ITS Standardization Activities of ISO/TC 204

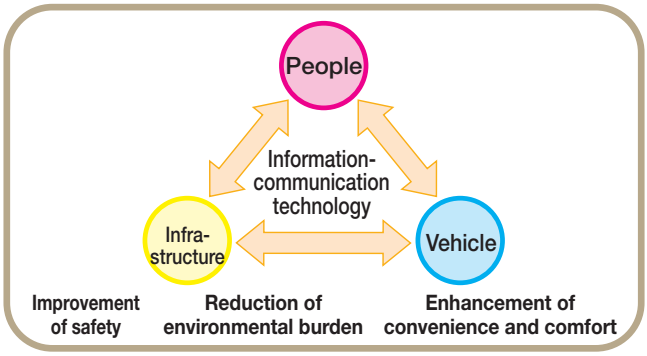
2023

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 reduce or remove unnecessary trade barriers. International standards are documents written by standardization organizations independent of the United Nations or government institutions. Although they are not inherently legally binding, compliance with those standards is considered mandatory, based on the TBT Agreement.

Moreover, 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.

TBT Agreement (extracts)

(Members,) Recognizing the important contribution that international standards and conformity assessment systems can make in this regard by improving efficiency of production and facilitating the conduct of international trade;

(From the Preamble.)

Where technical regulations are required and relevant international standards exist or their completion is imminent, Members shall use them, or the relevant parts of them, as a basis for their technical regulations except when such international standards or relevant parts would be an ineffective or inappropriate means for the fulfilment of the legitimate objectives pursued (…)

(From Article 2.4.)

What is standardization?

Document (…) that provides, for common and repeated use, rules, guidelines, or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

Standards should be based on the consolidated results of science, technology, and experience, and aimed at the promotion of optimum community benefits.

(Source: ISO/IEC Directives Part 2, 2021 (ISO/IEC Guide 2:2004))

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

ITS International Standardization Activities

International standardization for ITS is carried out by the TC 204 Technical Committee (TC) of the International Organization for Standardization (ISO). TC 204 was established in 1992, and held its first meeting the following year. Working groups (WGs) consisting of experts on the theme of the group from various countries, have been established under TC 204 and are responsible for developing drafts of standards. Some working groups have been suspended, merged, or newly created since the inception of TC 204, and there are currently 13 active working groups (see next page).

International standardization also involves setting up a broad range of liaisons with other TCs handling ITS-related technologies, as well as with the IEC, ITU, and other international standardization bodies and related organizations.

Deliverable	Published	Under development
International Standards	195	52
Technical Specifications	67	40
Publically Available Specifications	1	1
Technical Reports	60	19
Other (Amendments, etc.)	8	2
Total	331	114

(As of July 2023)

Scope:

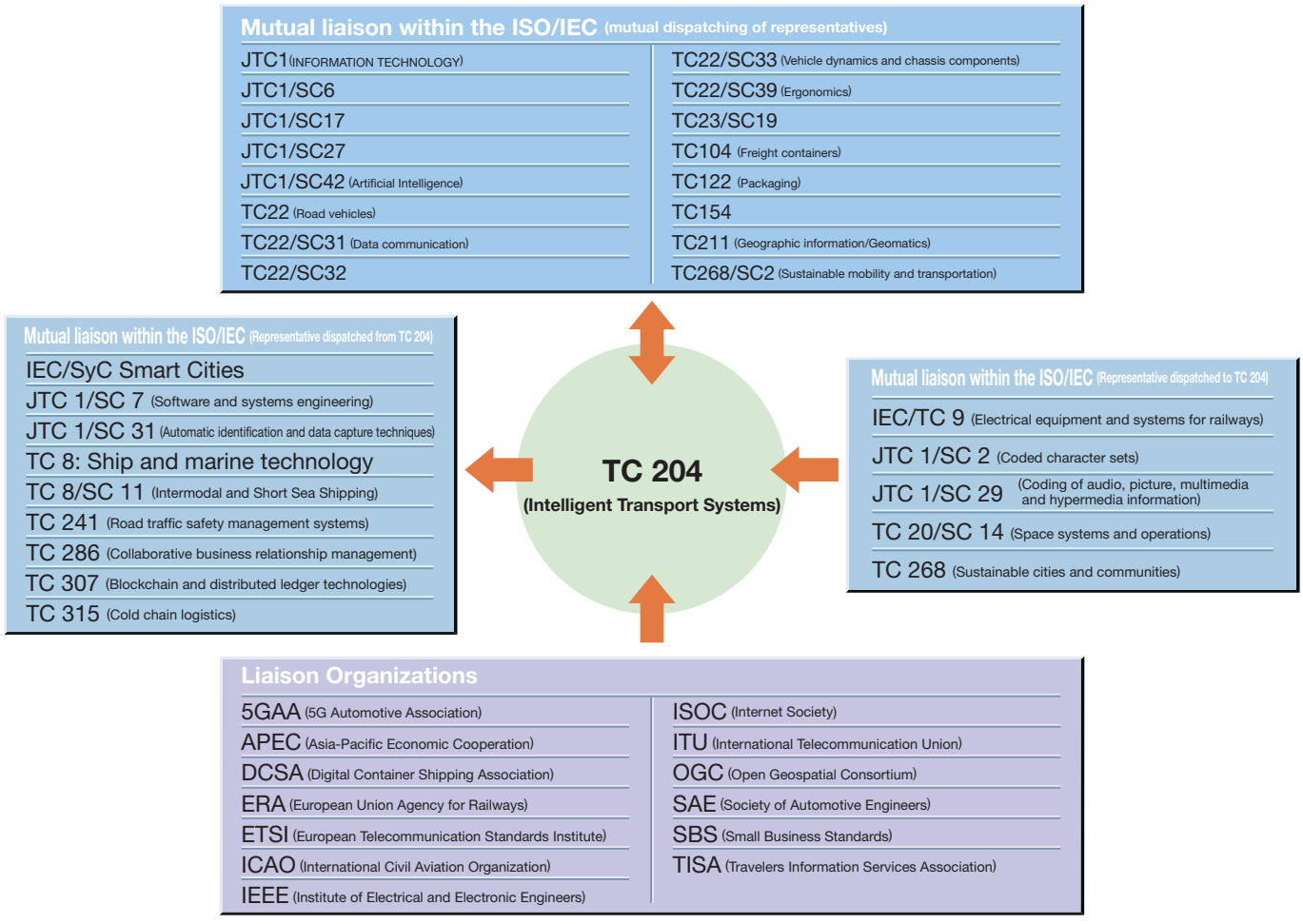
Standardization of information, communication and control systems in the field of urban and rural surface transportation, including intermodal and multi-modal aspects thereof, traveller information, traffic management, public transport, commercial transport, emergency services and commercial services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



(Liaison representatives can participate in the relevant liaison committee meetings and obtain documents.)

Framework for Standardization

TC 204 Committee Organization (International)

The US has served as chair and lead country for TC 204 since its inception. Complementing the 13 WGs under TC 204, a joint working group (JWG) with the ISO/IEC/JTC 1/WG 11 (Smart cities) was formed in 2023. This JWG has begun working on the development of a standard for city data models related to transportation planning.

In an effort to further accelerate the development of standards in TC 204, advisory groups (AGs) tasked with improving TC operations and assessing its business plan were established in 2021. These AGs carry out initiatives such as reviewing activities from a cross-WG perspective. A new chairperson assumed office in 2023 and is planning to strengthen such initiatives.

Relationship between ITS standardization organizations

TC 204 Chairperson

Secretariat : SAE International

AG2	: Identifiers	Germany
AG3	: Operational improvement group	USA
AG4	: Program coordination	Norway
AG5	: Publication and marketing review	USA
JWG1	: City data model transportation planning	USA

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	France
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
WG 20	: Big Data and Artificial Intelligence supporting ITS	South Africa

Participating members (32 countries): Contribute to the meetings, participate actively in the work, and have the obligation to vote.

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

Observing members (29 countries): Follow the work as observers with the right to submit comments and attend the meetings.

Algeria, Bulgaria, Chile, Colombia, Congo, Croatia, Cuba, Cyprus, Denmark, Egypt, Ethiopia, Greece, Hong Kong China, Indonesia, Ireland, Mexico, Mongolia, Montenegro, Pakistan, Philippines, Poland, Romania, Saudi Arabia, Serbia, Singapore, Slovakia, Thailand, Turkey, Ukraine

ITS Standardization Committee of Japan

The ISO (and IEC) allows participation of only one member organization per country. Based on the approval of the Cabinet Office, Japan is represented by the Japanese Industrial Standards Committee (JISC).

Within Japan, the ITS Standardization Committee (National Committee), set up under the auspices of the Society of Automotive Engineers of Japan (JSAE), carries out TC 204 international standardization activities on behalf of the Japanese Industrial Standards Committee (JISC). The main tasks of the Committee are to (1) act swiftly in response to changes in the standardization environment, (2) carry out standardization projects in accordance with the established strategy, (3) provide assistance with national standardization (JIS), and (4) provide related parties with up-to-date information.

To share information on ITS communications, the Committee also liaises with the ITS Info-Communications Forum, administered by the Association of Radio Industries and Businesses (ARIB) and the TTC Standardization Committee, administered by the Telecommunication Technology Committee (TTC).

ITS Standardization Committee Organization

ITS Standardization Committee

- Planning strategies for ITS standardization
- Decision on votes
- Comprising 30 members, including manufacturers, consumers and neutral parties

Secretariat: Society of Automotive Engineers of Japan

Technical committee

- Confirmation of progress in work by subcommittees
- Information exchange
- Comprising some 30 members, including WG representatives, liaison persons and experts

Liaison

ITS Info-Communications Forum
Secretariat: Association of Radio Industries and Businesses

TTC Standardization Committee
Secretariat: The Telecommunication Technology Committee

- Development of standardization drafts and response to international working groups

Working group	Secretariat
Architecture (WG 1)	JSAE (Society of Automotive Engineers of Japan)
ITS geographic data (WG 3)	DRM (Japan Digital Road Map Association)
Fee and toll collection (WG 5)	HIDO (Highway Industry Development Organization)
General fleet management and commercial/freight (WG 7)	HIDO (Highway Industry Development Organization)
Public transport/emergency (WG 8)	JICE (Japan Institute of Country-ology and Engineering)
Integrated transport information, management and control (WG 9)	UTMS (UTMS Society of Japan)
Traveler information systems (WG 10)	UTMS (UTMS Society of Japan)
Vehicle/roadway warning and control systems (WG 14)	JSAE (Society of Automotive Engineers of Japan)
Communications (WG 16)	JEITA (Japan Electronics and Information Technology Industries Association)
Nomadic Devices in ITS Systems (WG 17)	JEITA (Japan Electronics and Information Technology Industries Association)
Cooperative systems (WG 18)	HIDO (Highway Industry Development Organization)
Mobility integration (WG 19)	HIDO (Highway Industry Development Organization)
Big Data and Artificial Intelligence supporting ITS (WG 20)	JSAE (Society of Automotive Engineers of Japan)

Initiatives of the Ministry of Economy, Trade and Industry toward the Realization of a New Mobility Society

Provided by: Manufacturing Industries Bureau of the Ministry of Economy, Trade and Industry

Panel on the Business Strategy of Automated Driving Version 7.0

The Panel on the Business Strategy of Automated Driving promotes the realization of automated driving businesses under an all-Japan organization consisting of members from government, industry, and academia. This panel has been active since February 2015 under the initiative of the Director-General of the Manufacturing Industries Bureau of METI and the Director-General of the Road Transport Bureau of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). In March of this year, the Panel held its 14th meeting and published the *Action Plan for Realizing Automated Driving Version 7.0* in April. This document defines the realization of a safe traffic space in which the entire traffic flow is optimized as the "future vision of safe and comfortable mobility". It raises "measures for the digitalization of cars", "building service models", and "establishing environments for development and implementation" as the three discussion points to address to realize that vision, and consolidates the contents assessed for each initiative.

1) Measures for car digitalization

After identifying technology domains of competition and cooperation in the new competitive environment of digitalization, discussions focused on the points to delve into in the domains of cooperation ((1) in-car domain (AD/ADAS, E/E architecture, vehicle OS), (2) securing frequency bands for V2X, and (3) use of probe data).

(1) Cooperation in the in-car domain

Specific proposals were presented and discussed for cooperative initiatives, including the joint development of AD/ADAS systems for general roads and the standardization of AD/ADAS middleware, the formulation of a roadmap for E/E architecture, and the release of an API for the vehicle OS. The in-car domain strongly influences design concepts, which form the source of competition between automakers. As this is expected to make cooperative initiatives difficult, the Panel agreed not only to reaffirm the importance of sharing an understanding and engaging in deeper discussion, but also to pursue the discussion into the next fiscal year and study ways to maximize domains of cooperation.

At the same time, the questions of what constitutes the competitive axis in SDV development, what is required to secure an advantage along that axis, what strategies are employed by players outside Japan, and what the immediate issues Japan faces will be put front of mind. These questions will frame a reassessment of the points to discuss that takes their relationship and interconnections into account as discussions aimed at ensuring the Japanese automotive industry remains internationally competitive continue this year and beyond.

(2) Promotion of V2X (securing V2X frequencies)

A shared awareness of the importance of not only cooperative, unified automotive and related industry initiatives, but also government initiatives in establishing and spreading V2X (e.g., the timing of the launch of compatible vehicles) to maximize the effectiveness of introducing of the 5.9 GHz band, which is seeing international adoption, in addition to the existing 760 MHz band was reached. The study group on next-generation ITS communications for cooperative automated driving of the Ministry of Internal Affairs and Communication (MIC), established in February 2023, received a report on the conclusions from the discussions of the automated driving and digitalization strategy WG. That report helped the MIC make concrete assessments grounded in the competitiveness of the automotive industry.

