Procedures based on the New Approach, technical standards developed under the standardization directive become virtually mandatory European standards. European EN standards differ from ISOs in that: (1) once detailed work on an EN has started, similar standardization work in individual European countries ceases; (2) once an EN is established, any standard in individual European countries that no longer compatible with the new one is abolished; and (3) EN is mandatory in public procurement.

At present, CEN/ TC 278 has 14 active Working Groups (WGs) and TC 204 and CEN/TC 278 collaborate closely in working on standardization.

In addition, CID (Commission Implementing Decision) for promoting standardization of Urban ITS was issued in February 2016, and WG 17 was created within CEN/TC 278 in April.

Currently, EU funding is nearing completion and standardization work is almost complete. The results will be presented ISO/TC 204/ WG 19 and are being proposed as an ISO. Also, at the CEN/TC 278 Stockholm plenary meeting in September 2019, the name WG was changed to Mobility Integration and became the same as ISO/TC 204/ WG 19. The original name Urban ITS is no longer used in the EU as the expression is considered unsuitable. The WG 17 project team includes PT 1701 to PT 1711, and PT 1712, which was newly created in 2020. EU ICIP (European ITS communications and information protocols) deliberations have started. WG 17 aims to develop a toolkit for governments to realize smart cities. Joint WG meetings with WG 19 Mobility Integration, created at the ISO/TC204 Budapest plenary meeting in September 2018, are being held frequently.

List of CEN/TC 278 working groups

CEN/TC 278 Working Group	Working Group	Lead Country	Corresponding TC 204 Working Group
WG1	Electronic Fee Collection (EFC)	Sweden	WG5
WG2	Freight, Logistics and Commercial Vehicle Operations	United Kingdom	WG7
WG3	Public Transport	France	WG8
WG4	Traffic and Traveler Information	United Kingdom	WG10
WG5	Traffic Control Systems	United Kingdom	WG9
WG7	ITS Spatial Data	Germany	WG3
WG8	Road Traffic Data	Netherlands	
WG9	Dedicated Short-Range Communications (DSRC)	Germany	WG16 (abolished WG 15)
WG10	Human-Machine Interfacing	Germany	(TC22/SC13/W8)
WG12	Automatic Vehicle and Equipment Identification	Norway	W4 (abolished)
WG13	Architecture and Terminology	United Kingdom	WG1
WG14	Recovery of Stolen Vehicles	France	
WG15	eSafety / eCall	United Kingdom	
WG16	Cooperative ITS	Germany	WG18
WG17	Mobility inegration (formerly Urban ITS)	Norway	WG19

●The Vienna Agreement

Background and significance of the Vienna Agreement

The Vienna Agreement, concluded in 1990, aims to foster close cooperation between CEN (the European Committee for Standardization) and ISO standardization programs. The Vienna Agreement defines cooperation between both organizations on the following three points.

1) Document exchange between TC and CEN/TC:
   Documented draft standards prepared by the committees of each group will be exchanged through their respective coordinating countries.
2) Dispatching mutual representatives to committees and WGs:
   Per agreement between the TC and CEN/TC committees, up to four representatives may attend meetings of the other party's committee. In such instances, non-CEN national members are given priority as representatives.
   •1 Formal appointment by the ISO/CEN committee is required.
   •2 Representatives are expected to have an interest in the subject and contribute constructively at the meeting. The representatives do not have voting rights.
3) Parallel inquiries in developing standards:
   The ISO has priority in leading work items when the NP requirement is met. Leadership by CEN is only exceptionally permitted, with the approval of a simple majority of P-member of non-CEN nations in the ISO committee. However, ISO leadership is required for later revisions to standards developed under the CEN lead. Exceptions are only made upon approval by a simple majority of P-members of non-CEN nations. When the development of the standard is led by CEN, it is important to participate in CEN meetings, in accordance with the Vienna Agreement, at the development stage, since voting in TC is to be made in parallel at the DIS phase.
4) Others:
   The CS (Central Secretariat), CEN, and the NSB (National Standardization Body) are responsible for the correct implementation of the Vienna Agreement. The ISO Central Secretariat and CCMC (CEN/CENELEC management center) are responsible for ordinary transaction and management. Secretary-generals of ISO and CCMC are responsible for making decisions of necessary actions when problems emerge in the enforcement and functionality of the Vienna Agreement and its guidelines. The Vienna Agreement plays a special role in the ISO standard development to CEN standardization activities, and as such, non-European countries may feel it gives European countries an unfair advantage. On the other hand, it is also possible to say that it plays a role in preventing disadvantages from being passed to non-European countries, with internationally influential European standardization activities completed within Europe. Thus it is important to use the rights given to non-European countries via the Vienna Agreement as tools to counter standardization in progress at the initiative of Europe.

Reference 1: https://boss.cen.eu/media/CEN/ref/va_guidelines_implementation.pdf
Reference 2: Guidelines for the implementation of the Agreement on Technical Co-operation between ISO and CEN (Vienna Agreement), Seventh Edition dated 2016. https://webdesk.jsa.or.jp/pdf/dev/md_472.pdf

ISO/TC 22 (Road Vehicles) Standardization Activities

Founded at the same time as ISO in 1947, TC 22 is one of the oldest TCs.The following diagram shows its scope and structure. TC 22 plenary meetings are held every 18 months, and the following eight member countries regularly attend: France, Germany, USA, Japan, Italy, Sweden, South Korea and Malaysia. There are 964 TC 22-published international standards as of July 2021, and 226 draft standards are currently under development.

For more details on TC22, see the pamphlet "Vehicle Standardization".

Scope and structure of TC 22

ISO/TC 22

Chair: France
P member: 36 countries
O member: 41 countries

Secretariat: AFNOR
International secretariat: BNA

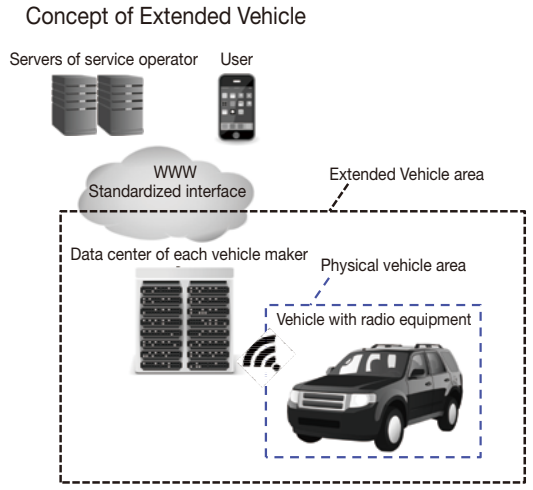
[Scope]
All questions of standardization concerning compatibility, interchangeability and safety, with particular reference to terminology and test procedures (including the characteristics of instrumentation) for evaluating the performance of the following types of road vehicles and their equipment as defined in the relevant items of Article 1 of the convention on Road Traffic, Vienna in 1968 concluded under the auspices of the United Nations:
Moped (item m), Motor cycle (item n), Motor vehicle (item p), Trailer (item q), Semi-trailer (item r), Light trailers (item s), Combination vehicles (item t), Articulated vehicle (item u)

SC	Name	Chair
SC 31	Data communication	Germany/ France
SC 32	Electrical and electronic components/ systems	Japan
SC 33	Vehicle dynamics and chassis components	Germany
SC 34	Powertrain	U.S.
SC 35	Lighting and visibility	Italy
SC 36	Safety and impact tests	U.S.
SC 37	Electrically propelled vehicles	Germany
SC 38	Motorcycles and mopeds	Japan
SC 39	Ergonomics	U.S.
SC 40	Commercial vehicles, buses and trailers	Italy
SC 41	Gasoline engine vehicles	Italy

AFNOR: Association Française de Normalisation; BNA: Bureau de Normalisation de l'Automobile (France)

●Extended Vehicle transferred from TC204 to TC22

Standardization of the connection interface between a vehicle and nomadic devices such as cell phones was studied in TC204/WG17. ISO 13185 "Intelligent transport systems - Vehicle interface for provisioning and support of ITS services Part 3" standardized the configuration of in-vehicle gateways that connect to devices outside the vehicle. The Joint Working Group (TC22/SC3/JWG2) was established in June 2013 to address the need for joint studies between TC22/SC3 (now SC31) and TC204/WG17, which are responsible for the standardization of automotive electronic devices. The scope of standardization required for remote fault diagnosis services was discussed as a representative use case. In May 2014, Extended Vehicle was proposed as an additional standardization proposal relating to an inside/outside vehicle interface for sharing vehicle information. In response to this proposal, TC22/ SC31/WG6 Extended Vehicle (ExVe)/Remote Diagnostic Support has been established, and standardization is being examined. This standardization aims to provide vehicle data externally with fewer information security risks. New services based on the use of vehicle data are expected to increase in the future. In the medium to long term, additional use cases using the concept of Extended Vehicle may be considered. In Japan, the Vehicle Information Interface WG was established under the Data communication SC in FY2015 to address this issue.



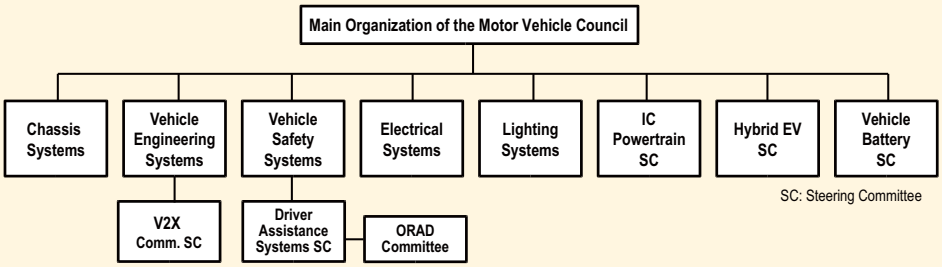
●Memorandum of Understanding between TC 22 and TC 204

Due to developments in driving assistance technology and embodiment of standardization work with progress in driving automation technology, duplicated content of duties between TC 22 and TC 204 were revealed. A memorandum of understanding for establishing cooperation procedures between both TCs was therefore agreed in June 2014. The memorandum describes procedures including that the scopes of both TCs and liaison between remain unchanged, but problems of duplicated standardization work should be solved between both WGs, and problems not solvable between the WGs should be resolved between the chairmen of the WGs. As a result of the cooperative activity based on this memorandum, TC 22/SC33/WG16 (Active safety test equipment) has published the pedestrian dummy standards (ISO/DIS 19206-1). TC 204/WG 14 has published standards for pedestrian detection and collision mitigation systems (ISO 19237). To promote future standardization activities, which are crucial for the automotive industry, the need for flexible handling of cooperation between both TC/WGs is becoming an issue of concern.

SAE International Standardization Activities

SAE International is a non-profit organization whose aim is to create standards and promote related programs. The origin of the organization can be traced to the Society of Automobile Engineers, founded in 1904 in the United States. In the process of expanding its scope, originally that of motor vehicles exclusively, to include aircraft, ships, railway and other modes of transport, it began to use the term "Automotive," meaning a self-propelling conveyance, and to deploy branch offices in Canada and Brazil. It thus became known as the Society of Automotive Engineers or SAE International.

It now has more than 145,000 members worldwide, of whom 20,000 are engaged in standardization work. The standardization organization comprises more than 600 technical committees under six councils. The council that is most relevant to TC 204 is the Motor Vehicle Council. Unique to SAE is that specialists participate in the organization's standardization work for voting and other activities in a personal capacity, unlike other bodies, where they act as representatives of countries or organizations.



●Agreement on Standard Co-Development between ISO and SAE

The SAE agreed with the PSDO (Partnership Standards Development Organization) on TC 22 (Road Vehicles) and TC 204 (ITS) in September 2016. The agreement aims to achieve the collaborative creation of common standards to avoid creating conflicting standards in the same technology field, so that especially CAV (Connected and Automated Vehicles) and C-ITS (Cooperative ITS) using communications can smoothly develop and prevail. SAE and TC 22 have begun to develop standards related to "Automotive Security Engineering."

Furthermore, SAE and TC 204 have begun to develop standards related to the "Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles." A wireless power supply method for electric vehicles, etc., is one of the fields the groups are considering for future development.

●SAE Automated Driving Committee Activities

The SAE ORAD (On-Road Automated Driving) committee is considering standards pertaining to automated driving. SAE J3016 "Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles" and SAE J3018 (Guidelines for Safe On-Road Testing of SAE Level 3, 4, and 5 Prototype Automated Driving Systems (ADS)), etc. have already been issued.

Other representative standards that are currently under development include the following two items:

- SAE J3092 (Dynamic Test Procedures for Verification & Validation of Automatic Driving Systems (ADS))
- SAE J3131 (Automated Driving Reference Architecture)

Based on the joint development agreement in the preceding section, SAE J3016 was formulated by a joint working group with ISO/TC 204 and work to revise it to improve its contents is in progress. This working group is comprised of members selected from the ORAD committee on the SAE side and members selected from WG 14 on the ISO/TC 204 side. First edition issued in August 2021 as an ISO/SAE co-owned document called ISO PAS 22736/SAE J3016.

●Reorganization of the SAE V2X Committee

The SAE DSRC (Dedicated Short-Range Communications) technology committee has established standards relevant to cooperative ITS in the United States. Well-known standards include SAE J2735: DSRC Message Set Dictionary (Dedicated Short-Range Communications Message Set Dictionary) and the SAE 2945 series (DSRC performance requirements).