(3) Use of probe data

It was agreed that there is a need to advance concrete assessments concerning the establishment of the environment required for data coordination across OEMs to help draw on that data in various use cases, notably high benefit use cases (e.g., congestion alleviation, safety measures, urban planning), while capitalizing on the structure of the Building a Smart Mobility Platform research project from the next-term Strategic Innovation Promotion Program (SIP). Similarly, it also recognized the need to initiate assessments aimed at generating and updating high precision suburban area maps using probe data to realize the high precision maps already prepared for expressways efficiently and cost-effectively for suburbs and other areas.

2) Building movement and logistics service models

The Automated Driving and Logistics Services Social Implementation WG presented a progress report on each of the themes of the RoAD to the L4 project. The WG also clarified the relationships between the targets newly set by the government for automated driving mobility services in FY 2025, the concepts underlying the KPIs, and a course of action for future initiatives. Finally, it discussed potential upcoming initiatives to realize those services.

Specifically, the new "50 locations in around 2050" government target will serve as a reference point while confirming the importance of assessing the validity of current policies and the need for new ones. At the same time, to ensure the target KPIs truly contribute to resolving social issues and raising international competitiveness, the concepts underlying the KPIs was discussed based on the two perspectives of (1) the standpoint of achieving the government targets and (2) the standpoint of enabling many initiatives in Japan to tackle the challenge. The future plan of action was then divided into technical development, commercialization, social acceptance, and establishing environments.

Based on that discussion, the matters to implement in each theme to achieve the targets will be reevaluated, and new initiatives that should be implemented will be assessed.

3) Preparation of an environment for development and implementation

(1) Establishing safety evaluation methods

Elements specific to general roads (e.g., adding intersections to road shapes and cornering to vehicle behavior) were added to expand the scenario database for safety evaluations (the Sakura Project) to general roads based on the concept for motorways. In addition, 58 general road scenarios for four-wheeled vehicles were compiled. Among those, work on quantifying parameters and other aspects of generating specific scenarios for right turns at intersections has started.

The safety evaluation framework for motorway scenarios resulting from Japan-Germany cooperation (e.g., evaluation procedures and methods for deriving critical scenarios) was published as the ISO 34502 international standard in November 2022.

Building on the SIP achievements, work to establish a safety evaluation framework will continue in cooperation with DIVP/AD-URBAN.

(2) Securing personnel

The importance of people versed in software to take charge of software first development has been growing. At the same time, labor market trends such as the shortage of digital talent in all industries and sectors and the rise in wages is creating fierce competition over the recruitment of external talent.

The failure of the individual initiatives of various entities to scale due to their self-contained nature, and the fact that demand is not being met in terms of both quality and quantity were discussed as current issues in light of the progress of the 2022 government initiative (the expansion of courses, setting of skill criteria, and other aspects of the reskilling course accreditation program).

Specific initiatives concerning the use of universities and other higher learning institutions to train and find talent based on industry needs or the formation of a new promotion entity involving training people also came under discussion. An agreement to work on creating specific examples and concretizing assessments starting in the next fiscal year was also reached.

“RoAD to the L4” Project

1) Outline of the RoAD to the L4 Project

The environment surrounding the automotive industry is changing drastically as expressed by the challenges of connected, automated, service-related, and electrification (CASE) technologies, and carbon neutrality. Under these conditions, the following objectives have been raised for the realization and popularization of new mobility services: (1) the realization of unmanned automated driving mobility services that use remote monitoring only (Level 4) in limited areas in early FY 2023, (2) the application of these services in approximately 50 locations by around FY 2025, (3) the realization of Level 4 automated trucks on expressways from FY 2025, and the like. Consequently, RoAD to the L4 was established in September 2021 as a new project incorporating every aspect of these objectives, including research and development, field operational tests (FOTs), and social implementation. With the amended Road Traffic Act coming into effect in April 2023, the initiative in Eiheiji Town, Fukui Prefecture—one part of the project—obtained an operational permit under that Act and initiated the first Level 4 automated driving services in Japan in May 2023. The RoAD to the L4 project will continue to realize automated driving mobility services relevant to the resolution of social issues such as ensuring sufficient transportation as the population declines and ages, eliminating accidents and congestion, and contributing to carbon neutrality. For this purpose, it will focus its efforts on developing technologies, establishing environments, fostering public acceptance, and accelerating commercialization, as well as disseminate the results nationally, and work to realize proper social implementation while considering international trends.

2) Details of the project

This project consists of four themes. Theme 1 aims to realize automated driving services (Level 4) using only remote monitoring in limited areas of Eiheiji Town, Fukui Prefecture. (The services launched in May 2023.) Theme 2 aims to provide an automated driving service based on medium-duty buses as part of the Hitachi BRT (dedicated bus roads) program in Hitachi City, Ibaraki Prefecture. Theme 4 aims to establish the infrastructure coordination systems and the like required to develop Level 4 driving in mixed spaces in Kashiwa City, Chiba Prefecture (Kashiwanoha). Theme 3 aims to keep abreast of general digital discussions while realizing Level 4 automated trucks on expressways. Each of these initiatives is considered necessary for making proper progress toward the social implementation of new mobility services.

In addition, the National Institute of Advanced Industrial Science and Technology (AIST) was selected as the coordinating institution responsible for general surveys and studies. AIST will promote the project while managing its progress.

At the same time, the institution is collaborating with operators and the relevant government agencies to formulate the Digital Lifeline Development Plan in FY 2023. With respect to automated driving or drone inspections and logistics, infrastructure management DX, and other services relying on digital technologies, this initiative seeks to set up, in every corner of Japan, the digital lifeline necessary to accelerate the transition from treating field operational tests as points to implementations viewed as lines or planes.

Theme 1: Realization of Level 4 mobility services in limited areas

Promotion of demonstration projects toward the realization of automated driving services (Level 4) with remote monitoring only.
(The services have been launched)

- Aim to **realize automated driving services (Level 4) using remote monitoring only for limited areas and vehicles in FY 2023.**
- In addition, to help improve the business potential, work toward establishing a system that enables one person to monitor four vehicles simultaneously.

Image:
Eiheiji Town remote automated driving system

Area and vehicle expansion

Theme 2: Efforts to expand areas and vehicles

In addition to expanding the target areas and vehicles, carry out initiatives to improve business potential

- Study driving environment expansion and business potential improvements.
- Specifically, conduct FOTs, define use cases, toward the installation of automated driving systems in medium-duty buses, etc.

Image:
Automated buses

Mixed space support

Theme 3: Practical application of advanced logistics systems on expressways

Initiatives toward the practical application of high-performance automated trucks, including platoon driving on expressways

- Aim to **realize Level 4 automated trucks and the like on expressways in around FY 2025.**
- Use cases and priority areas to be established are being identified and the form of a new mainline logistics system including vehicles is under consideration based on these items.

Image:
Automated driving on an expressway

Mixed space support

Theme 4: Establishment of services in mixed spaces

Initiatives for infrastructure coordination and cooperation between vehicles and between vehicles and pedestrians to develop Level 4 driving in mixed spaces

- Aim to establish a system that enables cooperation between vehicles, infrastructure, other vehicles, and **the like to enable the deployment of Level 4 automated driving services in more complex driving environments (mixed spaces) from 2025.**
- First, compile use cases that require cooperation with infrastructure and the like, and study a scheme for linking data belonging to vehicles and infrastructure (dynamic surroundings), and apply to FOTs.

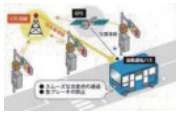


Image:
Driving support from infrastructure

Current Use and Future Developments of Mobility Data Use in the Field of ITS

Provided by: Kenya Sato, Mobility Research Center, Doshisha University

Fusion of the real and virtual spaces

Over the last several years, private cars, public transportation buses, freight transport trucks, and other vehicles have been equipped with a variety of sensors, including GPS and cameras, pedestrians have smartphones containing multiple sensors, and roads feature roadside sensors to monitor the surroundings. Communication networks now make it possible to collect the data from all those sensors. Road environment data, including the high precision 3D maps for automated driving, can be centrally managed in the cloud. The analysis of such mobility data is gradually leading to the building of an environment that provides various services.

Making use of that mobility data requires measuring physical information in the real world through sensors or other devices and consolidating the results on servers to build virtual models used to understand and predicting real world circumstances. Figure 1 illustrates the concept of feeding those predictions back into the real world based on the circumstances. One specific example in Japan is the Cabinet Office science and technology policy proposing the Society 5.0[(1)] concept. This concept is defined as a human-centered society that achieves both economic growth and the resolution of social issues through systems that achieve a high level of fusion between the cyber (virtual) and physical (real) worlds. Other examples include cyber physical systems[(2)] (CPS, systems that consolidate information from the real physical world into the cyberspace inside computers and feed the results of analyses back into the physical world), the Internet of Things[(3)] (IoT, mechanisms or systems that connect physical devices and their data processing resources to a communication network to exchange data), and digital twins[(4)] (the concept of digitally reproducing physical devices, systems, or processes for the purpose of conducting practical simulations, monitoring, or tests). The use of mobility data is not necessarily the only envisioned use for those technologies, but they play a crucial role in considering the processing workflow for mobility data. Potential specific services include, for example, safe driving support, operational management, increased travel efficiency, optimized traffic flow, and urban planning.

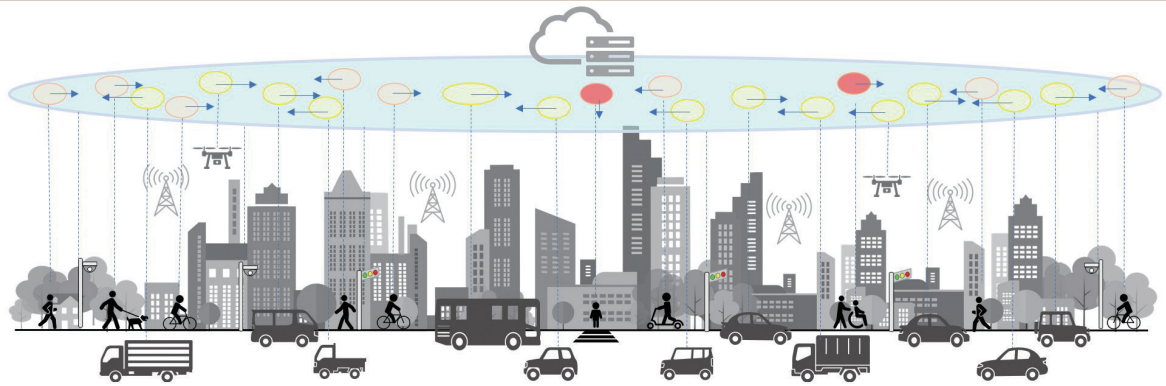


Fig. 1: Visualization of the use of mobility data based on the fusion of the real (physical) space and the virtual (server) space

Process of using mobility data

As shown in Fig. 2, making use of mobility data generally involves the steps of collecting, processing, analyzing, controlling/visualizing, and otherwise manipulating data, and coordinating each of those steps.

1) Recognition and collection The base data at the initial stage. It includes vehicle or pedestrian position obtained through the GNSS (GPS) installed in navigation systems or smartphones, vehicles and pedestrians in the vicinity identified by cameras or radars in vehicles or roadside units, and the position or movement of bicycles.

2) Analysis and decision Analyze the recognized/collected data using various algorithms, including statistical processing and artificial intelligence (AI), and establish a basis for decisions on the various services to realize.

3) Operation and control Using the analysis and decision results makes it possible to, for example, perform safe driving by sending feedback to vehicle control or control traffic by operating traffic signals.

4) Visualization Turning the analysis and decision results into graphs, charts, figures, tables or other visual representations makes it easier to visually identify patterns or trends hidden in user data.

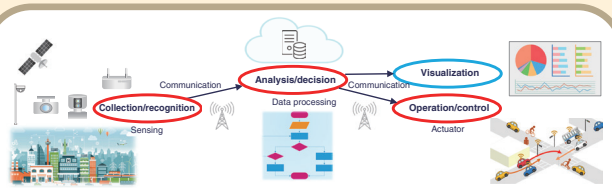


Fig. 2: Process of using mobility data

Time-based mobility data classification

Looking at the collection and use of that data using its processing time as a yardstick yields the type of classification, with specific examples, shown in Table 1. Services involving vehicle control or collision avoidance, for instance, require extremely rapid processing of the sensed data and control of the vehicle, and generally rely on self-contained processing of mobility data within the vehicle. Scenarios such as following the preceding vehicle or carrying out cooperative driving between vehicles require using direct communication between

Table 1: Time-based mobility data classification

Time	Specific service example
~3×10^{-1} seconds (0.3 seconds)	Vehicle control, collision avoidance
~3×10^{0} seconds (3 seconds)	Following preceding vehicle, cooperative driving
~3×10^{1} seconds (30 seconds)	Driving route control, traffic signal coordination
~3×10^{2} seconds (300 seconds = 5 minutes)	Providing traffic information, sharing services
~3×10^{3} seconds (3,000 seconds = about 1 hour)	Congestion information, route guidance
~3×10^{4} seconds (30,000 seconds = about 8 hours)	Transportation services, supply chain
~3×10^{5} seconds (300,000 seconds = about 3 days)	Traffic demand prediction, infrastructure maintenance inspections
~3×10^{6} seconds (3,000,000 seconds = about 1 month)	Public transportation improvements, accident prevention
~3×10^{7} seconds (30,000,000 seconds = about 1 year)	Environmental burden reduction, urban planning support

vehicles and sharing mobility data in a relatively short time. Services based on driving routes or coordination with traffic signals call for coordination with the traffic infrastructure. In contrast, focusing on traffic demand prediction or support for urban planning requires collecting a broad range of mobility data on a large scale.