Meanwhile, as a consequence of the progress of cellular communications technologies, the C-V2X (Cellular V2X) technology committee was newly organized in June 2017, but overlaps in work content with the DSRC technology committee became apparent due to the standardization of applications with low dependence on the communications medium, etc.

In addition, as a consequence of the expansion of the scope of the studies of cooperative ITS, the V2X Communications Steering Committee was established to control ITS communications technologies such as vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), vehicle-to-pedestrian (V2P), etc. The former DSRC technology committee and C-V2X technology committee were reorganized in February 2019 as nine Technology Committees under the umbrella of the V2X Communications Steering Committee.

- DSRC (matters unique to wireless access technologies)
- Cellular V2X (ditto)
- Advanced applications
- Security
- V2X Core (matters in common)
- Infrastructure Applications
- Traffic Signal Applications
- Vehicular Applications
- Tolling Applications

Since there is a close relationship between the work of the SAE V2X technology committee and the work of TC 204, ongoing exchanges of information between them are necessary.

ETSI TC ITS Activities

ETSI (European Telecommunication Standards Institute) is a nonprofit organization approved by the EU (European Union) as ESO (European Standardization Organization). It is developing standards for the entire telecommunication field.

It is based in Sophia Antipolis, in the suburbs of Nice in southern France. Its logo "World Class Standards" represents the global influence of the organization, which has member companies and organizations in more than 60 countries.[1]

Unlike the ISO membership structure in which each country is represented in the organization, any company, organization or individual paying the membership fee becomes a member of ETSI. It has numerous member companies and organizations in the United States and in Asian countries including Japan, in addition to countries in Europe.

Among more than 40 TCs (technical committees) including those for wireless, wired, broadcast and network, TC ITS is responsible for standardization of ITS. It comprises five working groups, as shown in Table 1, that are developing standards corresponding to each technical field.

Table 1 ETSI TC ITS Structure Diagram

WG 1	Application requirements and services
WG 2	Architecture and cross-layer items
WG 3	Networking and Transport
WG 4	Communication media and media-related items
WG 5	Security

The cooperative ITS standardization directive (M453) was presented by European Commission in October 2009. ETSI and CEN (the Euroean Committee for Standardization) undertook the standardization. Consequently, even at the initial stage, called Release 1, more than 110 relevant standards were published. [2]

ETSI has published many standards related to communications for vehicle-to-vehicle and roadside-to-vehicle using 5.9 GHz band DSRC. Two European standards (ENs) shown in Table 2 are especially well known.

Table 2 Typical European Standards published by ETSI TC ITS

EN 302 637-2	Specification of Cooperative Awareness Basic Service	Definition of transmission/reception, etc., of CAMs (Cooperative Awareness Message) to steadily provide other participants in traffic at a certain interval with data of positions, movement and attributions, etc., in vehicle-to-vehicle and roadside-to-vehicle communications to promote their awareness.
EN 302 637-3	Specifications of Decentralized Environmental Notification Basic Service	Definition of transmission/reception, etc., of DENMs (Decentralized Environmental Notification Message) to provide details at random times, mainly when dangerous incidents occur in road traffic.

These standards are implemented in roadside devices and invehicle equipment from a variety of equipment vendors. Conformance and interoperability between devices is tested in events called C-ITS Plugtests™ held by ETSI every year.

The development of other standards is in progress in preparation for actual deployment of cooperative ITS, including congestion control in case of growth in numbers of vehicles equipped with ITS devices, and discussion on issues in multi-channel communications.

ETSI/TC-ITS has also begun to develop a set of standards in anticipation of automated driving technologies called Release 2.

Examples of these include:

- Truck platooning; Pre-standardization study
- Cooperative ITS for the safety of Vulnerable Road Users (VRU)
- Collective Perception Service that shares the information from onboard sensors with other vehicles using wireless communications
- Manoeuvre coordination service at intersections and merging roads

Note that in January 2019, a draft delegated act related to ITS station specifications was released by the European Commission. The 5.9 GHz Dedicated Short-Range Communications (ITS-G5) have been designated as the communications medium in princile, it however states that a revision will be carried out within three years taking account of the new communications technologies (LTE-V2X, 5G, etc.).

Taking this situation into account, ETSI is studying the feasibility of interoperability among heterogeneous ITS systems, such as LTE-V2X, using a mobile phone communication technology, and ITS-G5 (5.9 GHz, Dedicated Short-Range Communications), and backward compatibility.

ETSI TR 103 576 -2:

Pre-standardization study on ITS architecture;
Part 2: Interoperability among heterogeneous ITS systems and backward compatibility

Since communications among heterogeneous ITS systems require installation of at least two receivers, animated discussions continue about technical feasibilities and challenges.

Work on ETSI TC-ITS is closely related to that in the SAE V2X Communications Committee. Both groups are closely exchanging information to arrive at the harmonization and co-development of standards.

Verification of harmonization and information sharing in relation to work items of ETSI/TC ITS are also in progress under TC 204.

References
(1) http://www.etsi.org/about, ETSI Annual Report, April 2017,
(2) Japan Automobile Research Institute: ITS report 2014

ITS-related standardization in ITU

●What is ITU?

The International standardization of ITS is being considered by ISO TC204, and the ITU (International Telecommunication Union) is currently standardizing the Recommendations production, etc., relating to the communications field.

ITU Recommendations stipulate the technical requirements that communication systems and devices should comply with, as recommendations, and each country or company must adopt the necessary Recommendations as essential requirements.

ITU is a United Nations specialized agency whose membership includes 193 Member States, as well as Sector Members and Associates (businesses, universities and other bodies) from nearly 900 organizations as of June 2021. ITU is composed of three sectors: ITU-R (Radio communications), ITU-T (Telecommunications), and ITU-D (Telecommunications development).

ITU-R is involved in the adoption of international regulations and international treaties regarding terrestrial and space (satellite) radio frequency allocation and the orbital position of geostationary satellites. Countries must establish relevant laws and regulations in accordance with the rules and treaties. Study groups (SG) which are lower-level bodies under ITU-R generate recommendations, which are the standards for wireless communications. ITS is handled by SG 5 (terrestrial services). SG5 has several Working Parties (WP) serving under it, and WP5A (responsible for the land movement business excluding IMT, amateur business and amateur satellite business) is carrying out standardization work related to ITS.

ITU-T is also responsible for generating recommendations for research and standardization with respect to the technologies and the usage of telecommunications. SG12 (Performance), SG16 (Multimedia applications), and SG17 (Security) are working on standardization in fields that are relevant to ITS communications.

ITU-D is promoting the development of Telecommunications through global technology assistance activities in the telecommunications field.

●Standardization of ITS in ITU-R

ITS standardization in ITU-R originated with the proposal of a new Study Question in 1994 that was adopted in 1995. Subsequently, M.1310, which describes the wireless requirements for ITS, was approved as a recommendation in 1997. This recommendation is a document that lays out the architecture of ITS radio communications. Based on this policy, three recommendations were drafted and approved in 2000: Functionalities, 60/76 GHz shortrange radar, and 5.8 GHz dedicated short-range communications.

Subsequently, to realize systems such as driving safety support systems that contribute to reducing traffic accidents, studies on the application of advanced ITS radio communication systems using road-to-vehicle and vehicle-to-vehicle communications were proceeded in Japan, the U.S., and Europe. In light of such trends, Japan proposed replacing Recommendation M. 1310 with new ITS Guidelines and Objectives, which became Recommendation M. 1890 in 2011. M.1890 was revised in 2019 according to recent trends, and from 2013 a new vehicle communications recommendation that incorporates the results of the standardization of 700-MHz advanced ITS wireless systems and the European ETSI and high-resolution radar using the 79 GHz band were made Recommendation M.2057.

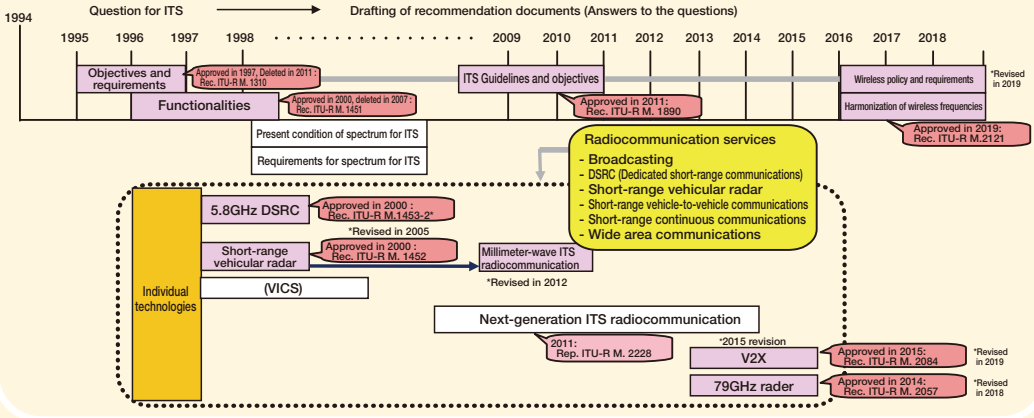
At the WRC (World Radio communication Conference)-19, held in 2019, it was decided to recommend that the use of globally or regionally harmonized spectrum should be considered for ITS planning and deployment, and that coexistence with existing services should be considered where necessary.

The recommendation for this is M.2121 (Harmonization of frequency bands for Intelligent Transport Systems in the mobile service) and the related reports are Report M.2444 (Examples of arrangements for Intelligent Transport Systems deployments under the mobile service) and Report M.2445 (Intelligent transport systems (ITS) usage).

In addition, works for generating a report on wireless communication requirements for Connected Automated Vehicles (CVAs) were started in 2020.

Time-line of ITS recommendations developments and their outlines are below indicated.

The process of formulating the recommendations for ITS



List of Recommendation documents

Recommendation number	Recommendation name	Target system	Publication Year/month
ITU-R M.1452-2	Millimetre wave vehicular collision avoidance radars and radiocommunication systems for intelligent transport system applications	60GHz/76GHz radar systems 60GHz communication systems	2012/5 (revision)
ITU-R M.1453-2	Intelligent transport systems - Dedicated short range communications at 5.8 GHz	5.8Ghz DSRC systems	2005/6 (revision)
ITU-R M.1890-1	Operational radiocommunication objectives and requirements for advanced Intelligent Transport Systems	General ITS radio communication	2019/01 (revision)
ITU-R M.2057-1	Systems characteristics of automotive radars operating in the frequency band 76-81 GHz for intelligent transport systems applications	76-81GHz radar systems	2018/01 (revision)
ITU-R M.2084-0	Radio interface standards of vehicle-to-vehicle and vehicle-to-infrastructure communications for Intelligent Transport System applications	V2V and V2I communication systems	2015/09
ITU-R M.2121-0	Harmonization of frequency bands for Intelligent Transport Systems in the mobile service	General ITS radio communication	2019/01

●ITS-related Standardizations in ITU-T

In ITU-T, eleven SGs (Study Groups) share the standardization work in the ICT field.

Focusing on the importance of ITS communications, ITU held a Fully Networked Car Workshop in collaboration with ISO and IEC as one of the events at the Salon International de l'Auto in Geneva from 2005 through 2013. From 2014, it has been hosting a Future Networked Car Symposium collaboratively with UNECE.

Before beginning the process of actual recommendation development, by leveraging a mechanism referred to as FG (focus group) that allows non-members to participate in preliminary discussions, four FGs, FG-FITCAR, FG-FITCAR II and FG-CarCom, which discussed voice calls from vehicles, and FG Driver Distraction, which discussed what ICT technology can do to reduce auto accidents based on the UN report and ITU Council Resolution, have been organized from 2007 through 2013. They resulted in related recommendation developments in SG12. From 2018, the FG on Vehicular Multimedia (FG-VM), has been studying the extraction, organization and resolving of issues concerning the standardization of multimedia related to automobiles. From 2020, the FG on AI for Autonomous & Assisted Driving (FG-AI4AD) has been studying AI for automated driving.