Looking at the mechanisms making use of mobility data in the context of time shows that cases requiring extremely rapid processing should not only process sensor data directly, but also use low latency and highly reliable means of communication to transmit narrow-scope low-information data between vehicles or between roadside and on-board units. In cases involving longer processing times, the desired level of precision can be increased by collecting, and statistically processing, a sufficient amount of data within as broad a range as possible.

In particular, consolidating data in the cloud for processing in situations calling for cooperative operation/control after rapidly processing several types of mobility data results in high latency. Therefore, as shown in Fig. 3, edge servers and other computing resources capable of high speed processing in a limited area are necessary[5].

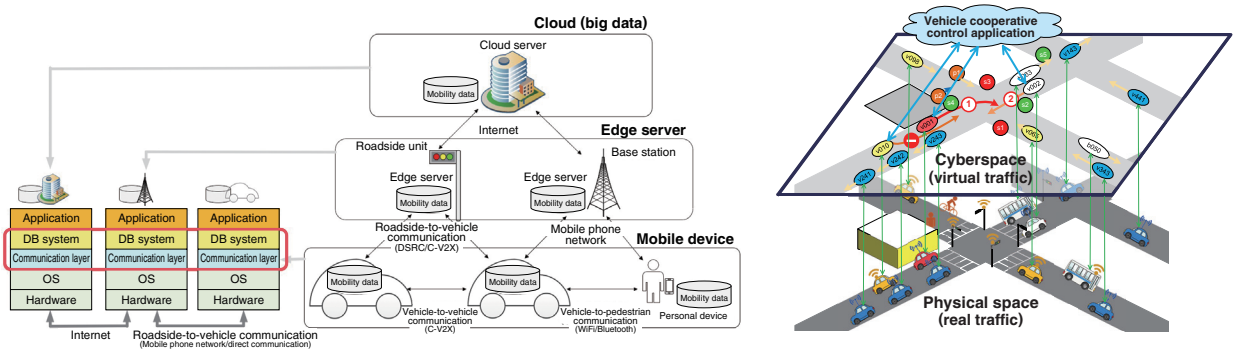


Fig. 3: Configuration of the high speed data processing platform

Necessity of standardization and attendant issues

Making use of dynamic mobility data requires management linked to static map data. Dynamic maps represent a conceptual aggregation of data that combines static maps with vehicle, traffic conditions, and other position-related data managed and maintained in layers. In contrast, the use of mobility data by a variety of applications benefits from a shared ICT platform based on the reference architecture shown in Fig. 4. Standardizing such a platform would enable access to the data through a specified application programming interface (API). This allows application developers to easily create functions for the desired use case without needing to know the communication protocols or the details of the database and security systems. Moreover, from the standpoint of users, this configuration also means that the applications can be used without awareness of whether the smart phone is connected to a mobile phone network or a wireless LAN. Figure 5 shows an example configuration for such a platform making use of mobility data.

The broad use of mobility data requires addressing issues such as the need to assess how to collect and provide data, possibly for a fee, as well as the need to consider how to ensure the reliability of the data, guarantee its security, and protect privacy. The use of mobility plays a critical role it plays in various domains, including improving traffic safety, enhancing mobility (passenger and freight) services, increasing the efficiency of the traffic infrastructure, supporting urban planning, and reducing the burden on the environment. Consequently, further advances are expected as new breakthroughs are made in data collection and analysis technologies.

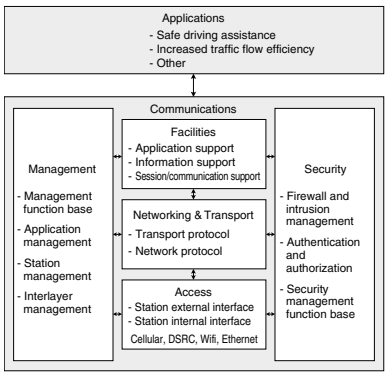


Fig 4: ITS station reference architecture

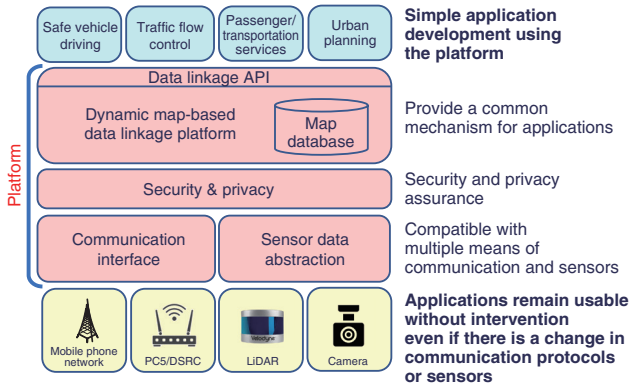


Fig. 5: Mobility data platform

Reference

(1) Cabinet Office, Society 5.0, https://www8.cao.go.jp/cstp/english/society5_0/index.html

(2) Wayne Wolf, Cyber-physical Systems, Computer, Vol.32, No.3, pp.88-89, 2009.

(3) Reza S. Raji, Smart Networks for Control, IEEE Spectrum, Vol.31, No.6, pp.49-55, 1994.

(4) David Gelernter, Mirror Worlds: or the Day Software Puts the Universe in a Shoebox—How It Will Happen and What It Will Mean, Oxford University Press, 1991.

(5) Yousuke Watanabe, Kenya Sato, and Hiroaki Takada, DynamicMap 2.0 : A Traffic Data Management Platform Leveraging Clouds, Edges and Embedded Systems, International Journal on Intelligent Transport Systems Research, Vol.18, Issue 1, pp.77-89, 2020.

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	ISO/TR 12859	Guidelines for protecting privacy in the development of ITS standards and Systems
	2	Reference model architecture(s) for the ITS sector	ISO 14813-1	Definitions of service domains (categories, groups)
			ISO 14813-5	The terms and forms to be used when documenting or referencing the architecture
			ISO 14813-6	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	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	Management procedures for data registration
	5	ITS data dictionaries/Part 3: Object identified assignments for ITS data concepts	ISO 14817-3	OID structure
	6	Using UML for defining and documenting ITS/TICS interfaces	ISO/TR 17452	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	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	ISO/TR 24907-2	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	ISO/TR 24097-3	Quality of services in the context of ITS
★	10	Procedures for developing ITS deployment plans utilizing ITS system architecture	ISO/TR 24098	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	ISO/TR 24529	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	Stipulation of rules on the use of XML for ITS standards, data registries and data dictionaries
	13	Harmonization of ITS data concepts	ISO/TR 25100	Provision of guidelines for data concepts related to registration in data registries
	14	'Use Case' pro forma template	ISO/TR 25102	Provision of a template to facilitate use case description
	15	Training requirements for ITS architecture	ISO/TR 25104	Definition of requirements concerning training courses about ITS architecture
	16	Use of 'process-orientated methodology' in ITS International Standards and other deliverables	ISO/TR 26999	Stipulation of rules for process (function) oriented methodologies for ITS standards, data registries and data dictionaries
	17	Cooperative ITS - Part 1: Terms and definitions	ISO/TR 17465-1	Definition of Cooperative ITS
	18	Cooperative ITS - Part 2: Guidelines for standard documents	ISO/TR 17465-2	Guidelines on the formulation of Cooperative ITS standards documents
	19	Cooperative ITS - Part 3: Release procedures for standards documents	ISO/TR 17465-3	Release procedure for the development of standards documents on cooperative ITS
	20	Vocabulary	ISO/TS 14812	Vocabulary Related to ITS
	21	Architecture - Applicability of data distribution technologies within ITS	ISO/TR 23255	Report on possibility of application for the data delivery technology
	22	Identifiers	ISO 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.

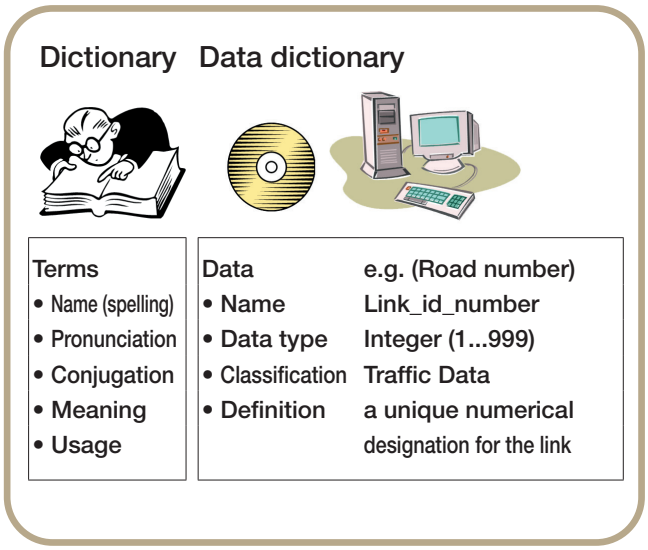
Although WG 1 developed the ISO 14817 series around the year 2000, and has conducted data registry trial operations in the past, it has yet to move to actual operations. We will put forth application ID (ITS-AID), vocabulary (data concept) and data model, among others, as content candidates for the data 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, a standard (ISO 5345) that defines the process of identifier designation has been published.

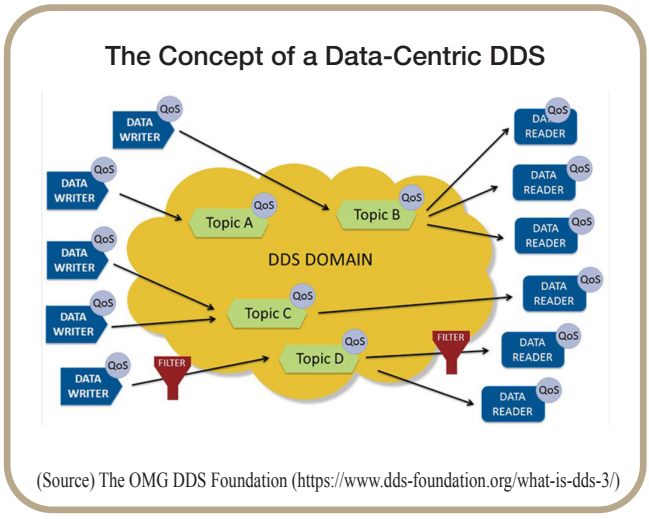


Application of ICT-related technologies in ITS

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/TR 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/)

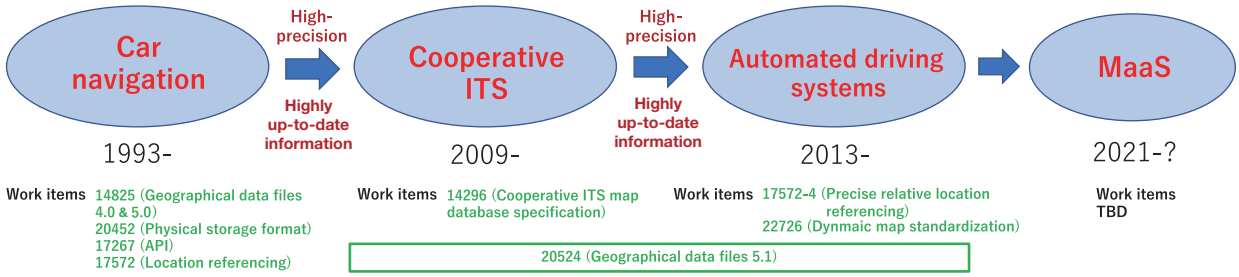
WG 3 ITS geographic data

WG 3 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. Geographic data plays a notably critical role in vehicle navigation systems, which exhibit remarkable advances, as well as in cooperative ITS, which is gradually being implemented and deployed. 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 TC 204 WG 3



- Car navigation: In 1993, Japan was the only country in the world where car navigation was popular.
  - Japan chaired ISO TC 204 WG 3 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: WG 19 (Mobility integration) established in TC 204 in 2018.
  - Candidates for cooperation with WG 3: Tourist navigation, useable transportation networks (costs, nodes), parking management systems...

List of WG 3 work items

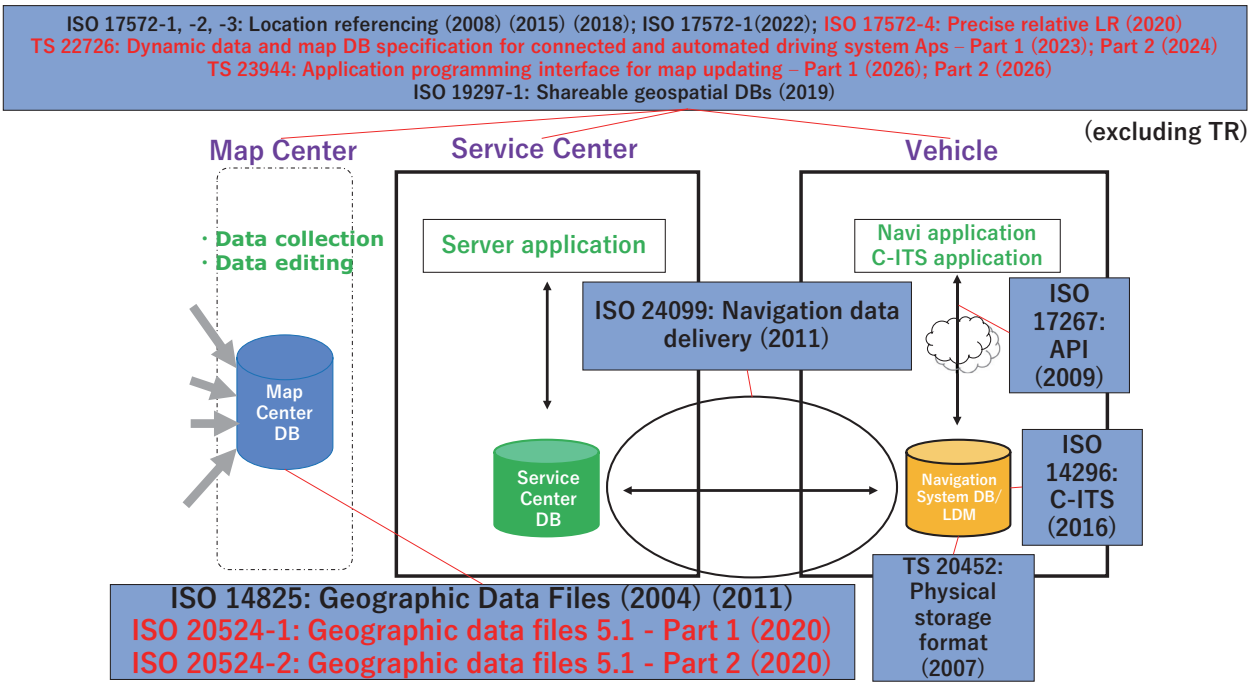
		Standardization themes	ISO Number	Content
★	1	Requirements and Logical Data Model for a Physical Storage Format (PSF) and an Application Program Interface (API) and Logical Data Organization for PSF used in Intelligent Transport Systems (ITS) Database Technology	TS 20452	Standardization of physical storage 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	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) Work on a revised version will start as quickly as possible
★	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	Application programming interface for map updating Part 1	PWI/TS 23944-1	Requirements
	14	Application programming interface for map updating Part 2	PWI/TS 23944-2	Architecture and platform-independent data model

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

ADAS: Advanced Driver Assistance Systems
PSF: Physical Storage Format

WG 3 All related work items diagram (as of July 2023)

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.

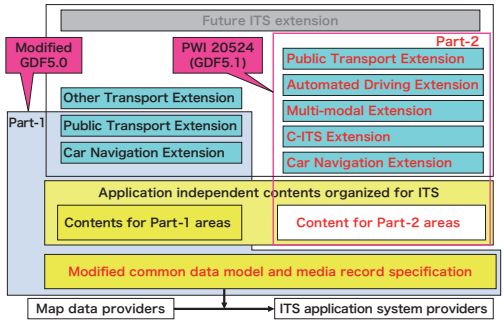
Led by Japan, work toward applying the ISO 14296 specifications to cooperative ITS is moving forward, with specifications being prepared that allow regionally-limited high-precision transmissions that match GDF 5.0 precision for all areas.

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 US 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 IS 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 IS 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 IS 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.

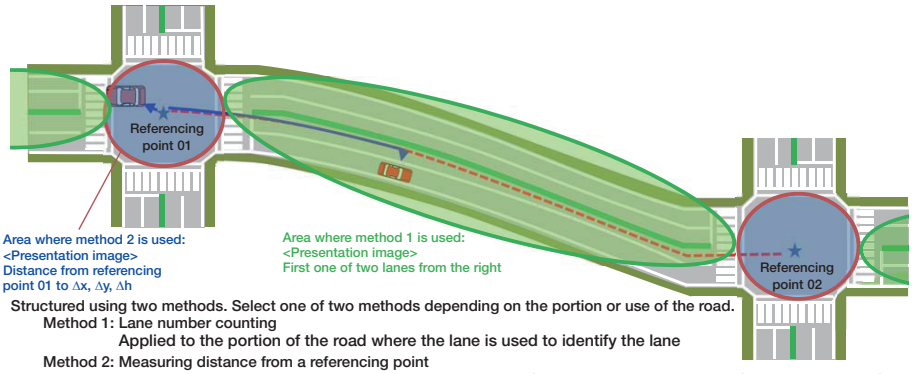
During the stalemate, the need for standardization of general-purpose LR grew sharply as the information community moved rapidly toward standardization. WG 3 therefore decided to broaden its focus from coordinate systems and road descriptors and work to establish a more comprehensive standard. Discussions 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 IS 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 IS 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 IS 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)

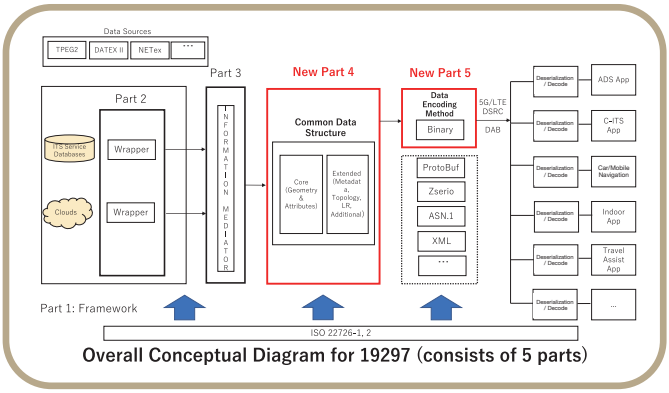
For in-vehicle digital map databases, Japan proposed a new PWI, "Extension of current specification of in-vehicle digital map databases" in response to new requirements such as ADAS and multi-modal navigation.

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 IS was published in February 2016.

Shareable Geospatial Databases for ITS Applications (ISO 19297-1)

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. This is being followed by the development of the common data structure WD as Part 4. In April 2020, the existing Part 4 was split into two parts to increase efficiency, with development continuing as Part 4 (Common Data Structure) and Part 5 (Data Encoding Method). Due to circumstances such as the ill health of the Korean SWG 3.5 convenor, both parts were temporarily suspended at the directive of the ISO central secretariat in February 2023. Work is scheduled to start again in January 2024 under the direction of the successor to the SWG 3.5 convenor.



Overall Conceptual Diagram for 19297 (consists of 5 parts)

API for map updates (PWI/TS 23944-1 and PWI/TS 23944-2)

In light of the increasing sophistication of the demand for map updates stemming from the latest advances in automated driving systems, a joint task force led by WG 3 and comprising related organization outside TC 204 (CEN TC 278/WG 7 (ITS Spatial Data), TN-ITS (Transport Network – Intelligent Transport Systems), and SENSORIS (Sensor Interface Specification)) was instituted in February 2023. Standardization work then began with the approval of the PWI below at the TC 204 plenary meeting in May 2023. Note that this standard addresses the gap analysis recommendations from AG 4.

✓ Target: TS with Part-1 & -2

✓ Title: Intelligent transport systems - Application programming interface for map updating

- Part-1: Requirements
- Part-2: Architecture and platform-independent data model

Dynamic data and map database specification for connected and automated driving system applications (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.

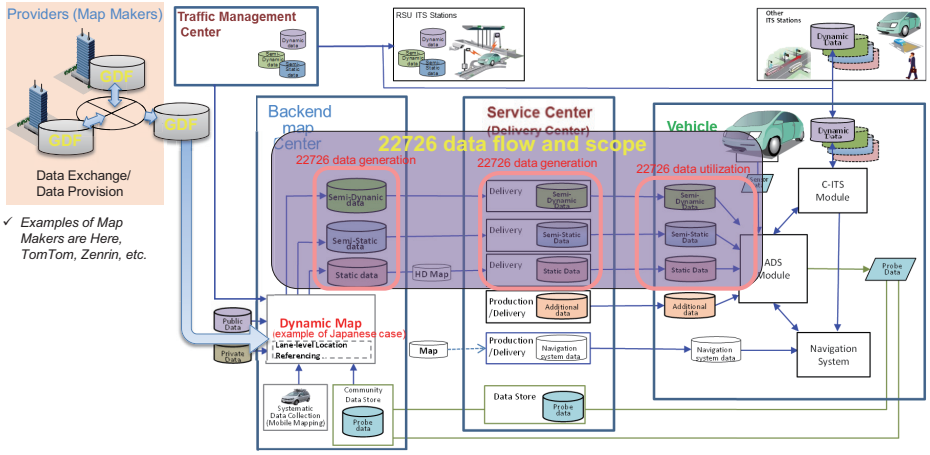
The titles of each part of 22726 are as follows.

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

Part 2: Logical data model of dynamic data

Part 1 was published in June 2023, but due to pending issues concerning traffic regulation information and other matters, work on a revised version to address those issues is scheduled to start as quickly as possible. Europe is in charge of editing Part 2, and the CIB balloting on a WD containing the requirements from Japan ended in July 2023. The transition to DTS balloting is scheduled after comment resolution finishes. The development deadline for Part 2 is January 2024.

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 published the European Directive on the Interoperability of Electronic Road charging Systems (Directive 2004/52/EC). In October 2009, it published 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 on-board equipment (OBE), Japan proposed an OBE setup methodology, which was formally published in November 2021.

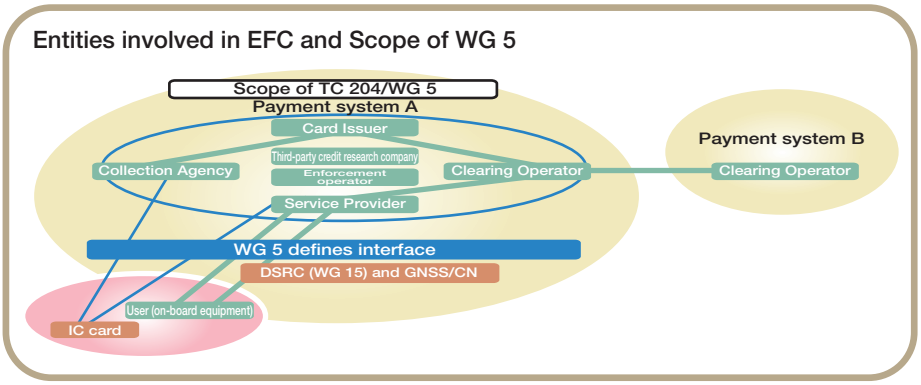
List of WG 5 work items

		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 EFC applications for DSRC based EFC
★	2	EFC – Test procedures for user and fixed equipment-Part 1 to 2	ISO 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	ISO 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 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 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 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 TS 12813-Part 1 & 2	ISO 13143	Defines conformity evaluation methods for the interfaces defined in TS 12813 (Compliance check communication for autonomous systems) between OBE and roadside equipment
	12	EFC – Evaluation of on-board and roadside equipment for conformity to ISO TS 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 37444	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 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 TS 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	TR 6026	Technical report for further new proposals on EFC using Automatic Number Plate Recognition (ANPR) technology

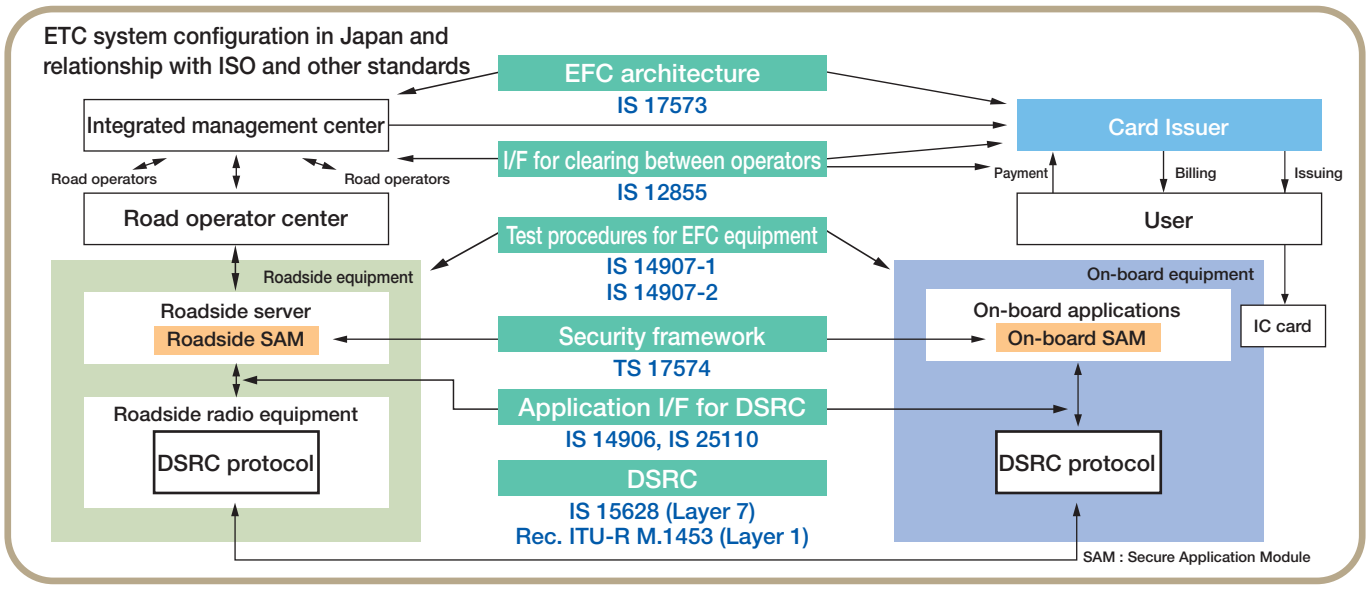
★ Item(s) that Japan is / has been actively working on

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.