The main items discussed at ITU-T include the standardization of network architectures and gateway platforms for ITS communications, security in ITS communications, and quality of service using ITS communications. (For its most recent status, refer to the following ITU-T Website: http://www.itu.int/en/ITU-T/Pages/default.aspx)

ITS communications study group (SG) in ITU-T

Study group	Fields in charge and main standardization fields in ITS communications
SG12 (Performance, QoS and QoE)	In charge of performance, QoS (Quality of Service) and QoE (Quality of Experience) of the info-communication network. Discussing standardization of in-vehicle communication via handover, etc.
SG16 (Multimedia)	In charge of multimedia applications using the info-communication network Discussing requirements and architecture (including gateway platform) to the info-communication network from the point of view of various applications including ITS communications
SG17 (Security)	In charge of security of the info-communication network Studies security technology in ITS communication and its related standardization

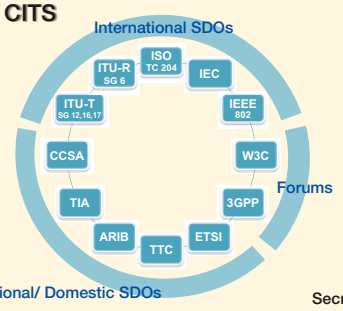
Outline of recommendation documents

SG	Name of the document	Document number	Content
SG12	Narrowband hands-free communication in motor vehicles	ITU-T P.1100	Hands-free communication adapter using in-vehicle narrow band voice encoding.
	Wideband hands-free communication in motor vehicles	ITU-T P.1110	Hands-free communication adapter using in-vehicle wide band voice encoding.
	Super-wideband and fullband stereo hands-free communication in motor vehicles	ITU-T P.1120	Hands-free communication adapter using in-vehicle ultra wide band and full -band stereo voice encoding.
	Subsystem requirements for automotive speech services	ITU-T P.1130	In-vehicle subsystem requirements for speech services.
	Speech communication requirements for emergency calls originating from vehicles	ITU-T P.1140	Speech communication requirements for emergency calls from vehicles.
SG16	Functional requirements for vehicle gateways	ITU-T F.749.1	Functional requirements for in-vehicle gateways.
	Service requirements for vehicle gateway platforms	ITU-T F.749.2	Service requirements for in-vehicle gateway platforms.
	Use cases and requirements for vehicular multimedia networks	ITU-T F.749.3	Use cases and requirements for in-vehicle multimedia networks
	Use cases and requirements for multimedia communication enabled vehicle systems using artificial intelligence	ITU-T F.749.4	Use cases and requirements for multimedia communication-enabled in-vehicle systems using artificial intelligence
	Architecture and functional entities of vehicle gateway platforms	ITU-T H.550	Architecture and functional entities of in-vehicle gateway platforms.
	Communications interface between external applications and a vehicle gateway platform	ITU-T H.560	Communication interface between external applications and an in-vehicle gateway platform.
SG17	Security threats to connected vehicles	ITU-T X.1371	Document summarizing security threats in threat information to consistently promote standardization of security related to connected cars
	Security guidelines for vehicle-to-everything (V2X) communication systems	ITU-T X.1372	Security guidelines for vehicle-to-vehicle communication, including V2V, V2I, V2D, and V2P, and when the vehicle and other devices communicate
	Secure software update capability for intelligent transportation system communication devices	ITU-T X.1373	Security guidelines for remote software updates for ITS communication devices
	Security requirements for external interfaces and devices with vehicle access capability	ITU-T X.1374	Security requirements for external interfaces and devices to access the vehicle's systems
	Guidelines for an intrusion detection system for in-vehicle networks	ITU-T X.1375	Guidelines for detecting external intrusions into in-car networks
	Security-related misbehaviour detection mechanism using big data for connected vehicles	ITU-T X.1376	Specifies a method for detecting security-related unauthorized behavior using data collected from vehicles and service providers

●CITS (Collaboration on ITS Communication Standards)

CITS (Collaboration on ITS Communication Standards) was structured as a framework to provide a place where standardization institutions/bodies involved, including ITU-R, ISO, IEC, IEEE, regional standardization bodies and various forums, etc., establish collaboration and cooperation on the initiative of ITU-T. It aims to foster information sharing and opinion exchange in the form of workshops and meetings, and for work sharing, cross citation and revision of standard drafts based on agreements. Since the preparatory meeting held by TC 204 and ITU-T SG16 in August 2011, 28 CITS meetings have been held as of March 2020, at which participants exchanged and shared meaningful information about what had been achieved by each standardization body.

Concept of CITS



Secretariat: ITU-T

ITS-related Standardizations by IEEE

●Standardizations by the IEEE 802 Committee

IEEE (The Institute of Electrical and Electronics Engineers) is the institution for electricity and electronics specialists. It proceeds with discussions on electronics, communications and information, etc., and is working on standardization. IEEE 802, one of IEEE's technical committees is conducting LAN (Local Area Network) and MAN (Metropolitan Area Network)-related standardization activities. It includes Working Groups (WGs) for both wired and wireless technologies. Table 1 lists wireless technology WGs related to ITS.

Table 1 ITS related Working Groups under IEEE 802 Committee

802.11	Wireless Local Area Network (WLAN)	Deals with technologies for wireless communication within a building and/or facility (Several tens to several hundreds meters)
802.15	Wireless Personal Area Network (WPAN)	Deals with technologies for wireless communication within a room (Several to several tens meters)
802.16	Wireless Metropolitan Area Network (WMAN)	Deals with technologies for wireless communication within a region like a city (Several to several ten kms)
802.20	Mobile Broadband Wireless Access (MBWA)	Deals with broadband IP wireless communication in high speed mobile environments such as vehicles
802.21	Handover between heterogeneous networks	Deals with technologies to continue communication by switching across different kind of networks
802.22	Wireless Regional Area Network (WRAN)	Deals with cognitive radio technologies enabling communications in TV broadcast band without causing interference

WLANs, WMANs and MBWAs are considered applicable as media for ITS communications between roadside and vehicle and between vehicles. WPANs can be used as a communication medium for short distances such as inside a vehicle. WRANs may also be applicable to ITS. Future ITS equipment is expected to use multiple communication media, and technology capable of continuing communication by switching across different kind of networks (handover) is considered necessary.

The IEEE 802.11 WG, which functions as WLAN (wireless LAN) used in various occasions, is engaged in a range of standardization activities with many Task Groups under it. Established in 2004, Task Group p standardized as IEEE 802.11p a protocol that took IEEE 802.11a, commonly used in wireless LAN, as a base and modified it to suit ITS usage environments. This protocol uses OFDM modulation to achieve efficient data transmission in harsh environments as it uses a communication control method that allows links to be established quickly.

In 1999, the U.S. allocated the 5.9 GHz band for ITS communications, and a number of demonstrations have been conducted using IEEE 802.11p, which was still being standardized. IEEE 802.11p was finally approved in June 2010 and published in July 2010.

Currently, IEEE is investigating a new communication method that extends IEEE 802.11p. Initially called NGV (Next Generation Vehicular), work on this began in 2019 in Task Group bd.

The standard, which will become IEEE 802.11bd, will use IEEE 802.11ac (5 GHz band) technology, which has been used in wireless LANs in recent years, to increase speed while maintaining compatibility with IEEE 802.11p. A 60GHz millimeter wave frequency band is also available as an option, which is expected to enable even higher capacity communications.

Table 2 Outline of IEEE 802.11p Specifications

Frequency band to be used	5.85-5.925 GHz
Channel band width	10 MHz (optionally 20 MHz available in part)
Number channels	7
Modulation method	OFDM (same as IEEE 802.11a)
Max. transmission power/ communication distance	Class A: 0 dBm/ 15m, Class B: 10 dBm/ 100m Class C: 20dBm/ 400m, Class D: 28.8dBm/ 1000m
Medium access benefit	RSU and OBU are substantially equal. Quick link establishment

The 5.9 GHz band was also allocated in Europe in 2008 in anticipation of the use of IEEE 802.11p, and a great deal of testing was conducted. In 2009, the European Telecommunications Standards Institute (ETSI)'s ITS Technical Committee defined ITS-G5, a communication standard using IEEE 802.11p. TC204/WG16 also standardized the IEEE 802.11p communication media as ISO 21215.

●Standardizations in IEEE 1609 Project

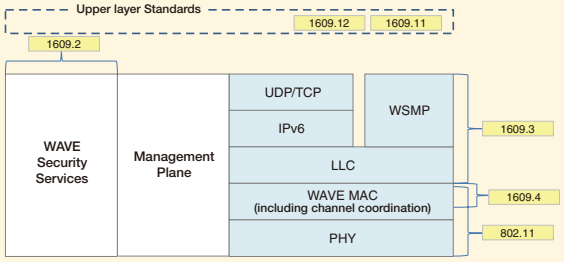
The ITS communication system in the U.S. is referred to as WAVE (Wireless Access in Vehicular Environments). While WAVE communication media will use the above-mentioned IEEE 802.11p, the other parts are likely to use the IEEE 1609 standards prepared in the IEEE 1609 project.

Based on 1609.0 (Architecture), which describes the overall configuration, the standards have been published, and some are still being examined for revision. However, some parts are no longer being revised or were withdrawn after publication.

Table 3 Standardization Items in IEEE 1609

1609.0	WAVE Architecture
1609.2	Security Services for Applications and Management Messages
1609.3	Networking Services
1609.4	Multi-Channel Operation
1609.11	Over-the-Air Electronic Payment Data Exchange Protocol for ITS (withdrawn)
1609.12	Identifier
1609.13	Reliable Data Transport Mechanisms for Multiple Receivers (under review)
1609.20	Recommended practice for extending the functionality of IEEE Std 1609.2 (under review)

Overall WAVE architecture



TC 204 List of Work Items and Progress Stages as of July 2021

WG	ISO Number	Title	Stage						Pub-lished
			PWI	NP	WD	CD	DIS	FDIS	
TC204	ISO/TR 28682:2008	Intelligent transport systems — Joint APEC-ISO study of progress to develop and deploy ITS standards							○
TC204	ISO 24535:2007	Intelligent transport systems — Automatic vehicle identification — Basic electronic registration identification (Basic ERI)							○
TC204	ISO 24534-1:2010	Automatic vehicle and equipment identification — Electronic registration identification (ERI) for vehicles — Part 1: Architecture							○
TC204	ISO 24534-2:2010	Automatic vehicle and equipment identification — Electronic registration identification (ERI) for vehicles — Part 2: Operational requirements							○
TC204	ISO 24534-3:2016	Intelligent transport systems — Automatic vehicle and equipment identification — Electronic registration identification (ERI) for vehicles — Part 3: Vehicle data							○
TC204	ISO 24534-4:2010	Automatic vehicle and equipment identification — Electronic registration identification (ERI) for vehicles — Part 4: Secure communications using asymmetrical techniques							○
TC204	ISO 24534-4:2010/ Amd 1:2019	Automatic vehicle and equipment identification — Electronic registration identification (ERI) for vehicles — Part 4: Secure communications using asymmetrical techniques — Amendment 1							○
TC204	ISO 24534-5:2011	Intelligent transport systems — Automatic vehicle and equipment identification — Electronic Registration Identification (ERI) for vehicles — Part 5: Secure communications using symmetrical techniques							○
TC204	ISO 24534-5:2011/ Amd 1:2019	Intelligent transport systems — Automatic vehicle and equipment identification — Electronic Registration Identification (ERI) for vehicles — Part 5: Secure communications using symmetrical techniques — Amendment 1							○
TC204	ISO/TR 17384:2008	Intelligent transport systems — Interactive centrally determined route guidance (CDRG) — Air interface message set, contents and format							○
TC204	ISO 17264:2009	Intelligent transport systems — Automatic vehicle and equipment identification — Interfaces							○
TC204	ISO 17264:2009/ Amd 1:2019	Intelligent transport systems — Automatic vehicle and equipment identification — Interfaces — Amendment 1							○
TC204	ISO 17263:2012	Intelligent transport systems — Automatic vehicle and equipment identification — System parameters							○
TC204	ISO 17263:2012/ Cor 1:2013	Intelligent transport systems — Automatic vehicle and equipment identification — System parameters — Technical Corrigendum 1							○
TC204	ISO 17262:2012	Intelligent transport systems — Automatic vehicle and equipment identification — Numbering and data structures							○
TC204	ISO 17262:2012/ Amd 1:2019	Intelligent transport systems — Automatic vehicle and equipment identification — Numbering and data structures — Amendment 1							○
TC204	ISO 17262:2012/ Cor 1:2013	Intelligent transport systems — Automatic vehicle and equipment identification — Numbering and data structures — Technical Corrigendum 1							○
TC204	ISO 17261:2012	Intelligent transport systems — Automatic vehicle and equipment identification — Intermodal goods transport architecture and terminology							○
TC204	ISO 15075:2003	Transport information and control systems — In-vehicle navigation systems — Communications message set requirements							○
TC204	ISO 14816:2005	Road transport and traffic telematics — Automatic vehicle and equipment identification — Numbering and data structure							○
TC204	ISO 14816:2005/ Amd 1:2019	Road transport and traffic telematics — Automatic vehicle and equipment identification — Numbering and data structure — Amendment 1							○
TC204	ISO 14815:2005	Road transport and traffic telematics — Automatic vehicle and equipment identification — System specifications							○
TC204	ISO 14814:2006	Road transport and traffic telematics — Automatic vehicle and equipment identification — Reference architecture and terminology							○
WG 1	ISO/TR 26999:2012	Intelligent transport systems — Systems architecture — Use of process-oriented methodology in ITS International Standards and other deliverables							○
WG 1	ISO/TR 25104:2008	Intelligent transport systems — System architecture, taxonomy, terminology and data modelling — Training requirements for ITS architecture							○
WG 1	ISO/TR 25102:2008	Intelligent transport systems — System architecture — 'Use Case' pro-forma template							○
WG 1	ISO/TR 25100:2012	Intelligent transport systems — Systems architecture — Harmonization of ITS data concepts							○
WG 1	ISO 24531:2013	Intelligent transport systems — System architecture, taxonomy and terminology — Using XML in ITS standards, data registries and data dictionaries							○
WG 1	ISO/TR 24529:2008	Intelligent transport systems — Systems architecture — Use of unified modelling language (UML) in ITS International Standards and deliverables							○
WG 1	ISO/TR 24098:2007	Intelligent transport systems — System architecture, taxonomy and terminology — Procedures for developing ITS deployment plans utilizing ITS system architecture							○
WG 1	ISO 24097-1:2017	Intelligent transport systems — Using web services (machine-machine delivery) for ITS service delivery — Part 1: Realization of interoperable web services							○
WG 1	ISO/TR 24097-2:2015	Intelligent transport systems — Using web services (machine-machine delivery) for ITS service delivery — Part 2: Elaboration of interoperable web services' interfaces							○
WG 1	ISO/TR 24097-3:2019	Intelligent transport systems — Using web services (machine-machine delivery) for ITS service delivery — Part 3: Quality of service							○
WG 1	ISO/DTR 23255	Intelligent transport systems — Architecture — Applicability of data distribution technologies within ITS				○			
WG 1	ISO/AWI TR 23254	Intelligent transport systems — Architecture — Use cases and high-level reference architecture for connected, automated vehicles			○				