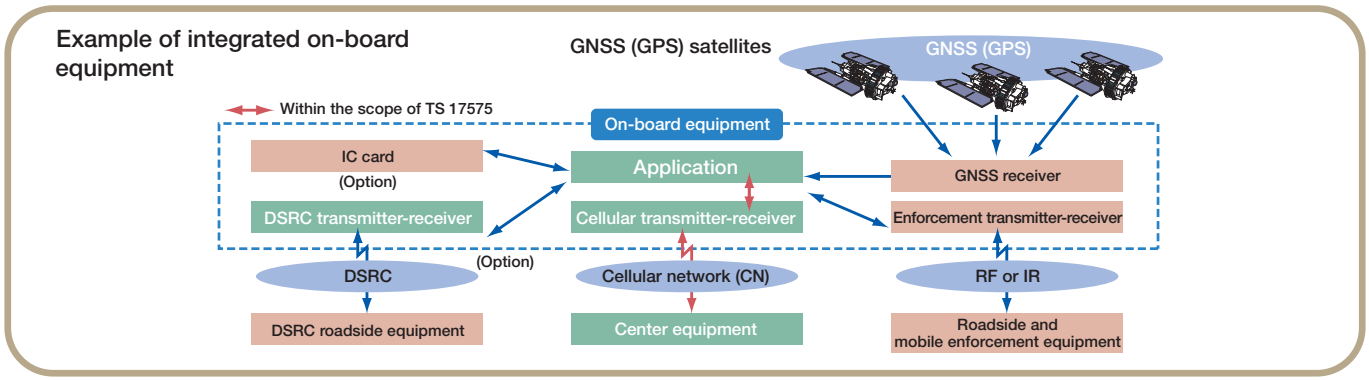


The figure below shows the ETC system configuration in Japan, and the corresponding ISO standards and ITU recommendations



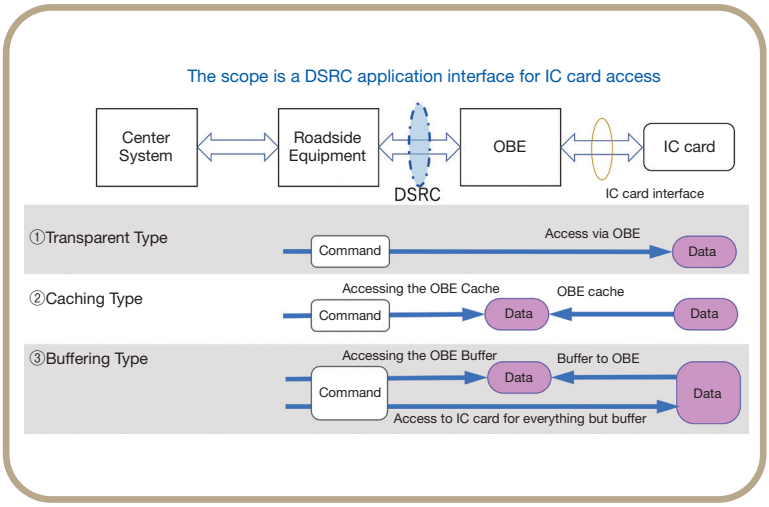
Application Interface Definition for Autonomous Systems (GNSS/CN) (ISO 17575)

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 OBE continuously positions the geodetic coordinates of the present location using a built-in GNSS (GPS) receiver, and collects tolls referring to tariff data. Various means of calculating these tariffs are available, including a method in which the tariff data is downloaded via a cellular network and processed on-board the vehicle, and a method in which position data is transmitted via the cellular network and processed at a Center. 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 both the GNSS/CN method and the DSRC method.



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

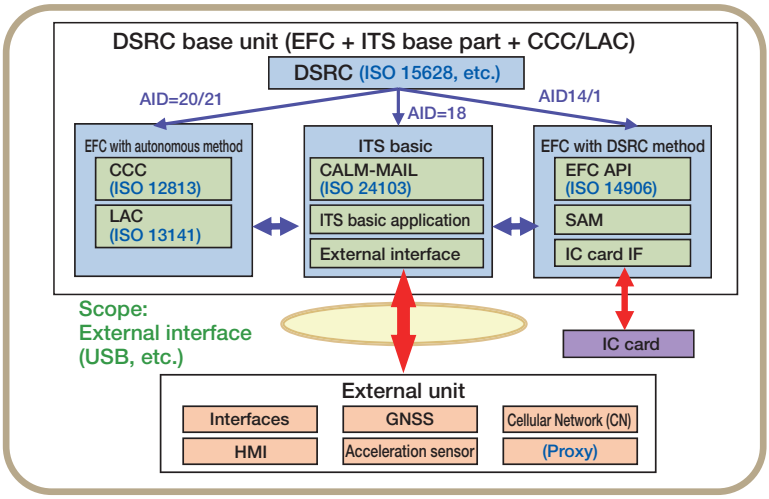
There are two major EFC-related charging methods. One is the central account system predominant in Europe and US, and the other is the on-board account system using IC cards, used in Japan, Korea and other Asian countries. The ISO 25110 application interface defines three types, (1) the transparent type (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.

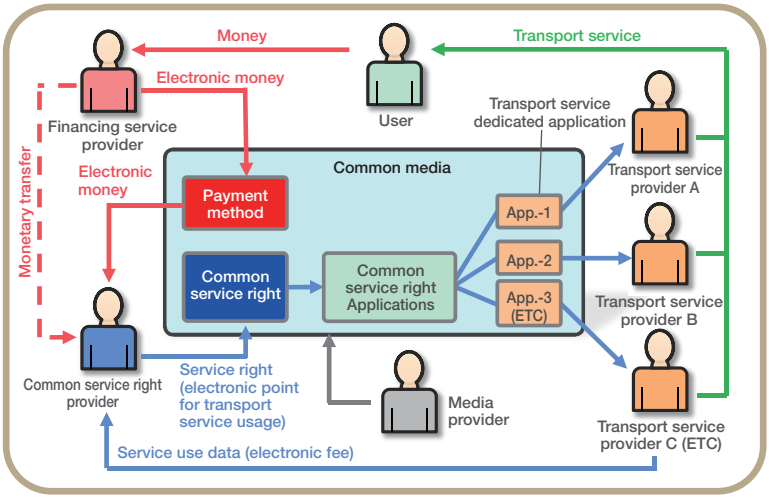
The OBE can also be used as an autonomous EFC OBE by connecting an external onboard device that implements a GNSS receiver module and a cellular communication module to the OBE. Thus, expandability can be provided by configuring the OBE with an external connection interface.



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 US 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)	
GNSS	Odometer			USA Road Usage Charge		
GNSS	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				

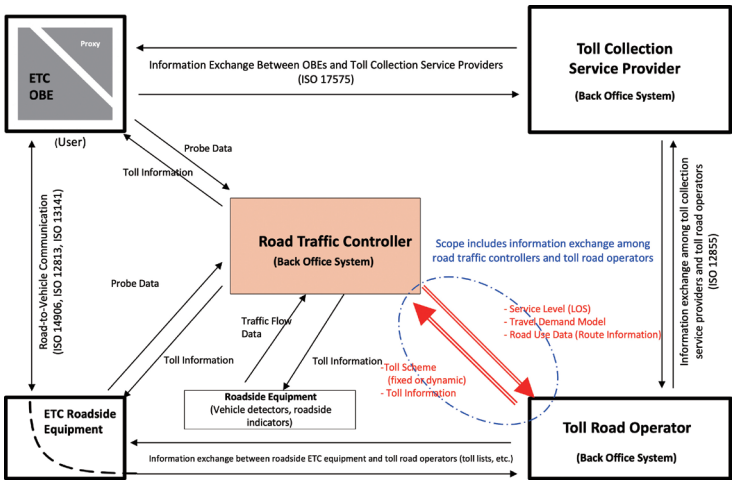
EFC based on existing technology

EFC based on new technology

Note: Countries in parentheses planning to introduce in near future

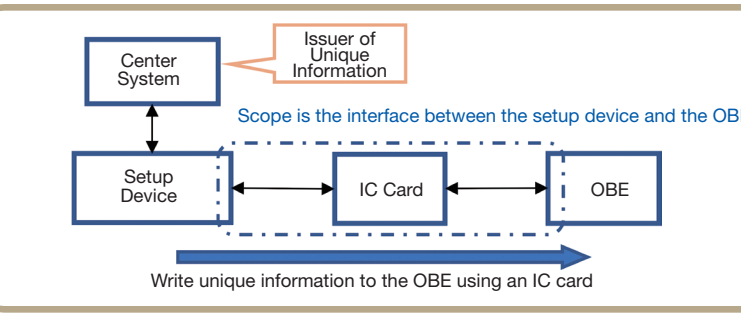
EFC support for traffic management (TS 21192)

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 US, 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 (TS 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 (TR 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
	2	Electronic information exchange to facilitate the movement of freight and its intermodal transfer – Road transport information exchange methodology	AWI 24533-1 ISO 24533-2	Definition of data concept applied to freight multi-modal transport. Includes data exchanging message through transport interface along logistic chains.
	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.
★	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.
★	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.
★	6	Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV)	ISO 15638-1 to 26	Definition of collaborative telematics application of regulated commercial freight vehicles.
★	7	Framework that uses TARV as a secure vehicle interface.	DTS 7815-1 DTS 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 26)

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.

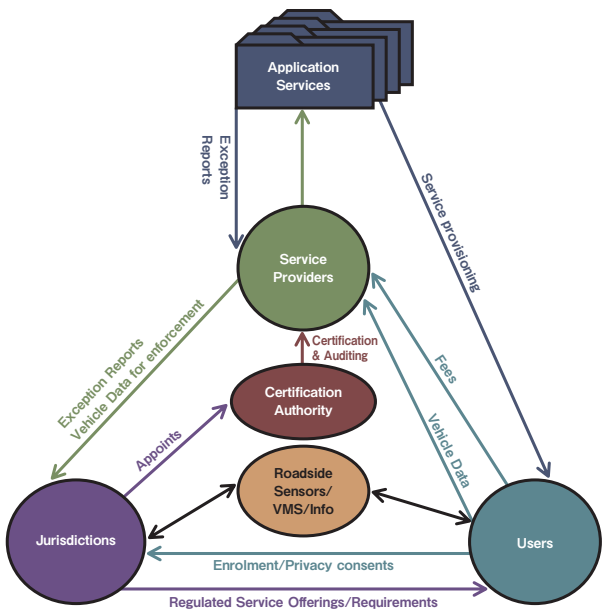
In the future, the ISO 15638 series is supposed to enable driver management, operational management and weight monitoring of heavy vehicles, and stable driving through combination of standards for each Part. The intention is to make it a valuable standard to improve efficiency of urban logistics.

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. Part 26 is a framework for monitoring charging data while driving.

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
CD 15638-23	Tire monitoring
ISO 15638-24	Safety information provision
DIS 15638-25	Vehicle tall clearance monitoring
NP(TS) 15638-26	Electric vehicle dynamic charging monitoring

WG 8 Public Transport and Emergency

WG 8 is responsible for the standardization of information relating to public transport and emergency vehicles. Public transport includes not only buses, trains, and trams, but also ride sharing and similar services.

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 IS in 2021.

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

Recently, interest in Mobility as a Service (MaaS) and traveler information has been increasing globally, and such services are starting to be established. Therefore, it is necessary to closely watch the trends in the field of MaaS.

Korea made a PWI proposal for emergency recovery systems for automated public transport at the 2022 spring meeting.

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	Definition of the data dictionary and message sets of traffic signal 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 implementing IFMS based on the architecture defined in Part 1, and the relationships among these rules
	4	Public transport – Interoperable fare management system – Part 3: Complementary concepts to Part 1 for multi-application	TR 24014-3	Definition of the business practices within applications and interoperability among applications in the multiple application environment
★	5	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 and areas
	6	Public transport user information – Part 2: Public transport data and interface standards catalogue and cross reference	TR 17185-2	Description of public transport user information interfaces and definition of cross references
★	7	Public transport user information – Part 3: Use cases for journey planning systems and their interoperation	TR 17185-3	Definition of use cases for journey planning systems and the interoperation of these systems
	8	Emergency evacuation and disaster response and recovery – Part 1: Framework and concept of operation	TR 19083-1	Standardization of evacuation and restoration in emergencies
★	9	Interoperability between IFM systems and NFC mobile devices	TR 20527	Definition of the interoperability between IFMS systems and mobile equipment using near field communication devices
	10	Common transport service account systems – Part 1: Framework and use cases	TR 21724-1	Definition of framework and use cases for the accounting system for public transport payment
	11	Performance testing for connectivity and safety functions of automated driving buses - Part1: General framework	IS 21734-1	Definition of the framework related to the connectivity and safety of automated buses that communicate with road infrastructure such as signalized intersections, crossings, bus stops
	12	Performance testing for connectivity and safety functions of automated driving buses - Part 2: Performance requirements and test procedures	AWI 21734-2	Definition of the performance requirements and test methods necessary to ensure reliability
	13	Performance testing for connectivity and safety functions of automated driving buses - Part 3: Service framework and use cases	DTR 21734-3	Definition of the service framework and use cases for supporting automated buses

★ 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. Reduction of the dependence on automobiles is realized by increasing urban density and making cities more compact and thus promoting 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. Advances in ICT have made it possible to obtain information such as public transport networks, connections, travel time, congestion, and fares before and/or during a trip, and to choose the optimal route.

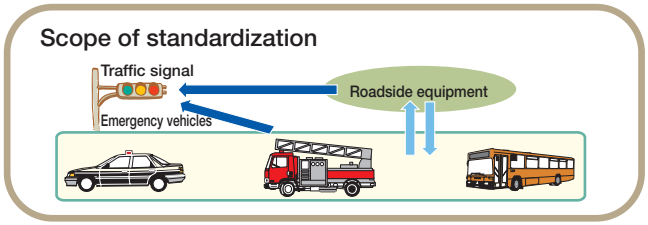
To dramatically improve the attractiveness of public transport, it is necessary to provide each passenger with seamless mobility by utilizing advanced information technologies. The launch of MaaS operations in various countries can be seen as a precursor to such new forms of public transport.