WG	ISO Number	Title	Stage						Published
			PWI	NP	WD	CD	DIS	FDIS	
WG 1	ISO/TR 17465-1:2014	Intelligent transport systems — Cooperative ITS — Part 1: Terms and definitions							○
WG 1	ISO/TR 17465-2:2015	Intelligent transport systems — Cooperative ITS — Part 2: Guidelines for standards documents							○
WG 1	ISO/TR 17465-3:2015	Intelligent transport systems — Cooperative ITS — Part 3: Release procedures for standards documents							○
WG 1	ISO/TR 17452:2007	Intelligent transport systems — Using UML for defining and documenting ITS/TICS interfaces							○
WG 1	ISO 14817-1:2015	Intelligent transport systems — ITS central data dictionaries — Part 1: Requirements for ITS data definitions							○
WG 1	ISO 14817-2:2015	Intelligent transport systems — ITS central data dictionaries — Part 2: Governance of the Central ITS Data Concept Registry							○
WG 1	ISO 14817-3:2017	Intelligent transport systems — ITS data dictionaries — Part 3: Object identifier assignments for ITS data concepts							○
WG 1	ISO/AWI 14813-1	Intelligent transport systems — Reference model architecture(s) for the ITS sector — Part 1: ITS service domains, service groups and services			○				
WG 1	ISO 14813-1:2015	Intelligent transport systems — Reference model architecture(s) for the ITS sector — Part 1: ITS service domains, service groups and services							○
WG 1	ISO 14813-5:2020	Intelligent transport systems — Reference model architecture(s) for the ITS sector — Part 5: Requirements for architecture description in ITS standards							○
WG 1	ISO 14813-6:2017	Intelligent transport systems — Reference model architecture(s) for the ITS sector — Part 6: Use of ASN.1							○
WG 1	ISO/DTS 14812	Intelligent transport systems — Vocabulary				○			
WG 1	ISO/TR 12859:2009	Intelligent transport systems — System architecture — Privacy aspects in ITS standards and systems							○
WG 1	ISO/DIS 5345	Intelligent transport systems — Identifiers — Processes					○		
WG 3	ISO 24099:2011	Navigation data delivery structures and protocols							○
WG 3	ISO/AWI TS 22726-1	Intelligent transport systems — Dynamic data and map database specification for connected and automated driving system applications — Part 1: Architecture and logical data model for harmonization of static map data			○				
WG 3	ISO/AWI TS 22726-2	Intelligent transport systems — Dynamic data and map database specification for connected and automated driving system applications — Part 2: Logical data model of dynamic data			○				
WG 3	ISO/TR 21718:2019	Intelligent transport systems — Spatio-temporal data dictionary for cooperative ITS and automated driving systems 2.0							○
WG 3	ISO 20524-1:2020	Intelligent transport systems — Geographic Data Files (GDF) GDF5.1 — Part 1: Application independent map data shared between multiple sources							○
WG 3	ISO 20524-2:2020	Intelligent transport systems — Geographic Data Files (GDF) GDF5.1 — Part 2: Map data used in automated driving systems, Cooperative ITS, and multi-modal transport							○
WG 3	ISO/TS 20452:2007	Requirements and Logical Data Model for a Physical Storage Format (PSF) and an Application Program Interface (API) and Logical Data Organization for PSF used in Intelligent Transport Systems (ITS) Database Technology							○
WG 3	ISO 19297-1:2019	Intelligent transport systems — Shareable geospatial databases for ITS applications — Part 1: Framework							○
WG 3	ISO/AWI 19297-4	Intelligent transport systems — Shareable geospatial databases for ITS applications — Part 4: Common data structure			○				
WG 3	ISO/AWI 19297-5	Intelligent transport systems — Shareable geospatial databases for ITS applications — Part 5: Data encoding method			○				
WG 3	ISO/DIS 17572-1	Intelligent transport systems (ITS) — Location referencing for geographic databases — Part 1: General requirements and conceptual model					○		
WG 3	ISO 17572-1:2015	Intelligent transport systems (ITS) — Location referencing for geographic databases — Part 1: General requirements and conceptual model							○
WG 3	ISO 17572-2:2018	Intelligent transport systems (ITS) — Location referencing for geographic databases — Part 2: Pre-coded location references (pre-coded profile)							○
WG 3	ISO 17572-3:2015	Intelligent transport systems (ITS) — Location referencing for geographic databases — Part 3: Dynamic location references (dynamic profile)							○
WG 3	ISO 17572-4:2020	Intelligent transport systems (ITS) — Location referencing for geographic databases — Part 4: Precise relative location references (precise relative profile)							○
WG 3	ISO 17267:2009	Intelligent transport systems — Navigation systems — Application programming interface (API)							○
WG 3	ISO 14296:2016	Intelligent transport systems — Extension of map database specifications for applications of cooperative ITS							○
WG 5	ISO/NP TS 37444	Electronic fee collection — Charging performance		○					
WG 5	ISO 25110:2017	Electronic fee collection — Interface definition for on-board account using integrated circuit card (ICC)							○
WG 5	ISO/TS 21719-1:2018	Electronic fee collection — Personalization of on-board equipment (OBE) — Part 1: Framework							○
WG 5	ISO/TS 21719-2:2018	Electronic fee collection — Personalization of on-board equipment (OBE) — Part 2: Using dedicated short-range communication							○
WG 5	ISO/PRF TS 21719-3	Electronic fee collection — Personalization of on-board equipment — Part 3: Using integrated circuit(s) cards						○	
WG 5	ISO/TS 21193:2019	Electronic fee collection — Requirements for EFC application interfaces on common media							○
WG 5	ISO/TS 21192:2019	Electronic fee collection — Support for traffic management							○
WG 5	ISO/TR 21190:2018	Electronic fee collection — Investigation of charging policies and technologies for future standardization							○

WG	ISO Number	Title	Stage						Pub-lished
			PWI	NP	WD	CD	DIS	FDIS	
WG 5	ISO/TR 19639:2015	Electronic fee collection — Investigation of EFC standards for common payment schemes for multi-modal transport services							○
WG 5	ISO 19299:2020	Electronic fee collection — Security framework							○
WG 5	ISO 17575-1:2016	Electronic fee collection — Application interface definition for autonomous systems — Part 1: Charging							○
WG 5	ISO 17575-2:2016	Electronic fee collection — Application interface definition for autonomous systems — Part 2: Communication and connection to the lower layers							○
WG 5	ISO 17575-3:2016	Electronic fee collection — Application interface definition for autonomous systems — Part 3: Context data							○
WG 5	ISO/TS 17574:2017	Electronic fee collection — Guidelines for security protection profiles							○
WG 5	ISO 17573-1:2019	Electronic fee collection — System architecture for vehicle-related tolling — Part 1: Reference model							○
WG 5	ISO/TS 17573-2:2020	Electronic fee collection — System architecture for vehicle related tolling — Part 2: Vocabulary							○
WG 5	ISO/PRF TS 17573-3	Electronic fee collection — System architecture for vehicle-related tolling — Part 3: Data dictionary						○	
WG 5	ISO/TS 17444-1:2017	Electronic fee collection — Charging performance — Part 1: Metrics							○
WG 5	ISO/TS 17444-2:2017	Electronic fee collection — Charging performance — Part 2: Examination framework							○
WG 5	ISO/TS 16785:2020	Electronic Fee Collection (EFC) — Application interface definition between DSRC-OBE and external in-vehicle devices							○
WG 5	ISO 16410-1:2017	Electronic fee collection — Evaluation of equipment for conformity to ISO 17575-3 — Part 1: Test suite structure and test purposes							○
WG 5	ISO 16410-2:2018	Electronic fee collection — Evaluation of equipment for conformity to ISO 17575-3 — Part 2: Abstract test suite							○
WG 5	ISO 16407-1:2017	Electronic fee collection — Evaluation of equipment for conformity to ISO 17575-1 — Part 1: Test suite structure and test purposes							○
WG 5	ISO 16407-2:2018	Electronic fee collection — Evaluation of equipment for conformity to ISO 17575-1 — Part 2: Abstract test suite							○
WG 5	ISO/TR 16401-1:2018	Electronic fee collection — Evaluation of equipment for conformity to ISO/TS 17575-2 — Part 1: Test suite structure and test purposes							○
WG 5	ISO/TR 16401-2:2018	Electronic fee collection — Evaluation of equipment for conformity to ISO 17575-2 — Part 2: Abstract test suite							○
WG 5	ISO 14907-1:2020	Electronic fee collection — Test procedures for user and fixed equipment — Part 1: Description of test procedures							○
WG 5	ISO 14907-2:2021	Electronic fee collection — Test procedures for user and fixed equipment — Part 2: Conformance test for the on-board unit application interface							○
WG 5	ISO/DIS 14906	Electronic fee collection — Application interface definition for dedicated short-range communication					○		
WG 5	ISO 14906:2018	Electronic fee collection — Application interface definition for dedicated short-range communication							○
WG 5	ISO 14906:2018/ Amd 1:2020	Electronic fee collection — Application interface definition for dedicated short-range communication — Amendment 1							○
WG 5	ISO 13143-1:2020	Electronic fee collection — Evaluation of on-board and roadside equipment for conformity to ISO 12813 — Part 1: Test suite structure and test purposes							○
WG 5	ISO 13143-2:2016	Electronic fee collection — Evaluation of on-board and roadside equipment for conformity to ISO 12813 — Part 2: Abstract test suite							○
WG 5	ISO/CD 13141	Electronic fee collection — Localisation augmentation communication for autonomous systems				○			
WG 5	ISO 13141:2015	Electronic fee collection — Localisation augmentation communication for autonomous systems							○
WG 5	ISO 13141:2015/ Amd 1:2017	Electronic fee collection — Localisation augmentation communication for autonomous systems — Amendment 1							○
WG 5	ISO 13140-1:2016	Electronic fee collection — Evaluation of on-board and roadside equipment for conformity to ISO 13141 — Part 1: Test suite structure and test purposes							○
WG 5	ISO 13140-2:2016	Electronic fee collection — Evaluation of on-board and roadside equipment for conformity to ISO 13141 — Part 2: Abstract test suite							○
WG 5	ISO/DIS 12855	Electronic fee collection — Information exchange between service provision and toll charging					○		
WG 5	ISO 12855:2015	Electronic fee collection — Information exchange between service provision and toll charging							○
WG 5	ISO/DIS 12813	Electronic fee collection — Compliance check communication for autonomous systems					○		
WG 5	ISO 12813:2019	Electronic fee collection — Compliance check communication for autonomous systems							○
WG 5	ISO/PWI TR 6026	Electronic fee collection — Pre-study on the use of vehicle licence plate information and automatic number plate recognition (ANPR) technologies	○						
WG 7	ISO 26683-1:2013	Intelligent transport systems — Freight land conveyance content identification and communication — Part 1: Context, architecture and referenced standards							○
WG 7	ISO 26683-2:2013	Intelligent transport systems — Freight land conveyance content identification and communication — Part 2: Application interface profiles							○
WG 7	ISO 26683-3:2019	Intelligent transport systems — Freight land conveyance content identification and communication — Part 3: Monitoring cargo condition information during transport							○
WG 7	ISO/TS 24533:2012	Intelligent transport systems — Electronic information exchange to facilitate the movement of freight and its intermodal transfer — Road transport information exchange methodology							○

WG	ISO Number	Title	Stage						Published
			PWI	NP	WD	CD	DIS	FDIS	
WG 7	ISO/AWI 24533-1	Intelligent transport systems — Electronic information exchange to facilitate the movement of freight and its intermodal transfer — Part 1: Road transport information exchange methodology			○				
WG 7	ISO/DIS 24533-2	Intelligent transport systems — Electronic information exchange to facilitate the movement of freight and its intermodal transfer — Part 2: Common Reporting System					○		
WG 7	ISO 18495-1:2016	Intelligent transport systems — Commercial freight — Automotive visibility in the distribution supply chain — Part 1: Architecture and data definitions							○
WG 7	ISO 17687:2007	Transport Information and Control Systems (TICS) — General fleet management and commercial freight operations — Data dictionary and message sets for electronic identification and monitoring of hazardous materials/ dangerous goods transportation							○
WG 7	ISO/TS 17187:2019	Intelligent transport systems — Electronic information exchange to facilitate the movement of freight and its intermodal transfer — Governance rules to sustain electronic information exchange methods							○
WG 7	ISO 15638-1:2012	Intelligent transport systems — Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) — Part 1: Framework and architecture							○
WG 7	ISO 15638-2:2013	Intelligent transport systems — Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) — Part 2: Common platform parameters using CALM							○
WG 7	ISO 15638-3:2013	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							○
WG 7	ISO/TS 15638-4:2020	Intelligent transport systems — Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) — Part 4: System security requirements							○
WG 7	ISO 15638-5:2013	Intelligent transport systems — Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) — Part 5: Generic vehicle information							○
WG 7	ISO 15638-6:2014	Intelligent transport systems — Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) — Part 6: Regulated applications							○
WG 7	ISO 15638-7:2013	Intelligent transport systems — Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) — Part 7: Other applications							○
WG 7	ISO 15638-8:2014	Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 8: Vehicle access management							○
WG 7	ISO 15638-9:2020	Intelligent transport systems — Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) — Part 9: Remote digital tachograph monitoring							○
WG 7	ISO 15638-10:2017	Intelligent transport systems — Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) — Part 10: Emergency messaging system/eCall							○
WG 7	ISO 15638-11:2014	Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 11: Driver work records							○
WG 7	ISO 15638-12:2014	Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 12: Vehicle mass monitoring							○
WG 7	ISO/TS 15638-13:2015	Intelligent transport systems — Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) — Part 13: "Mass" information for jurisdictional control and enforcement							○
WG 7	ISO 15638-14:2014	Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 14: Vehicle access control							○
WG 7	ISO 15638-15:2014	Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 15: Vehicle location monitoring							○
WG 7	ISO 15638-16:2014	Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 16: Vehicle speed monitoring							○
WG 7	ISO 15638-17:2014	Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 17: Consignment and location monitoring							○
WG 7	ISO 15638-18:2017	Intelligent transport systems — Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) — Part 18: ADR (Dangerous Goods)							○
WG 7	ISO/TS 15638-19:2013	Intelligent transport systems — Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) — Part 19: Vehicle parking facilities (VPF)							○
WG 7	ISO 15638-20:2020	Intelligent transport systems — Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) — Part 20: Weigh-in-motion monitoring							○
WG 7	ISO 15638-21:2018	Intelligent transport systems — Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) — Part 21: Monitoring of regulated vehicles using roadside sensors and data collected from the vehicle for enforcement and other purposes							○
WG 7	ISO 15638-22:2019	Intelligent transport systems — Framework for collaborative telematics applications for regulated commercial freight vehicles (TARV) — Part 22: Freight vehicle stability monitoring							○
WG 7	ISO/AWI 15638-23	Intelligent transport systems — Framework for collaborative telematics applications for regulated commercial freight vehicles (TARV) — Part 23: Tyre monitoring			○				
WG 7	ISO 15638-24:2021	Intelligent transport systems — Framework for collaborative telematics applications for regulated commercial freight vehicles (TARV) — Part 24: Safety information provisioning							○
WG 7	ISO/NP TS 7815-1	Intelligent transport systems — Telematics applications for regulated commercial freight vehicles (TARV) using ITS stations — Part 1: Secure vehicle interface framework and architecture		○					
WG 7	ISO/NP TS 7815-2	Intelligent transport systems — Telematics applications for regulated commercial freight vehicles (TARV) using ITS stations — Part 2: Specification of the secure vehicle interface		○					
WG 8	ISO/PWI 24299	Intelligent transport systems — Public transport - Machine learning/artificial intelligence for public transport route design and update	○						
WG 8	ISO/AWI 24298	Intelligent transport systems — Public transport — Light emitting diode (LED) destination board system for public transport buses			○				
WG 8	ISO 24014-1:2021	Public transport — Interoperable fare management system — Part 1: Architecture							○
WG 8	ISO/TR 24014-2:2013	Public transport — Interoperable fare management system — Part 2: Business practices							○
WG 8	ISO/TR 24014-3:2013	Public transport — Interoperable fare management system — Part 3: Complementary concepts to Part 1 for multi-application media							○

WG	ISO Number	Title	Stage						Published
			PWI	NP	WD	CD	DIS	FDIS	
WG 8	ISO 22951:2009	Data dictionary and message sets for preemption and prioritization signal systems for emergency and public transport vehicles (PRESTO)							○
WG 8	ISO/AWI 21734-1	Public transport — Performance testing for connectivity and safety functions of automated driving bus — Part 1: General framework			○				
WG 8	ISO/AWI 21734-2	Public transport — Performance testing for connectivity and safety functions of automated driving bus — Part 2: Performance requirements and test procedures			○				
WG 8	ISO/PWI TR 21734-3	Public transport — Performance testing for connectivity and safety functions of automated driving bus — Part 3: Service framework and uses cases	○						
WG 8	ISO/TR 21724-1:2020	Intelligent transport systems — Common Transport Service Account Systems — Part 1: Framework and use cases							○
WG 8	ISO/DTR 20527	Intelligent transport systems — Interoperability between IFM systems and NFC mobile devices				○			
WG 8	ISO/TR 20526:2017	Account-based ticketing state of the art report							○
WG 8	ISO/TR 19083-1:2016	Intelligent transport systems — Emergency evacuation and disaster response and recovery — Part 1: Framework and concept of operation							○
WG 8	ISO 17185-1:2014	Intelligent transport systems — Public transport user information — Part 1: Standards framework for public information systems							○
WG 8	ISO/TR 17185-2:2015	Intelligent transport systems — Public transport user information — Part 2: Public transport data and interface standards catalogue and cross references							○
WG 8	ISO/TR 17185-3:2015	Intelligent transport systems — Public transport user information — Part 3: Use cases for journey planning systems and their interoperation							○
WG 8	ISO/PWI TR 17185-4	Intelligent transport systems — Public transport user information — Part 4: 'Safe' journey planning use cases for multimodal travel for vulnerable road users	○						
WG 8	ISO/TR 14806:2013	Intelligent transport systems — Public transport requirements for the use of payment applications for fare media							○
WG 8	ISO/AWI TS 4398	Intelligent transport systems — Guided transportation service planning data exchange			○				
WG 8	ISO/PWI TR 4255	Public transport — Integration of multiple demand responsive transportation (DRT) services with public transport	○						
WG 9	ISO/DIS 22741-1	Intelligent transport systems — Roadside modules AP-DATEX data interface — Part 1: Overview					○		
WG 9	ISO/AWI TS 22741-10	Intelligent transport systems — Roadside modules AP-DATEX data interface — Part 10: Variable message signs			○				
WG 9	ISO/TR 21707:2008	Intelligent transport systems — Integrated transport information, management and control — Data quality in ITS systems							○
WG 9	ISO 20684-1:2021	Intelligent transport systems — Roadside modules SNMP data interface — Part 1: Overview							○
WG 9	ISO/TS 20684-2:2021	Intelligent transport systems — Roadside modules SNMP data interface — Part 2: Generalized field device basic management							○
WG 9	ISO/AWI TS 20684-3	Intelligent transport systems — Roadside modules SNMP data interface — Part 3: Triggers			○				
WG 9	ISO/AWI TS 20684-4	Intelligent transport systems — Roadside modules SNMP data interface — Part 4: Notifications			○				
WG 9	ISO/AWI TS 20684-5	Intelligent transport systems — Roadside modules SNMP data interface — Part 5: Logs			○				
WG 9	ISO/AWI TS 20684-6	Intelligent transport systems — Roadside modules SNMP data interface — Part 6: Commands			○				
WG 9	ISO/AWI TS 20684-7	Intelligent transport systems — Roadside modules SNMP data interface — Part 7: Support features			○				
WG 9	ISO/TS 20684-10:2021	Intelligent transport systems — Roadside modules SNMP data interface — Part 10: Variable message signs							○
WG 9	ISO/DTS 19468	Intelligent transport systems — Data interfaces between centres for transport information and control systems — Platform independent model specifications for data exchange protocols for transport information and control systems				○			
WG 9	ISO/TS 19468:2019	Intelligent transport systems — Data interfaces between centres for transport information and control systems — Platform independent model specifications for data exchange protocols for transport information and control systems							○
WG 9	ISO/TS 19082:2020	Intelligent transport systems — Definition of data elements and data frames between roadside modules and signal controllers for cooperative signal control							○
WG 9	ISO/TR 16786:2015	Intelligent transport systems — The use of simulation models for evaluation of traffic management systems — Input parameters and reporting template for simulation of traffic signal control systems							○
WG 9	ISO 15784-1:2008	Intelligent transport systems (ITS) — Data exchange involving roadside modules communication — Part 1: General principles and documentation framework of application profiles							○
WG 9	ISO 15784-2:2015	Intelligent transport systems (ITS) — Data exchange involving roadside modules communication — Part 2: Centre to field device communications using SNMP							○
WG 9	ISO 15784-2:2015/ Amd 1:2020	Intelligent transport systems (ITS) — Data exchange involving roadside modules communication — Part 2: Centre to field device communications using SNMP — Amendment 1: Support for SHA2 encryption							○
WG 9	ISO 15784-3:2008	Intelligent transport systems (ITS) — Data exchange involving roadside modules communication — Part 3: Application profile-data exchange (AP-DATEX)							○
WG 9	ISO 14827-1:2005	Transport information and control systems — Data interfaces between centres for transport information and control systems — Part 1: Message definition requirements							○
WG 9	ISO/CD 14827-2	Intelligent transport systems — Data interfaces between centres for transport information and control systems — Part 2: AP-DATEX				○			
WG 9	ISO 14827-2:2005	Transport information and control systems — Data interfaces between centres for transport information and control systems — Part 2: DATEX-ASN							○

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WG 9	ISO 14827-3:2019	Transport information and control systems — Data interfaces between centres for transport information and control systems — Part 3: Data interfaces between centres for intelligent transport sytems (ITS) using XML (Profile A)							○
WG 9	ISO/AWI TS 14827-4	Intelligent transport systems — Data interfaces between centres for intelligent transport systems — Part 4: Data interfaces between centres for Intelligent transport systems (ITS) using XML (Profile B)			○				
WG 9	ISO 10711:2012	Intelligent Transport Systems — Interface Protocol and Message Set Definition between Traffic Signal Controllers and Detectors							○
WG 10	ISO/TS 24530-1:2006	Traffic and Travel Information (TTI) — TTI via Transport Protocol Experts Group (TPEG) Extensible Markup Language (XML) — Part 1: Introduction, common data types and tpegML							○
WG 10	ISO/TS 24530-2:2006	Traffic and Travel Information (TTI) — TTI via Transport Protocol Experts Group (TPEG) Extensible Markup Language (XML) — Part 2: tpeg-locML							○
WG 10	ISO/TS 24530-3:2006	Traffic and Travel Information (TTI) — TTI via Transport Protocol Experts Group (TPEG) Extensible Markup Language (XML) — Part 3: tpeg-rtmML							○
WG 10	ISO/TS 24530-4:2006	Traffic and Travel Information (TTI) — TTI via Transport Protocol Experts Group (TPEG) Extensible Markup Language (XML) — Part 4: tpeg-ptiML							○
WG 10	ISO/DIS 21219-1	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 1: Introduction, numbering and versions (TPEG2-INV)					○		
WG 10	ISO/TS 21219-1:2016	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 1: Introduction, numbering and versions (TPEG2-INV)							○
WG 10	ISO 21219-2:2019	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 2: UML modelling rules (TPEG2-UMR)							○
WG 10	ISO 21219-3:2019	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 3: UML to binary conversion rules (TPEG2-UBCR)							○
WG 10	ISO 21219-4:2019	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 4: UML to XML conversion rules							○
WG 10	ISO 21219-5:2019	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 5: Service framework (TPEG2-SFW)							○
WG 10	ISO 21219-6:2019	Intelligent transport systems — Traffic and travel information(TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 6: Message management container (TPEG2-MMC)							○
WG 10	ISO/CD 21219-7	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 7: Location referencing container (TPEG2-LRC)				○			
WG 10	ISO/TS 21219-7:2017	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 7: Location referencing container (TPEG2-LRC)							○
WG 10	ISO/DIS 21219-9	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 9: Service and network information (TPEG2-SNI)					○		
WG 10	ISO/TS 21219-9:2016	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 9: Service and network information (TPEG2-SNI)							○
WG 10	ISO/DIS 21219-10	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 10: Conditional access information (TPEG2-CAI)					○		
WG 10	ISO/TS 21219-10:2016	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 10: Conditional access information (TPEG2-CAI)							○
WG 10	ISO/CD 21219-13	Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 2 (TPEG2) — Part 13: Public transport information (TPEG2-PTS)				○			
WG 10	ISO/DIS 21219-14	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 14: Parking information (TPEG2-PKI)					○		
WG 10	ISO/TS 21219-14:2016	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 14: Parking information application (TPEG2-PKI)							○
WG 10	ISO/DIS 21219-15	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 15: Traffic event compact (TPEG2-TEC)					○		
WG 10	ISO/TS 21219-15:2016	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 15: Traffic event compact (TPEG2-TEC)							○
WG 10	ISO/DIS 21219-16	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol exports group, generation 2 (TPEG2) — Part 16: Fuel price information and availability (TPEG2-FPI)					○		
WG 10	ISO/TS 21219-16:2016	Intelligent transport systems — Traffic and travel information via transport protocol exports group, generation 2 (TPEG2) — Part 16: Fuel price information and availability (TPEG2-FPI)							○
WG 10	ISO/CD 21219-17	Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 2 (TPEG2) — Part 17: Speed information (TPEG2-SPI)				○			
WG 10	ISO 21219-18:2019	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 18: Traffic flow and prediction application (TPEG2-TFP)							○
WG 10	ISO/DIS 21219-19	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 19: Weather information (TPEG2-WEA)					○		
WG 10	ISO/TS 21219-19:2016	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 19: Weather information (TPEG2-WEA)							○
WG 10	ISO/CD 21219-21	Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 2 (TPEG2) — Part 21: Geographic location referencing (TPEG-GLR)				○			
WG 10	ISO/TS 21219-21:2018	Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 2 (TPEG2) — Part 21: Geographic location referencing (TPEG-GLR)							○
WG 10	ISO/TS 21219-22:2017	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 22: OpenLR location referencing (TPEG2-OLR)							○
WG 10	ISO/CD 21219-23	Intelligent transport systems - Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 23: Roads and multimodal routes (TPEG2-RMR)				○			
WG 10	ISO/TS 21219-23:2016	Intelligent transport systems - Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 23: Roads and multimodal routes (TPEG2-RMR)							○
WG 10	ISO/CD 21219-24	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 24: Light encryption (TPEG2-LTE)				○			