At the same time, the shared use automobiles or bicycles is becoming more common in various countries, and BRT, buses with high level of service (BHLS) and similar systems are actively being 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 a data dictionary and message sets in the V2I/I2V communications.

Traffic signals are 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 IS was issued in January 2009.



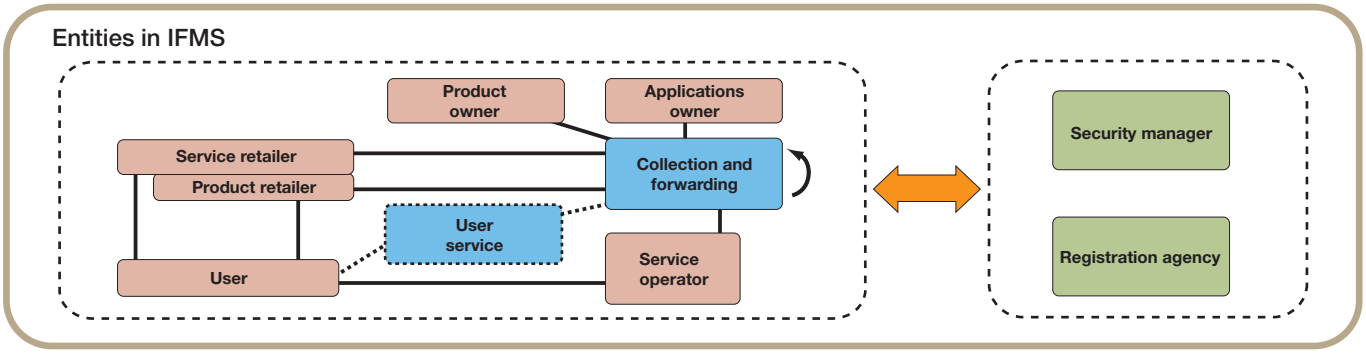
Interoperable Fare Management System: IFMS (ISO 24014)

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 IS 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 made 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.

The release of Parts 2 and 3 led to the need to revise the contents of Part 1. That task was jointly carried out by Japan and Germany, and the new IS was published 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 a catalogue of public transport in member countries.

However, preparing a catalogue of public transport information in each country takes a long time and great efforts, but works out limited practical value. Therefore, a comprehensive standard including information for users of public transport in member countries was proposed by Japan. The standard covers the Japanese standard in addition to the European TransModel and the US PTCIP.

"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.

Work on the standardization of Part 4 based on the US proposal had been progressing, but has now been cancelled.

Performance testing for connectivity and safety functions of automated driving buses (IS 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, transport 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 methodologies 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 was published as an IS in 2022. Part 2 is currently under development.

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
	2	Data interfaces between centres for transport information and control systems – Part 2: AP-DATEX	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)	TS 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 to 7, 10, 11	Definition of application interface using SNMP between roadside modules and the center
★	12	Roadside modules AP-DATEX data interface	ISO 22741-1, 2, 10	Definition of application interface using DATEX-ASN between roadside modules and the center

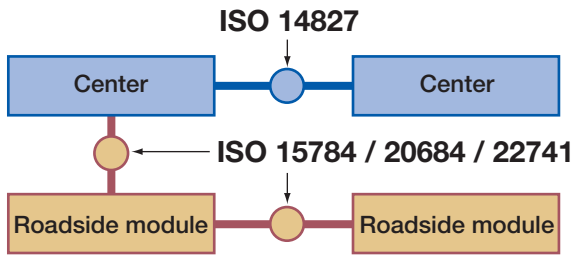
★ Item(s) that Japan is / has been actively working on

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 IS.

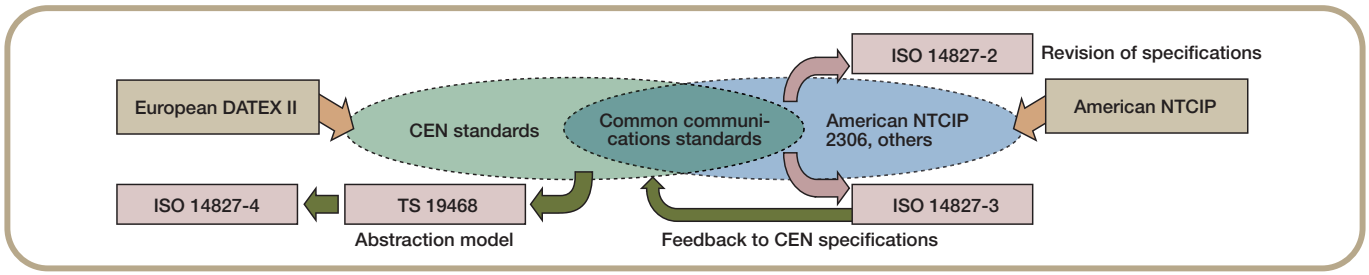
Communication between centers (ISO 14827, TS 19468)

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.

First, ISO 14827 Part 1 and Part 2, which specify the application layer communication protocol called DATEX-ASN, were published as an IS in 2005. In 2022, Japan led a revision efforts to ensure consistency with subsequently established European standards, abolishing Part 1 and publishing a revised Part 2 integrating the normative section of the former Part 1 as an international standard.

Japan is also advancing studies for Part 3, which defines the XML-based protocol, in a form compatible with both the European DATEX II and the American NTCIP standards for communication between centers. This was published as an IS in 2019.

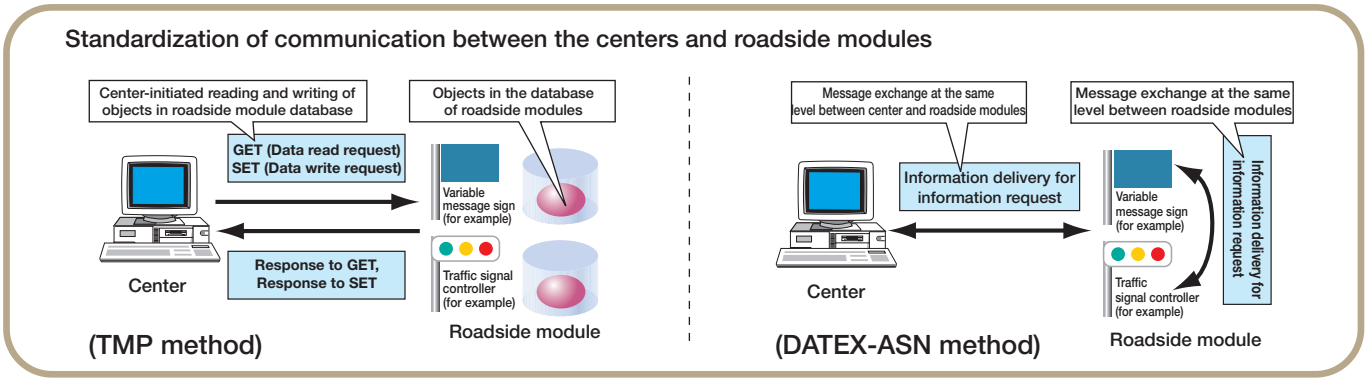
Europe has led TS 19468 which specifies the platform-independent abstraction model based on DATEX II. Furthermore, Part 4 of ISO 14827, which is in accordance with TS 19468 and defines the protocol using XML-based SOAP was published as a TS.



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 US, 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 IS document.

Revision to Part 2 intended to incorporate the latest security-related standards is currently under consideration.



Communication Interface between centers and roadside modules (ISO 20684, ISO 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 ISO 20684 series led by the United States using the SNMP method and the ISO 22741 series led by Japan using the DATEX-ASN method are being developed in parallel. In the ISO 20684 series, Part 1 (Overview) was published as an IS, and Parts 2 to 7, which describe management and detailed functionality, were published as TS. In the ISO 22741 series, Part 1 was published as an IS, and Part 2, which describes management, was published as a TS. Moreover, Korea proposed the standardization of communication with visual message signs using both methods, and Part 10 of ISO 20684 was published as a TS in 2021. Studies are currently underway for Part 10 of ISO 22741.

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. 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 IS 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	DIS 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
			ISO 21219-1	TPEG2 UML version; Introduction, numbering and versions
			ISO 21219-2	TPEG2 UML version; UML modeling rules
			ISO 21219-3	TPEG2 UML version; UML to binary conversion rules
			ISO 21219-4	TPEG2 UML version; UML to XML conversion rules
			ISO 21219-5	TPEG2 UML version; Service framework
			ISO 21219-6	TPEG2 UML version; Message management container
			DIS 21219-7	TPEG2 UML version, Location referencing container
			ISO 21219-9	TPEG2 UML version; Service and network information
			ISO 21219-10	TPEG2 UML version; Conditional access information
			CD 21219-13	TPEG2 UML version; Public transport information
			ISO 21219-14	TPEG2 UML version; Parking information application
			ISO 21219-15	TPEG2 UML version; Traffic event compact
			ISO 21219-16	TPEG2 UML version; Fuel price information application
			ISO 21219-17	TPEG2 UML version; Speed information
			ISO 21219-18	TPEG2 UML version; Traffic flow and prediction application
			ISO 21219-19	TPEG2 UML version; Weather information
			DIS 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
			DIS 21219-25	TPEG2 UML Version: Electromobility charging infrastructure
			TS 21219-26	TPEG2 UML Version: Vigilance location information

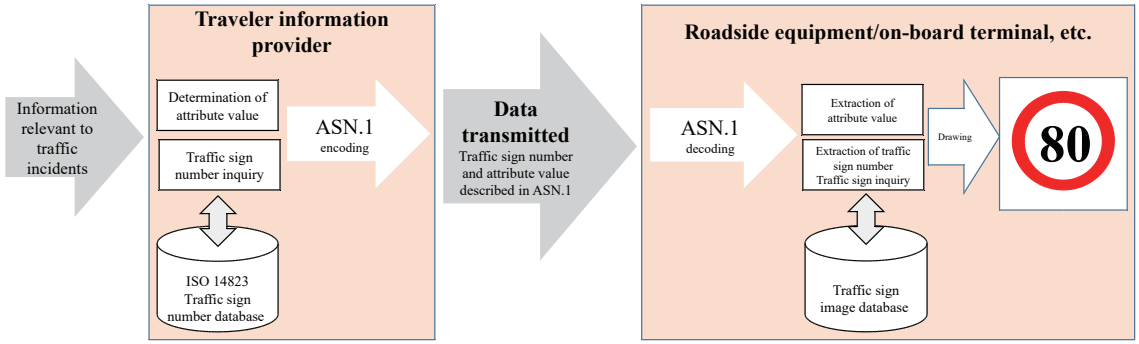
Note: TTI: Traffic and Travel Information, RDS-TMC: Radio Data System-Traffic Message Channel
★ Item(s) that Japan is / has been actively working on

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. The GDD codes are provided by traffic information providers or traffic control centers to display the appropriate pictogram on variable information boards or on-board displays. Since pictograms vary from one country to another, the standard is strictly limited to covering the codes corresponding to the pictogram (code 11348 for road work, for example) and its attributes (e.g., time, distance, direction, vehicle width, and vehicle height), but not the graphic form of the pictogram.

The standard was published as a TS in 2008 under Japanese leadership. Thereafter, the contents of the standard were revised at the strong insistence of the European members of DT 8.3 in WG 18. Major revisions were implemented in coordination with WG 1 and the result was released as an IS in 2017. However, requests from various countries led to working on more revisions, and an IS second edition is scheduled to be published in 2023. (The IS published in 2017 is also quoted in the European DATEXII and IN-ITS.) Furthermore, examples of codes and attributes described in ASN.1 were published as a TR (ISO 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, ISO/DIS/CD/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.

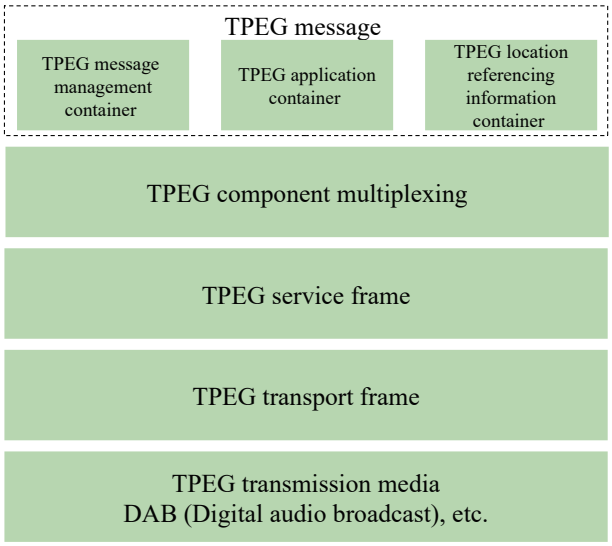
TPEG standardization has progressed in the binary and XML categories, with UML currently being advanced for the next-generation TPEG. Further, official liaison has been established between WG 10 and the Traffic Information Service Association (TISA), a European organization engaged in the actual preparation 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.