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WG 10	ISO/TS 21219-24:2017	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 24: Light encryption (TPEG2-LTE)							○
WG 10	ISO/CD 21219-25	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 25: Electromobility charging infrastructure (TPEG2-EMI)				○			
WG 10	ISO/TS 21219-25:2017	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 25: Electromobility charging infrastructure (TPEG2-EMI)							○
WG 10	ISO/CD 21219-26	Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 2 (TPEG2) — Part 26: Vigilance location information (TPEG2-VLI)				○			
WG 10	ISO/TS 21219-26:2018	Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 2 (TPEG2) — Part 26: Vigilance location information (TPEG2-VLI)							○
WG 10	ISO/TS 18234-1:2013	Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format — Part 1: Introduction, numbering and versions (TPEG1-INV)							○
WG 10	ISO/TS 18234-2:2013	Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format — Part 2: Syntax, semantics and framing structure (TPEG1-SSF)							○
WG 10	ISO/TS 18234-3:2013	Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format — Part 3: Service and network information (TPEG1-SNI)							○
WG 10	ISO/TS 18234-4:2006	Traffic and Travel Information (TTI) — TTI via Transport Protocol Expert Group (TPEG) data-streams — Part 4: Road Traffic Message (RTM) application							○
WG 10	ISO/TS 18234-5:2006	Traffic and Travel Information (TTI) — TTI via Transport Protocol Expert Group (TPEG) data-streams — Part 5: Public Transport Information (PTI) application							○
WG 10	ISO/TS 18234-6:2006	Traffic and Travel Information (TTI) - TTI via Transport Protocol Expert Group (TPEG) data-streams — Part 6: Location referencing applications							○
WG 10	ISO/TS 18234-7:2013	Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format — Part 7: Parking information (TPEG1-PKI)							○
WG 10	ISO/TS 18234-8:2012	Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format — Part 8: Congestion and Travel Time application (TPEG1-CTT)							○
WG 10	ISO/TS 18234-9:2013	Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format — Part 9: Traffic event compact (TPEG1-TEC)							○
WG 10	ISO/TS 18234-10:2013	Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format — Part 10: Conditional access information (TPEG1-CAI)							○
WG 10	ISO/TS 18234-11:2013	Intelligent transport systems — Traffic and Travel Information (TTI) via transport protocol experts group, generation 1 (TPEG1) binary data format — Part 11: Location Referencing Container (TPEG1-LRC)							○
WG 10	ISO 14823:2017	Intelligent transport systems — Graphic data dictionary							○
WG 10	ISO/CD 14823-1	Intelligent transport systems — Graphic data dictionary — Part 1: Specification				○			
WG 10	ISO/TR 14823-2:2019	Intelligent transport systems — Graphic data dictionary — Part 2: Examples							○
WG 10	ISO 14819-1:2021	Intelligent transport systems — Traffic and travel information messages via traffic message coding — Part 1: Coding protocol for Radio Data System-Traffic Message Channel (RDS-TMC) using ALERT-C							○
WG 10	ISO 14819-2:2021	Intelligent transport systems — Traffic and travel information messages via traffic message coding — Part 2: Event and information codes for Radio Data System-Traffic Message Channel (RDS-TMC) using ALERT-C							○
WG 10	ISO 14819-3:2021	Intelligent transport systems — Traffic and travel information messages via traffic message coding — Part 3: Location referencing for Radio Data System-Traffic Message Channel (RDS-TMC) using ALERT-C							○
WG 14	ISO 26684:2015	Intelligent transport systems (ITS) — Cooperative intersection signal information and violation warning systems (CIWS) — Performance requirements and test procedures							○
WG 14	ISO/AWI 23793-1	Intelligent transport systems — Minimal Risk Maneuver (MRM) for automated driving — Part 1: Framework, straight-stop and in-lane stop			○				
WG 14	ISO/PWI 23793-2	Intelligent transport systems — Minimal Risk Maneuver (MRM) for automated driving — Part 2: Requirements and test procedures for stopping without lane change control	○						
WG 14	ISO/AWI 23792-1	Intelligent transport systems — Motorway chauffeur systems (MCS) — Part 1: Framework and general requirements			○				
WG 14	ISO/PWI 23792-2	Intelligent transport systems — Motorway chauffeur systems (MCS) — Part 2: Requirements and test procedures for discretionary lane change	○						
WG 14	ISO/PRF 23376	Intelligent transport systems — Vehicle-to-vehicle intersection collision warning systems (VVICW) — Performance requirements and test procedures					○		
WG 14	ISO/AWI 23375	Intelligent transport systems — Collision evasive lateral manoeuvre systems (CELM) — Performance requirements and test procedures			○				
WG 14	ISO/CD 23374-1	Intelligent transport systems — Automated valet parking systems (AVPS) — Part 1: System framework, requirements for automated driving, and communication interface				○			
WG 14	ISO 22840:2010	Intelligent transport systems — Devices to aid reverse manoeuvres — Extended-range backing aid systems (ERBA)							○
WG 14	ISO 22839:2013	Intelligent transport systems — Forward vehicle collision mitigation systems — Operation, performance, and verification requirements							○
WG 14	ISO 22737:2021	Intelligent transport systems — Low-speed automated driving (LSAD) systems for predefined routes — Performance requirements, system requirements and performance test procedures							○
WG 14	ISO/SAE PAS 22736	Taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles						○	
WG 14	ISO 22078:2020	Intelligent transport systems — Bicyclist detection and collision mitigation systems (BDCMS) — Performance requirements and test procedures							○
WG 14	ISO 21717:2018	Intelligent transport systems — Partially Automated In-Lane Driving Systems (PADS) — Performance requirements and test procedures							○
WG 14	ISO 21202:2020	Intelligent transport systems — Partially automated lane change systems (PALS) — Functional / operational requirements and test procedures							○
WG 14	ISO 20901:2020	Intelligent transport systems — Emergency electronic brake light systems (EEBL) — Performance requirements and test procedures							○

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			PWI	NP	WD	CD	DIS	FDIS	
WG 14	ISO/CD 20900	Intelligent transport systems — Partially automated parking systems (PAPS) — Performance requirements and test procedures				○			
WG 14	ISO 20900:2019	Intelligent transport systems — Partially automated parking systems (PAPS) — Performance requirements and test procedures							○
WG 14	ISO/TR 20545:2017	Intelligent transport systems — Vehicle/roadway warning and control systems — Report on standardisation for vehicle automated driving systems (RoVAS)/Beyond driver assistance systems							○
WG 14	ISO 20035:2019	Intelligent transport systems — Cooperative adaptive cruise control systems (CACC) — Performance requirements and test procedures							○
WG 14	ISO 19638:2018	Intelligent transport systems — Road boundary departure prevention systems (RBDPS) — Performance requirements and test procedures							○
WG 14	ISO 19237:2017	Intelligent transport systems — Pedestrian detection and collision mitigation systems (PDCMS) — Performance requirements and test procedures							○
WG 14	ISO 18682:2016	Intelligent transport systems — External hazard detection and notification systems — Basic requirements							○
WG 14	ISO 17387:2008	Intelligent transport systems — Lane change decision aid systems (LCDAS) — Performance requirements and test procedures							○
WG 14	ISO/CD 17386	Intelligent transport systems — Manoeuvring Aids for Low Speed Operation (MALSO) — Performance requirements and test procedures				○			
WG 14	ISO 17386:2010	Transport information and control systems — Manoeuvring Aids for Low Speed Operation (MALSO) — Performance requirements and test procedures							○
WG 14	ISO 17361:2017	Intelligent transport systems — Lane departure warning systems — Performance requirements and test procedures							○
WG 14	ISO 16787:2017	Intelligent transport systems — Assisted parking system (APS) — Performance requirements and test procedures							○
WG 14	ISO/TS 15624:2001	Transport information and control systems — Traffic Impediment Warning Systems (TIWS) — System requirements							○
WG 14	ISO 15623:2013	Intelligent transport systems — Forward vehicle collision warning systems — Performance requirements and test procedures							○
WG 14	ISO 15622:2018	Intelligent transport systems — Adaptive cruise control systems — Performance requirements and test procedures							○
WG 14	ISO 11270:2014	Intelligent transport systems — Lane keeping assistance systems (LKAS) — Performance requirements and test procedures							○
WG 14	ISO 11067:2015	Intelligent transport systems — Curve speed warning systems (CSWS) — Performance requirements and test procedures							○
WG 14	ISO/PWI 7856	Intelligent transport systems — Remote assist system for Low-Speed Automated Driving (LSAD) system equipped vehicle — Performance requirements and test procedures	○						
WG 14	ISO/AWI 4273	Intelligent transport systems — Automated braking during low speed manoeuvring (ABLS) — Requirements and test procedures			○				
WG 14	ISO/CD 4272	Intelligent transport systems — Truck platooning systems (TPS) — Function and operational requirements				○			
WG 16	ISO/TS 29284:2012	Intelligent transport systems — Event-based probe vehicle data							○
WG 16	ISO 29283:2011	ITS CALM Mobile Wireless Broadband applications using Communications in accordance with IEEE 802.20							○
WG 16	ISO 29282:2011	Intelligent transport systems — Communications access for land mobiles (CALM) — Satellite networks							○
WG 16	ISO 29281-1:2018	Intelligent transport systems — Localized communications — Part 1: Fast networking & transport layer protocol (FNTP)							○
WG 16	ISO 29281-2:2019	Intelligent transport systems — Localized communications — Part 2: Legacy system support							○
WG 16	ISO/TS 25114:2010	Intelligent transport systems — Probe data reporting management (PDRM)							○
WG 16	ISO 25113:2010	Intelligent transport systems — Communications access for land mobiles (CALM) — Mobile wireless broadband using HC-SDMA							○
WG 16	ISO 25112:2010	Intelligent transport systems — Communications access for land mobiles (CALM) — Mobile wireless broadband using IEEE 802.16							○
WG 16	ISO 25111:2009	Intelligent transport systems — Communications access for land mobiles (CALM) — General requirements for using public networks							○
WG 16	ISO 24978:2009	Intelligent transport systems — ITS Safety and emergency messages using any available wireless media — Data registry procedures							○
WG 16	ISO 24103:2009	Intelligent transport systems — Communications access for land mobiles (CALM) — Media adapted interface layer (MAIL)							○
WG 16	ISO 24102-1:2018	Intelligent transport systems — ITS station management — Part 1: Local management							○
WG 16	ISO 24102-2:2018	Intelligent transport systems — ITS station management — Part 2: Remote management of ITS-SCUs							○
WG 16	ISO 24102-3:2018	Intelligent transport systems — ITS station management — Part 3: Service access points							○
WG 16	ISO 24102-4:2018	Intelligent transport systems — ITS station management — Part 4: Station-internal management communications							○
WG 16	ISO/CD 24102-6	Intelligent transport systems — ITS station management — Part 6: Path and flow management				○			
WG 16	ISO 24102-6:2018	Intelligent transport systems — Communications access for land mobiles (CALM) — ITS station management — Part 6: Path and flow management							○
WG 16	ISO 24101-1:2008	Intelligent transport systems — Communications access for land mobiles (CALM) — Application management — Part 1: General requirements							○
WG 16	ISO 24101-2:2010	Intelligent transport systems — Communications access for land mobiles (CALM) — Application management — Part 2: Conformance test							○
WG 16	ISO 24100:2010	Intelligent transport systems — Basic principles for personal data protection in probe vehicle information services							○

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			PWI	NP	WD	CD	DIS	FDIS	
WG 16	ISO 22837:2009	Vehicle probe data for wide area communications							○
WG 16	ISO 22738:2020	Intelligent transport systems — Localized communications — Optical camera communication							○
WG 16	ISO 22418:2020	Intelligent transport systems — Fast service announcement protocol (FSAP) for general purposes in ITS							○
WG 16	ISO 21218:2018	Intelligent transport systems — Hybrid communications — Access technology support							○
WG 16	ISO 21217:2020	Intelligent transport systems — Station and communication architecture							○
WG 16	ISO 21216:2012	Intelligent transport systems — Communication access for land mobiles (CALM) — Millimetre wave air interface							○
WG 16	ISO 21215:2018	Intelligent transport systems — Localized communications — ITS-M5							○
WG 16	ISO 21214:2015	Intelligent transport systems — Communications access for land mobiles (CALM) — Infra-red systems							○
WG 16	ISO 21213:2008	Intelligent transport systems — Communications access for land mobiles (CALM) — 3G Cellular systems							○
WG 16	ISO 21212:2008	Intelligent transport systems — Communications access for land mobiles (CALM) — 2G Cellular systems							○
WG 16	ISO 21210:2012	Intelligent transport systems — Communications access for land mobiles (CALM) — IPv6 Networking							○
WG 16	ISO 21210:2012/ Amd 1:2017	Intelligent transport systems — Communications access for land mobiles (CALM) — IPv6 Networking — Amendment 1							○
WG 16	ISO/WD 21210-1	Intelligent transport systems — IPv6 Networking — Part 1: Common terms, definitions and requirements			○				
WG 16	ISO/WD 21210-2	Intelligent transport systems — IPv6 Networking — Part 2: Addressing and forwarding			○				
WG 16	ISO/WD 21210-3	Intelligent transport systems — IPv6 Networking — Part 3: Mobility management			○				
WG 16	ISO/WD 21210-4	Intelligent transport systems — IPv6 Networking — Part 4: ITS station management adaptation entity			○				
WG 16	ISO 19414:2020	Intelligent transport systems — Service architecture of probe vehicle systems							○
WG 16	ISO 19080:2016	Intelligent transport systems — Communications access for land mobiles (CALM) — CoAP facility							○
WG 16	ISO 19079:2016	Intelligent transport systems — Communications access for land mobiles (CALM) — 6LoWPAN networking							○
WG 16	ISO/TR 18317:2017	Intelligent transport systems — Pre-emption of ITS communication networks for disaster and emergency communication — Use case scenarios							○
WG 16	ISO 17515-1:2015	Intelligent transport systems — Communications access for land mobiles (CALM) — Evolved universal terrestrial radio access network (E-UTRAN) — Part 1: General usage							○
WG 16	ISO 17515-2:2020	Intelligent transport systems — Evolved universal terrestrial radio access network (E-UTRAN) — Part 2: Device to device communications (D2D)							○
WG 16	ISO 17515-3:2019	Intelligent transport systems — Evolved-universal terrestrial radio access network — Part 3: LTE-V2X							○
WG 16	ISO 16461:2018	Intelligent transport systems — Criteria for privacy and integrity protection in probe vehicle information systems							○
WG 16	ISO 16460:2021	Intelligent transport systems — Localized communications — Communication protocol messages for global usage							○
WG 16	ISO 15662:2006	Intelligent transport systems — Wide area communication — Protocol management information							○
WG 16	ISO 15628:2013	Intelligent transport systems — Dedicated short range communication (DSRC) — DSRC application layer							○
WG 16	ISO 13183:2012	Intelligent transport systems — Communications access for land mobiles (CALM) — Using broadcast communications							○
WG 16	ISO/TR 11769:2010	Intelligent transport systems — Communications access for land mobiles (CALM) — Data retention for law enforcement							○
WG 16	ISO/TR 11766:2010	Intelligent transport systems — Communications access for land mobiles (CALM) — Security considerations for lawful interception							○
WG 16	ISO/PWI 7869	Intelligent transport systems — Networked communications — LoRa	○						
WG 16	ISO/PWI 7865	Intelligent transport systems — Localized communications — Bluetooth	○						
WG 16	ISO 4426	Intelligent transport systems — Lower layer protocols for usage in the European digital tachograph						○	
WG 16	ISO/PRF TR 4286	Intelligent transport systems — Use cases for sharing of probe data						○	
WG 17	ISO/DIS 23795-1	Intelligent transport systems — Extracting trip data via nomadic device for estimating CO_2 emissions — Part 1: Fuel consumption determination for fleet management					○		
WG 17	ISO/CD 23795-2	Intelligent transport systems — Extracting trip data via nomadic device for estimating CO_2 emissions — Part 2: Information provision for eco-friendly driving behaviour				○			
WG 17	ISO/PWI TR 22087.2	Intelligent transport systems — Collection of agent behaviour information and sharing between ITS stations	○						
WG 17	ISO/TR 22086-1:2019	Intelligent transport systems (ITS) — Network based precise positioning infrastructure for land transportation — Part 1: General information and use case definitions							○
WG 17	ISO/NP 22086-2	Intelligent transport systems (ITS) — Network based precise positioning infrastructure for land transportation — Part 2: Functional requirements and data interface via nomadic device		○					
WG 17	ISO/TR 22085-1:2019	Intelligent transport systems (ITS) — Nomadic device service platform for micro-mobility — Part 1: General information and use case definitions							○
WG 17	ISO 22085-2	Intelligent transport systems (ITS) — Nomadic device service platform for micro mobility — Part 2: Functional requirements and dataset definitions						○	
WG 17	ISO/DIS 22085-3	Intelligent transport systems (ITS) — Nomadic device service platform for micro mobility — Part 3: Data structure and data exchange procedures					○		
WG 17	ISO/TR 21735:2019	Intelligent transport systems — Framework architecture for plug and play (PnP) functionality in vehicles utilizing nomadic devices							○
WG 17	ISO 20530-1:2020	Intelligent transport systems — Information for emergency service support via personal ITS station — Part 1: General requirements and technical definition							○

WG	ISO Number	Title	Stage						Published
			PWI	NP	WD	CD	DIS	FDIS	
WG 17	ISO/AWI 20530-2	Intelligent transport systems — Information for emergency service support via personal ITS station — Part 2: Service requirement for road incident notification			○				
WG 17	ISO/TR 20529-1:2017	Intelligent transport systems — Framework for green ITS (G-ITS) standards — Part 1: General information and use case definitions							○
WG 17	ISO/FDIS 20529-2	Intelligent transport systems — Framework for Green ITS (G-ITS) standards — Part 2: Integrated mobile service applications						○	
WG 17	ISO 18561-1:2020	Intelligent transport systems (ITS) — Urban mobility applications via nomadic device for green transport management — Part 1: General requirements for data exchange between ITS stations							○
WG 17	ISO/CD 18561-2	Intelligent transport systems — Urban mobility applications via nomadic device for green transport management — Part 2: Trip and modal choice applications and specification				○			
WG 17	ISO/PWI 18561-3	Intelligent transport systems — Urban mobility applications via nomadic device for green transport management — Part 3: Mobility integration service applications using hybrid V2X	○						
WG 17	ISO 17438-1:2016	Intelligent transport systems — Indoor navigation for personal and vehicle ITS station — Part 1: General information and use case definition							○
WG 17	ISO/AWI 17438-2	Intelligent transport systems — Indoor navigation for personal and vehicle ITS stations — Part 2: Requirements and specification for indoor maps			○				
WG 17	ISO/AWI 17438-3	Intelligent transport systems — Indoor navigation for personal and vehicle ITS stations — Part 3: Requirements and specification for indoor positioning reference data			○				
WG 17	ISO 17438-4:2019	Intelligent transport systems — Indoor navigation for personal and vehicle ITS station — Part 4: Requirements and specifications for interface between personal/vehicle and central ITS stations							○
WG 17	ISO/TR 13185-1:2012	Intelligent transport systems — Vehicle interface for provisioning and support of ITS services — Part 1: General information and use case definition							○
WG 17	ISO 13185-2:2015	Intelligent transport systems — Vehicle interface for provisioning and support of ITS services — Part 2: Unified gateway protocol (UGP) requirements and specification for vehicle ITS station gateway (V-ITS-SG) interface							○
WG 17	ISO 13185-3:2018	Intelligent transport systems — Vehicle interface for provisioning and support of ITS Services — Part 3: Unified vehicle interface protocol (UVIP) server and client API specification							○
WG 17	ISO 13185-4:2020	Intelligent transport systems — Vehicle interface for provisioning and support of ITS Services — Part 4: Unified vehicle interface protocol (UVIP) conformance test specification							○
WG 17	ISO/TR 13184-1:2013	Intelligent transport systems (ITS) — Guidance protocol via personal ITS station for advisory safety systems — Part 1: General information and use case definitions							○
WG 17	ISO 13184-2:2016	Intelligent transport systems (ITS) — Guidance protocol via personal ITS station for advisory safety systems — Part 2: Road guidance protocol (RGP) requirements and specification							○
WG 17	ISO 13184-3:2017	Intelligent transport systems (ITS) — Guidance protocol via personal ITS station for advisory safety systems — Part 3: Road guidance protocol (RGP) conformance test specification							○
WG 17	ISO 13111-1:2017	Intelligent transport systems (ITS) — The use of personal ITS station to support ITS service provision for travellers — Part 1: General information and use case definitions							○
WG 17	ISO/DIS 13111-2	Intelligent transport systems (ITS) — The use of personal ITS station to support ITS service provision for travelers — Part 2: General requirements for data exchange between ITS stations					○		
WG 17	ISO/TR 10992:2011	Intelligent transport systems — Use of nomadic and portable devices to support ITS service and multimedia provision in vehicles							○
WG 17	ISO/TR 10992-2:2017	Intelligent transport systems — Use of nomadic and portable devices to support ITS service and multimedia provision in vehicles — Part 2: Definition and use cases for mobile service convergence							○
WG 17	ISO/PWI TR 6029-1	Intelligent transport systems — Seamless positioning for multimodal transportation in ITS stations — Part 1: General information and use case definition	○						
WG 18	ISO/PWI 24102-7	Intelligent transport systems — ITS station management — Part 7: ITS-S capabilities	○						
WG 18	ISO/PWI 24102-8	Intelligent transport systems — ITS station management — Part 8: ITS-S application processes	○						
WG 18	ISO/PWI 24102-9	Intelligent transport systems — ITS station management — Part 9: ITS-S managed entities	○						
WG 18	ISO/PWI 23374-2	Intelligent transport systems — Automated valet parking systems (AVPS) — Part 2: Security integration	○						
WG 18	ISO/TS 21189:2019	Intelligent transport systems — Cooperative ITS — Test requirements and protocol implementation conformance statement (PICS) pro forma for ISO/TS 17426							○
WG 18	ISO/TR 21186-1:2021	Cooperative intelligent transport systems (C-ITS) — Guidelines on the usage of standards — Part 1: Standardization landscape and releases							○
WG 18	ISO/TR 21186-2:2021	Cooperative intelligent transport systems (C-ITS) — Guidelines on the usage of standards — Part 2: Hybrid communications							○
WG 18	ISO/TR 21186-3:2021	Cooperative intelligent transport systems (C-ITS) — Guidelines on the usage of standards — Part 3: Security							○
WG 18	ISO/TS 21185:2019	Intelligent transport systems — Communication profiles for secure connections between trusted devices							○
WG 18	ISO/TS 21184:2021	Cooperative intelligent transport systems (C-ITS) — Global transport data management (GTDM) framework							○
WG 18	ISO/CD 21177	Intelligent transport systems — ITS station security services for secure session establishment and authentication between trusted devices				○			
WG 18	ISO/TS 21177:2019	Intelligent transport systems — ITS station security services for secure session establishment and authentication between trusted devices							○
WG 18	ISO/TS 21176:2020	Cooperative intelligent transport systems (C-ITS) — Position, velocity and time functionality in the ITS station							○
WG 18	ISO/TS 20026:2017	Intelligent transport systems — Cooperative ITS — Test architecture							○
WG 18	ISO/AWI TS 19321	Intelligent transport systems — Cooperative ITS — Dictionary of in-vehicle information (IVI) data structures			○				

WG	ISO Number	Title	Stage						Pub-lished
			PWI	NP	WD	CD	DIS	FDIS	
WG 18	ISO/TS 19321:2020	Intelligent transport systems — Cooperative ITS — Dictionary of in-vehicle information (IVI) data structures							○
WG 18	ISO/TS 19091:2019	Intelligent transport systems — Cooperative ITS — Using V2I and I2V communications for applications related to signalized intersections							○
WG 18	ISO 18750:2018	Intelligent transport systems — Co-operative ITS — Local dynamic map							○
WG 18	ISO/TS 17429:2017	Intelligent transport systems — Cooperative ITS — ITS station facilities for the transfer of information between ITS stations							○
WG 18	ISO/AWI TS 17429-1	Cooperative intelligent transport systems (C-ITS) — ITS station facility services — Part 1: Communication profile handler		○					
WG 18	ISO/AWI TS 17429-2	Cooperative intelligent transport systems (C-ITS) — ITS station facility services — Part 2: Facility services handler		○					
WG 18	ISO/AWI TS 17429-3	Cooperative intelligent transport systems (C-ITS) — ITS station facility services — Part 3: Content subscription handler		○					
WG 18	ISO 17427-1:2018	Intelligent transport systems — Cooperative ITS — Part 1: Roles and responsibilities in the context of co-operative ITS architecture(s)							○
WG 18	ISO/TR 17427-2:2015	Intelligent transport systems — Cooperative ITS — Part 2: Framework overview							○
WG 18	ISO/TR 17427-3:2015	Intelligent transport systems — Cooperative ITS — Part 3: Concept of operations (ConOps) for 'core' systems							○
WG 18	ISO/TR 17427-4:2015	Intelligent transport systems — Cooperative ITS — Part 4: Minimum system requirements and behaviour for core systems							○
WG 18	ISO/TR 17427-6:2015	Intelligent transport systems — Cooperative ITS — Part 6: 'Core system' risk assessment methodology							○
WG 18	ISO/TR 17427-7:2015	Intelligent transport systems — Cooperative ITS — Part 7: Privacy aspects							○
WG 18	ISO/TR 17427-8:2015	Intelligent transport systems — Cooperative ITS — Part 8: Liability aspects							○
WG 18	ISO/TR 17427-9:2015	Intelligent transport systems — Cooperative ITS — Part 9: Compliance and enforcement aspects							○
WG 18	ISO/TR 17427-10:2015	Intelligent transport systems — Cooperative ITS — Part 10: Driver distraction and information display							○
WG 18	ISO/TS 17426:2016	Intelligent transport systems — Cooperative systems — Contextual speeds							○
WG 18	ISO/TS 17425:2016	Intelligent transport systems — Cooperative systems — Data exchange specification for in-vehicle presentation of external road and traffic related data							○
WG 18	ISO/TR 17424:2015	Intelligent transport systems — Cooperative systems — State of the art of Local Dynamic Maps concepts							○
WG 18	ISO 17423:2018	Intelligent transport systems — Cooperative systems — Application requirements and objectives							○
WG 18	ISO 17419:2018	Intelligent transport systems — Cooperative systems — Globally unique identification							○
WG 19	ISO/PWI 24318	Intelligent transport systems — Mobility integration — Architecture for automation	○						
WG 19	ISO/AWI 24317	Intelligent transport systems — Mobility integration — Mobility integration needs for vulnerable users and light modes of transport			○				
WG 19	ISO/PWI 24315-1	Intelligent transport systems - Management for Electronic Traffic Regulations (METR) — Part 1: General concept and architecture	○						
WG 19	ISO/PWI 24311	Intelligent transport systems — Urban ITS — 'Controlled zone' management for UVARs using C-ITS	○						
WG 19	ISO/PWI 24309-1	Intelligent transport systems — Location referencing harmonization for Urban ITS — Part 1: State of the art and guidelines	○						
WG 19	ISO/PWI 24309-2	Intelligent transport systems — Location referencing harmonization for Urban ITS — Part 2: Transformation methods	○						
WG 19	ISO/AWI TR 23797	Intelligent transport systems — Mobility integration — Gap and overlap analysis of ISO/TC 204 work programme for mobility integration			○				
WG 19	ISO/PWI TR 7878	Intelligent transport systems — Mobility integration — Enterprise view	○						
WG 19	ISO/PWI TR 7874	Intelligent transport systems — Mobility integration — Multimodal pricing	○						
WG 19	ISO/PWI TR 7872	Intelligent transport systems — Mobility integration — Digital infrastructure service role and functional model for urban ITS mobility service	○						
WG 19	ISO/DTS 5616	Intelligent transport systems — ITS data management, access and mobility issues — Governance using secure interfaces : High level specifications & information resource				○			
WG 19	ISO/DTS 5255-1.2	Intelligent transport systems — Mobility integration low-speed automated driving (LSAD) system service — Part 1: Overall role and functional model				○			
WG 19	ISO/PWI TR 5255-2	Intelligent transport systems - Mobility integration low-speed automated driving (LSAD) system service architecture — Part 2: Gap analysis	○						
WG 19	ISO/PWI 5255-3	Intelligent transport systems - Mobility integration low-speed automated driving (LSAD) system service architecture — Part 3: System components	○						
WG 19	ISO/AWI TS 5206-1	Intelligent transport systems — Parking — Part 1: Core data model			○				
WG 19	ISO/PWI TR 4448-1	Intelligent transport systems — Ground-based automated mobility systems — Part 1: Overview of paradigm	○						
WG 19	ISO/PWI TS 4448-2	Intelligent transport systems — Ground-based automated mobility systems — Part 2: Data definitions	○						
WG 19	ISO/PWI TS 4448-3	Intelligent transport systems — Ground-based automated mobility systems — Part 3: Communications and cybersecurity	○						