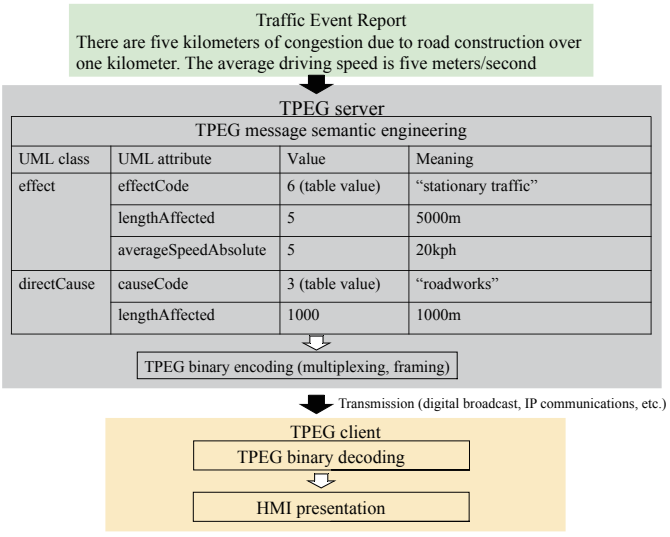
The figure shows examples of generation of traffic congestion information utilizing TPEG-TEC (TPEG traffic event compact).

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 CO_2 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.

Work items concerning automated parking and automated driving have been increasing, and standards on those topics are gradually being published.

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 PAS 22736	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 systems (AVPS) – Part 1: System framework, requirements for automated driving and for communications interface	ISO 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)	ISO 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 systems (VVICW)	ISO 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: Framework and general requirements (MCS-1)	ISO TS 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)	AWI 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 – Part 1: Framework, straight-stop and in-lane stop – Part 2: Road shoulder stop	DIS 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 specifies the framework and common requirements, and Part 2 specifies the requirements for systems that pull the vehicle over to the road shoulder.
	31	Highly Automated Motorway Chauffeur Systems (HMCS)	NP 19484	Specifies functional requirements and test procedures for systems that perform Level 4 automated driving on motorways.
★	32	Truck Platooning Systems (TPS)	ISO 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).

List of WG 14 work items

		Standardization themes	ISO Number	Content
	33	Automated Braking during Low Speed Maneuvering (ABLS)	DIS 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.
★	34	Remote support for LSAD system (RS-LSADS) – Performance requirements, system requirements and performance test procedures	CD 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.
	35	Automated Valet Driving Systems (AVDS) – Part 1: Part 1: Requirements, System Framework, Communication Interfaces and Test Procedures	AWI 12768-1	Automated driving systems that expand the operational design domain (ODD) of automated valet parking systems (AVPS) from within the limitations of a parking area to, for example, the roadways between different parking areas
	36	Automated Valet Driving Systems (AVDS) – Part 2: System framework, security procedures and requirements	NP 12768-2	Defines the necessary security requirements for AVDS.
	37	Guidance for Definition and Application of Operational Design Domain for Automated Driving System	AWI 17720	Studies into the types of expected behavior of automated driving systems at the boundaries between areas in which automated driving is and is not possible
★	38	Acceleration control for pedal error – Performance, requirements and test procedures	AWI 19486	Specifications on warning the driver using a warning lamp in the instrument panel and a buzzer, as well as on automatically controlling engine output and the brakes to prevent collision with an object or excessive acceleration in the event that the driver erroneously presses the accelerator pedal.
★	39	Information interface framework between automated driving system and user	AWI 19560	Organizes the set of information that is to be transmitted to the user by an active automated driving system (ADS) when necessary according to the urgency and importance of that information.

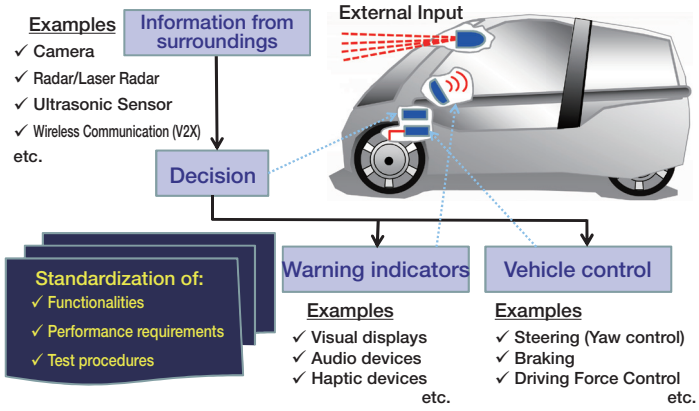
★ Item(s) that Japan is / has been actively working on

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 28 international standards to date. We have 28 currently valid standards, and 12 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].

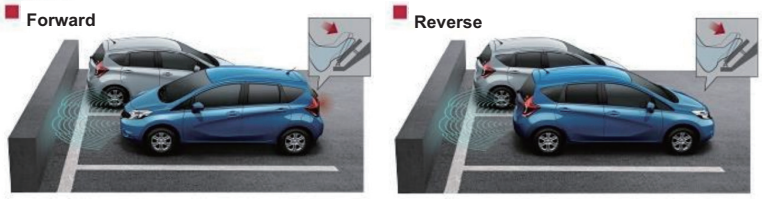
*1 European Telecommunications Standards Institute Technical Committee of ITS
*2 Dedicated Short Range Communication Technical Committee
*3 On-Road Automated Driving Technical Committee
*4 Road vehicles - Vehicle dynamics and chassis components

Scope of WG 14



AWI 19486 Acceleration control for pedal error (ACPE)

The aging of the population, already a pressing issue in Japan, is not limited to that country, but rather represents a global trend that is expected to reach the rest of Asia, the United States, Europe, and other countries. In these circumstances, accidents involving elderly drivers mistaking the accelerator and brake pedals, causing the vehicle to accelerate suddenly and collide with buildings or other vehicles occur notably frequently in Japan and have become a social issue. To address this situation, this standard specifies functional requirements for Acceleration control for pedal error, which mitigates damage in a collision.



AWI 19560 Information interface framework between automated driving system and user

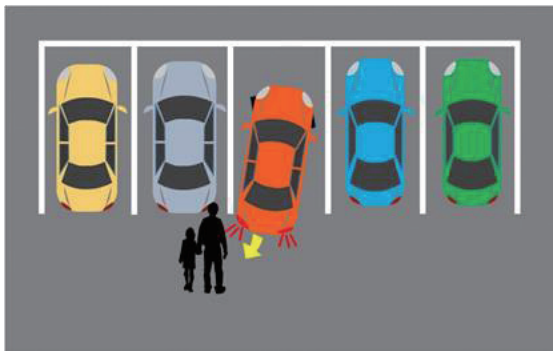
The anticipated spread of automated driving systems (ADS) has created the need for situation-based exchange of information from the ADS to the user and vice-versa. Examples include cases where certain circumstances required disabling automated driving mode and prompting the user to take over driving. Similarly, there are situations where the system has to confirm user intent when executing a function. Since users can use their smartphones or other devices at ADS Level 3 and higher, notifying them via the device can be effective in cases where the user is focusing on that device. This technical report will also define concepts and policies, and provide an internationally referenced official document concerning the exchange of information between ADS and users.

DIS 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.

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.

The objects for testing is also defines in coordination with TC 22/ SC 33/ WG 16.

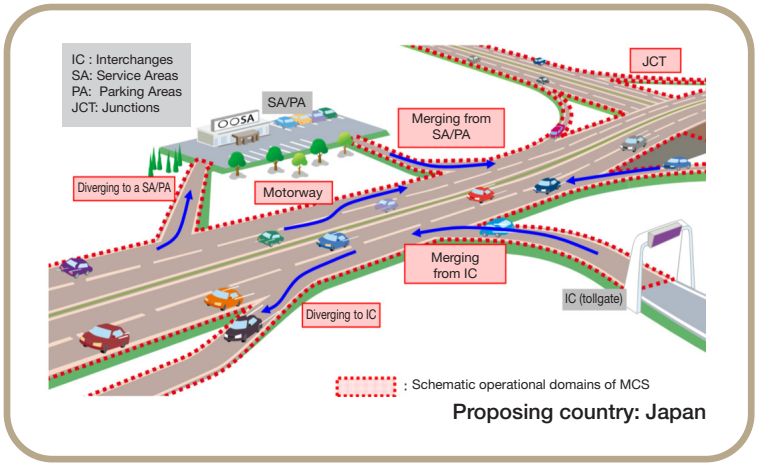


Proposing country: Germany

TS 23792-1 Motorway Chauffeur Systems (MCS) - Framework and general requirements (MCS Part 1)

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

The practical application of Level 3 automated driving systems on motorways has started. 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 that the user is ready to take over driving when the system stops operating, and it is important for the user to correctly understand the conditions under which the system begins and ends 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.

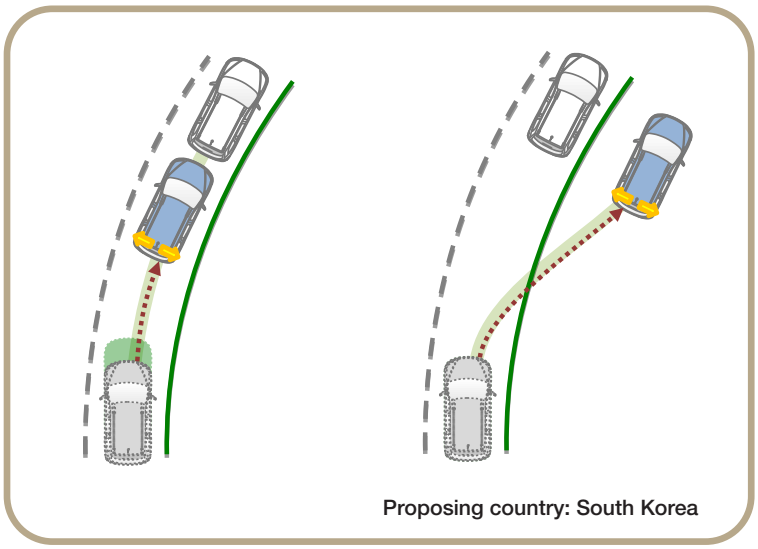


Proposing country: Japan

DIS 23793-1 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.

This part is subject to standardization, with describing the MRM classification framework and the requirements and test procedures for basic emergency stops and in-lanes stopping.

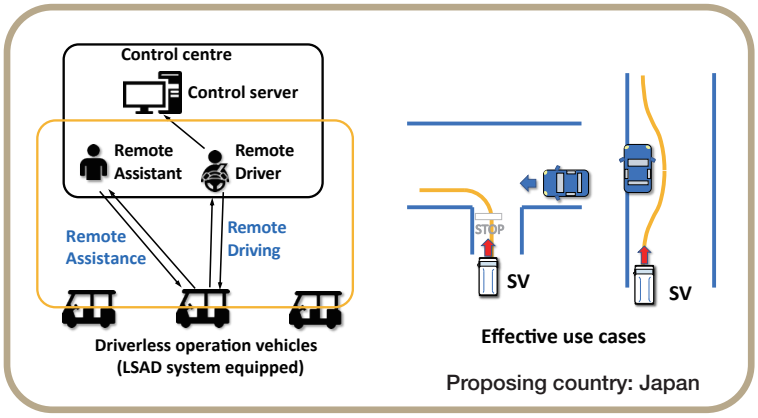


Proposing country: South Korea

CD 7856 Remote support for LSAD system (RS-LSADS)

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/SAE PAS 22736.

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.

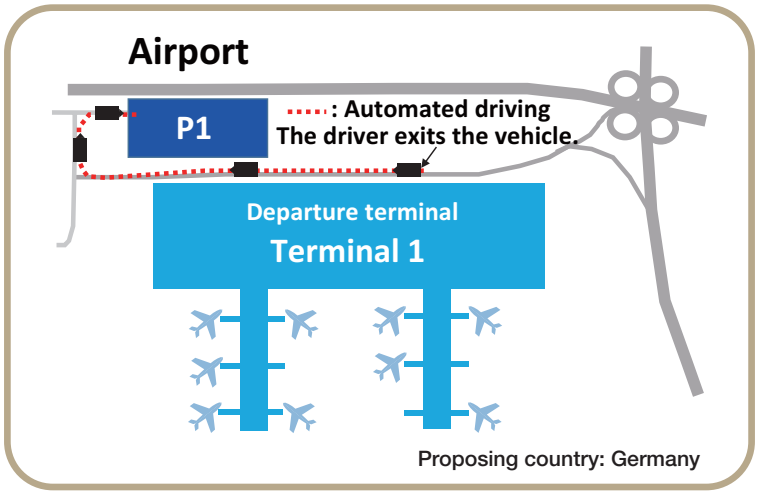


AWI 12768-1 Automated Valet Driving Systems (AVDS-1)

These are automated driving systems that expand the operational design domain (ODD) of automated valet parking systems (AVPS) from within the limitations of a parking area to, for example, the roadways between different parking areas.

Possible cases of this type of system are as follows. For example, after the driver and any other vehicle occupants exit a vehicle at the departure terminal of an airport, the on-board system cooperates with roadside infrastructure systems to autonomously move the vehicle to a chosen parking area. Or, after the vehicle is parked in this manner, the vehicle is moved autonomously to a maintenance area for services such as maintenance, charging, washing, or the like, before being returned autonomously to the original parking position.

The overall system configuration is basically the same as an automated valet parking system (AVPS), but requires high-level recognition and control performance due to the complexity of roadway profiles and routes.

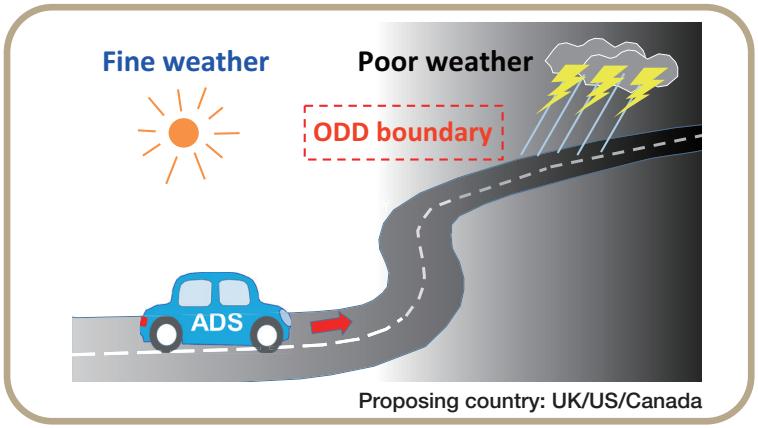


If such systems become widespread in line with AVPS, it will enable substantial improvements in user convenience via vehicle usage, related services, and the like.