WG	ISO Number	Title	Stage						Pub-lished
			PWI	NP	WD	CD	DIS	FDIS	
WG 19	ISO/PWI TS 4448-4	Intelligent transport systems — Ground-based automated mobility systems — Part 4: Procedures and protocols for kerbside loading and unloading	○						
WG 19	ISO/PWI TS 4448-5	Intelligent transport systems — Ground-based automated mobility systems — Part 5: Procedures and protocols for automated devices on footways	○						
WG 19	ISO/PWI TS 4448-6	Intelligent transport systems — Ground-based automated mobility systems — Part 6: Automated device behaviour on footways	○						
WG 19	ISO/PWI TS 4448-7	Intelligent transport systems — Ground-based automated mobility systems — Part 7: Integration of kerbside and footway deployment	○						
WG 19	ISO/PWI TS 4448-8	Intelligent transport systems — Ground-based automated mobility systems — Part 8: Social communication by automated devices on footways	○						
WG 19	ISO/PWI TS 4448-9	Intelligent transport systems — Ground-based automated mobility systems — Part 9: Determination of kerbside readiness for automated vehicle use	○						
WG 19	ISO/PWI TS 4448-10	Intelligent transport systems — Ground-based automated mobility systems — Part 10: Determination of footway readiness for automated vehicle use	○						
WG 19	ISO/PWI TS 4448-11	Intelligent transport systems — Ground-based automated mobility systems — Part 11: Determination of weather-worthiness of automated vehicles for use on footways	○						
WG 19	ISO/DTR 4447	Intelligent transport systems — Mobility integration — Comparison of two mainstream Integrated mobility concepts				○			
WG 19	ISO/PRF TR 4445	Intelligent transport systems — Mobility integration — Role model of ITS service application in smart cities						○	

Venues of TC 204 Plenary Meetings

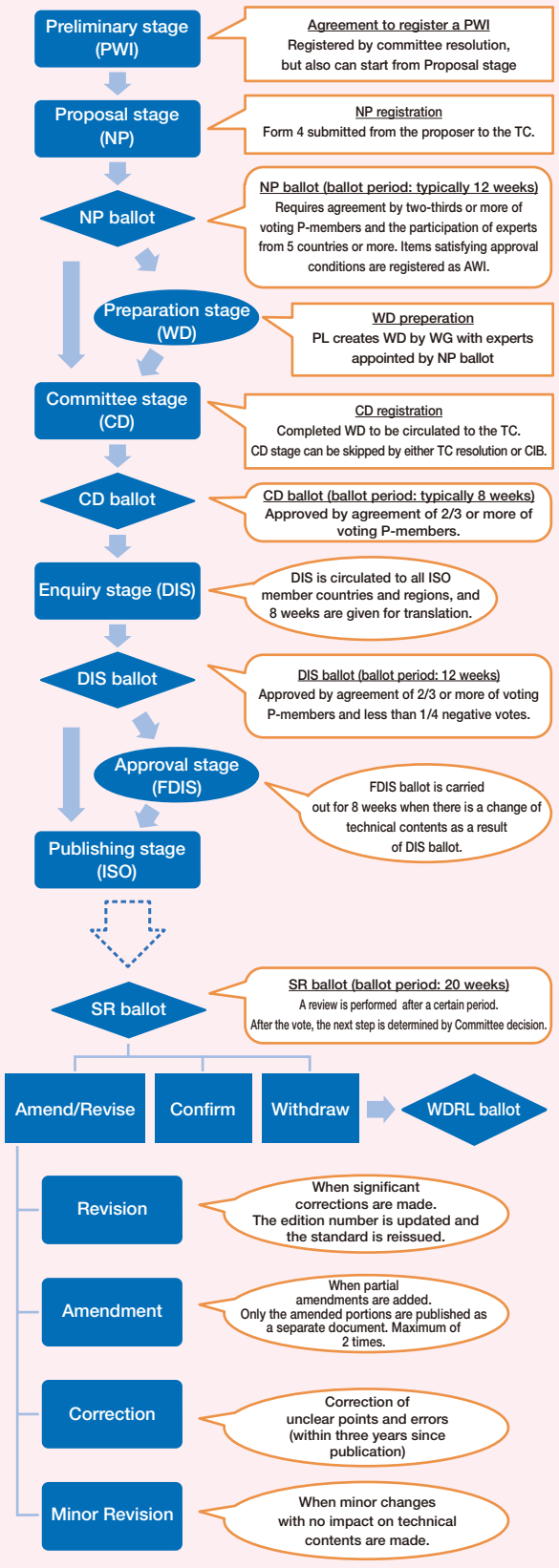
TC 204 holds two plenary meetings per year, with the host country rotated between the North America, Europe, and Asia Pacific regions. Due to preventing the spread of COVID-19 infection, the previous three meetings have been held online.

Number of times	Year/ month	Venue	Country
1st	1993.04	Washington	U.S.
Special Meeting	1993.06	Stuttgart	Germany
2nd	1993.11	Tokyo	Japan
3rd	1994.04	Atlanta	U.S.
4th	1994.12	Paris	France
5th	1995.05	Sidney	Australia
6th	1995.11	Yokohama	Japan
7th	1996.05	London	U.K.
8th	1996.10	Orland	U.S.
9th	1997.03	Noosa	Australia
10th	1997.10	Berlin	Germany
11th	1998.04	Toronto	Canada
12th	1998.10	Seoul	Korea
13th	1999.06	Amsterdam	Netherlands
14th	1999.11	Montreal	Canada
15th	2000.06	Kyoto	Japan
16th	2000.11	Napoli	Italy
17th	2001.04	Honolulu	U.S.
18th	2001.10	Queensland	Australia
19th	2002.05	London	U.K.
20th	2002.10	Chicago	U.S.
21st	2003.06	Nagano	Japan
22nd	2003.10	Wein	Austria
23rd	2004.05	Vancouver	Canada
24th	2004.10	Beijing	China
25th	2005.04	Paris	France
26th	2005.11	Portland	U.S.
27th	2006.04	Busan	Korea
28th	2006.11	Cape Town	South Africa

Number of times	Year/ month	Venue	Country
29th	2007.04	Lexington	U.S.
30th	2007.11	Qingdao	China
31st	2008.04	Munich	Germany
32nd	2008.11	Ottawa	Canada
33rd	2009.05	Chiang Mai	Thailand
34th	2009.09	Barcelona	Spain
35th	2010.04	New Orleans	U.S.
36th	2010.11	Jeju	Korea
37th	2011.04	Prague	Czech Rep.
38th	2011.10	Tampa	U.S.
39th	2012.04	Melbourne	Australia
40th	2012.10	Moscow	Russia
41st	2013.04	Seattle	U.S.
42nd	2013.10	Kobe	Japan
43rd	2014.04	Oslo	Norway
44th	2014.10	Vancouver	Canada
45th	2015.04	Hangzhou	China
46th	2015.10	Potsdam	Germany
47th	2016.04	Concord	U.S.
48th	2016.10	Auckland	New Zealand
49th	2017.04	Paris	France
50th	2017.10	San Antonio	U.S.
51st	2018.04	Seoul	Korea
52nd	2018.09	Budapest	Hungary
53rd	2019.04	Kennedy Space Center	U.S.
54th	2019.10	Singapore	Singapore
55th	2020.04	Held online	
56th	2020.10	Held online	
57th	2021.04	Held online	

Development of International Standards

TC 204 has published numerous international standards on subjects pertaining to ITS. Standards are developed by discussing and voting upon those subjects in accordance with the rules on developing standards specified in the ISO Directives. The following shows an overview of the workflow.



Target deadlines for standard publication

Development stage	Document	Target deadline (months)		
		18 months	24 months	36 months
Proposal stage	NP	Proposal → Approval → Registration	Proposal → Approval → Registration	Proposal → Approval → Registration
Preparation stage	WD	-	-	12
Committee stage	CD	-	6	6
Enquiry stage	DIS	13	12	12
Approval stage	FDIS/IS	5	6	6

Conditions for automatically deleting work items

- A PWI does not move to the NP stage within 3 years.
- No decision on follow-up actions is made within six months following the DIS or FDIS target deadline.
- If DIS approval is not reached within five years after NP registration.

Definitions and abbreviations

TC : Technical Committee
SC : Sub Committee
WG : Working Group
PL : Project Leader
PWI : Preliminary Work Item
NP : New Work Item Proposal
AWI : Approved Work Item
WD : Working Draft
CD : Committee Draft
DIS : Draft International Standard
FDIS : Final Draft International Standard
ISO : International Standard
SR : Systematic Review
WDRL: Withdrawal
TS : Technical Specification
Document published when agreement on an international standard cannot be reached immediately for a standardization item because it is still at the development stage, or for any other reason, even if such agreement is likely to be reached in the future.
PAS : Publicly Available Specification
Intermediate specification published ahead of the completion of an international standard. Agreement is reached at the NP stage.
TR : Technical Report
Document containing data different from an international standard. It must not include matter implying that it is normative contents.

Timing of systematic reviews

Deliverable	Max. elapsed time before systematic review	Max. number of times deliverables may be confirmed	Max. life
IS	5 years	No limit	No limit
TS	3 years	Once recommended	Preferably 6 times
PAS	3 years (No default action by ISO CS)	Once	6 years If not converted after this period, the deliverable is proposed for withdrawal
TR	Not specified	Not specified	No limit

Websites related to ITS

National and regional ITS representative organizations

ITS America	www.itsa.org	ITS Germany	www.itsgermany.org
ITS Australia	www.its-australia.com.au	ITS Netherlands(Connekt)	www.connekt.nl
ITS China	www.itschina.org	ITS Norway	www.its-norway.no
ITS Canada	www.itscanada.ca	ITS Spain	www.itsspain.es/
Czech and Slovak Intelligent Transport Systems & Services	https://www.sdt.cz/intro.php?lang=en	ITS Singapore	www.itssingapore.org.sg
ITS Finland	www.its-finland.fi	ITS South Africa	www.itssa.org
ITS France	www.atec-itsfrance.net	ITS Sweden	www.its-sweden.se
ITS Hong Kong	www.itshk.org	ITS Taiwan	www.its-taiwan.org.tw
ITS Japan	www.its-jp.org	ITS Thailand	www.its.in.th
ITS Korea	www.itskorea.kr	ITS United Kingdom	www.its-uk.org.uk
ITS Malaysia	www.itsmalaysia.com.my	REAM (Malaysia)	www.ream.org.my

Organizations involved in standardization of ITS (International)

AASHTO (America)	www.aashto.org	ISO	www.iso.org
ANSI (America)	www.ansi.org	ISO/TC204	www.iso.org/committee/54706.html
ASECAP	www.asecap.com		
ASTM (America)	www.astm.org	ITE	www.ite.org
CEN (Europe)	www.itsstandards.eu	ITU	www.itu.int
ERTICO (Europe)	www.ertico.com	ISO/IEC JTC1	www.jtc1.org
ETSI (Europe)	www.etsi.org	NEMA (America)	www.nema.org
ETSI ITS (Europe)	www.etsi.org/technologies/automotive-intelligent-transport	OMG	www.omg.org
		PIARC	www.piarc.org
IEC	www.iec.ch	SAE International	www.sae.org
IEEE	www.ieee.org	US-DOT (America)	www.dot.gov

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