AWI 17720 Considerations on automated driving systems (ADS) response to violations of operational design domain (ODD) boundary conditions

Although Level 3 automated driving systems have started to be practically adopted on motorways, fully automated driving in any location and under all environmental conditions still requires various technological breakthroughs. Consequently, automated driving will be limited to certain areas and certain environmental conditions for the foreseeable future.

This standard studies the types of expected behavior of automated driving systems at the boundaries between areas in which automated driving is and is not possible.



NP 19484 Highly Automated Motorway Chauffeur Systems (HMCS)

Vehicles offering seat rearrangement and the possibility of storing the steering wheel as well as the accelerator and brake pedals to enhance occupant comfort during Level 4 automated driving on motorways are under consideration. This makes it critical to design the system to ensure safety is not compromised when the vehicle reaches the automated driving domain boundary, even in the event of a vehicle malfunction or occupant emergency.

Therefore, this standard specifies the functional requirements and test procedures for the means of providing information on boundaries defining whether automated driving is possible or not, emergency stop functionality in the event of a vehicle malfunction or occupant emergency, and also for a human machine interface that keeps occupants informed on their roles. This standard is expected to further enhance the convenience of automated driving.

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
	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
★	39	ITS communication role and functional model	DTR 17732	Descriptions of the roles and functional models in ITS communication

★ 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 IS 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.

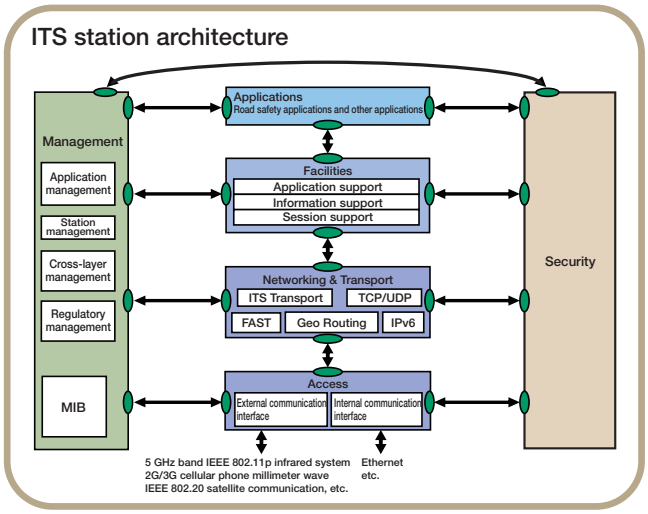
Station/Communication Architecture (ISO 21217)

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.

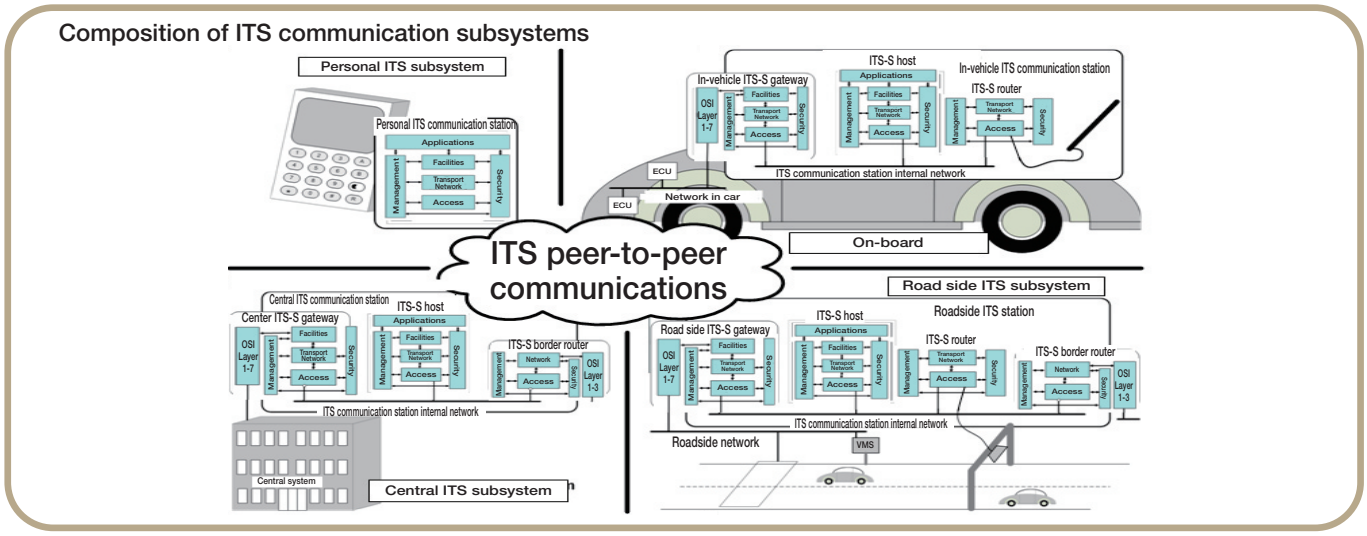
ITS stations feature various communications formats. The architecture standard divides them into 16 communications classes, depending on whether or not 1) multihop communications are used, 2) IPv6 or a non-IP protocol is used for the network layer, 3) handover is conducted, and 4) there is an Internet 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 IS 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 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 standard 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 standard 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 standard in 2012. Revisions have been discussed since 2015. Revision is currently being examined.

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 standard 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 802.20 ISO 29283
  ITS-CALM Mobile wireless broadband using IEEE 802.20 (625k-MC mode/Wideband mode)
  (ISO standard 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 standard in 2011.

Broadcast (ISO 13183)

UK proposed standardization for an interface to use broadcast communications (DAB, DVB, etc.) with ITS stations. It was published as an ISO standard 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 a standardization proposal related to the application of 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.

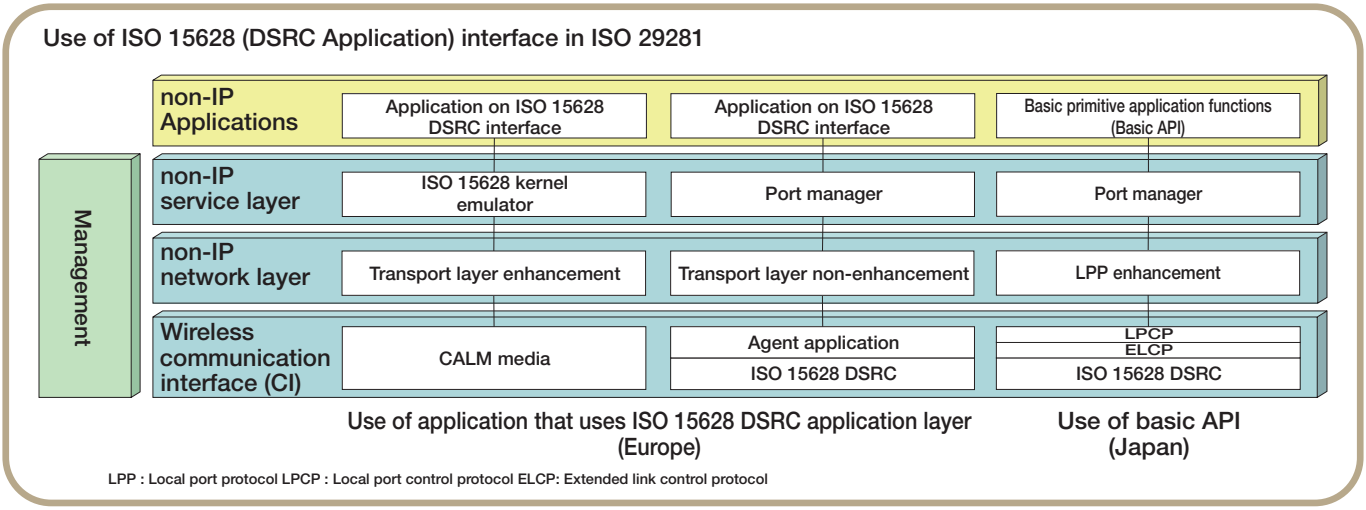
Non-IP networking (ISO 29281)

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 standard 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.

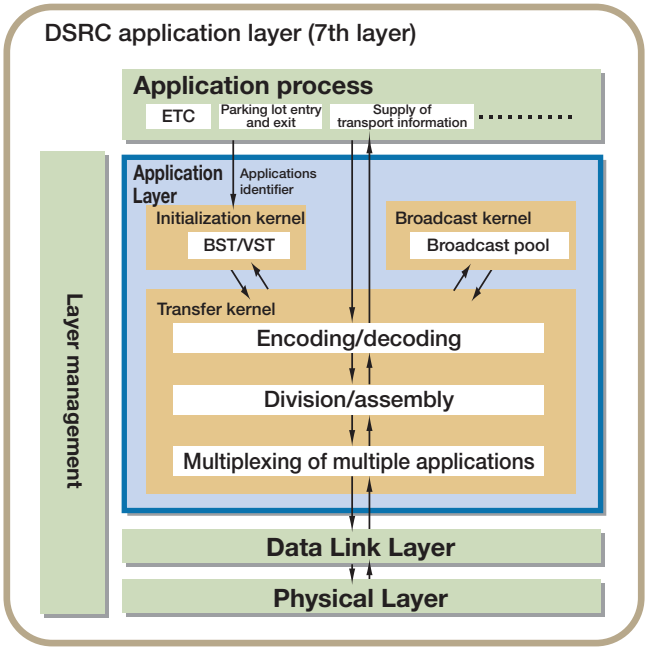
In Japan, the ASL (Application Sub Layer) standards and basic application interface technical specifications have been positioned above the 7th layer.

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)

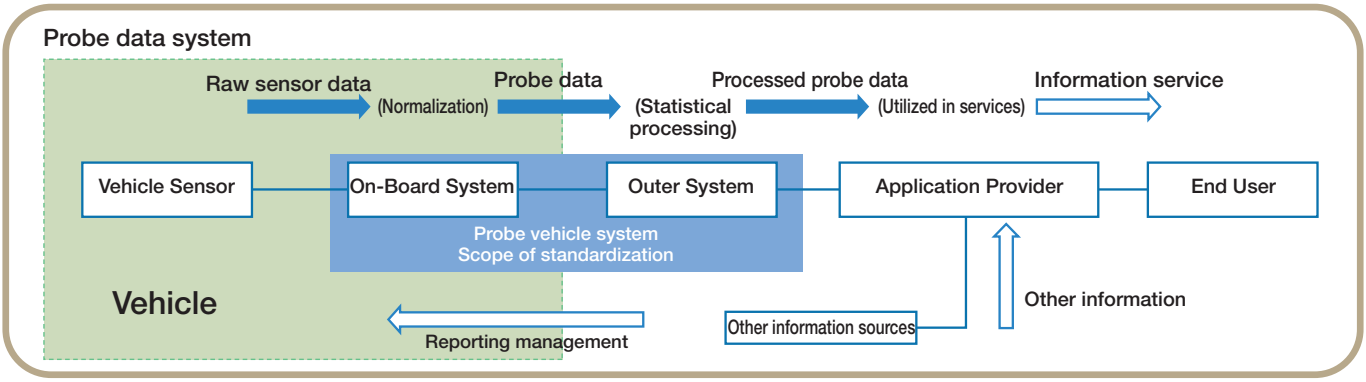
Communication lower layer standard for use in European digital tachographs that use DSRC. Proposed in 2019, this standard was issued in 2021.

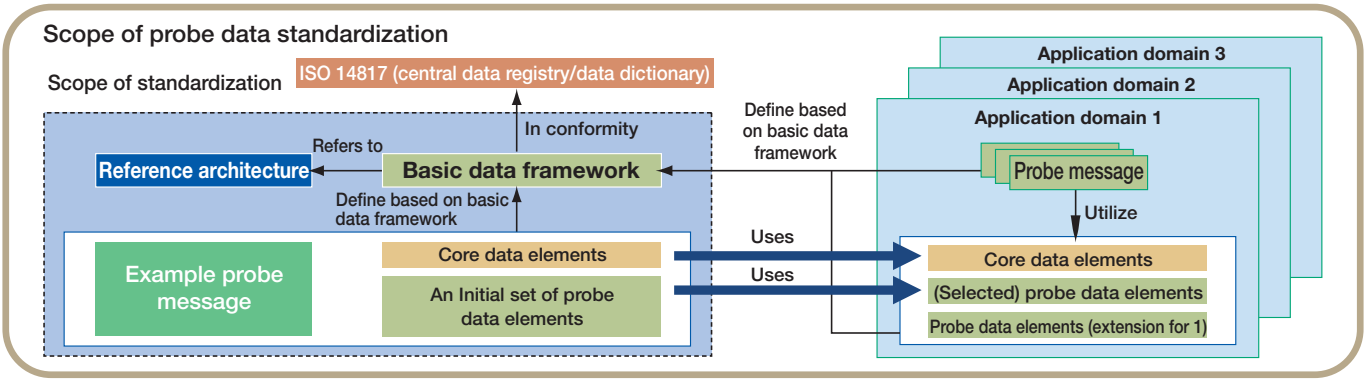
Probe Data

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 standard 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 standard 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

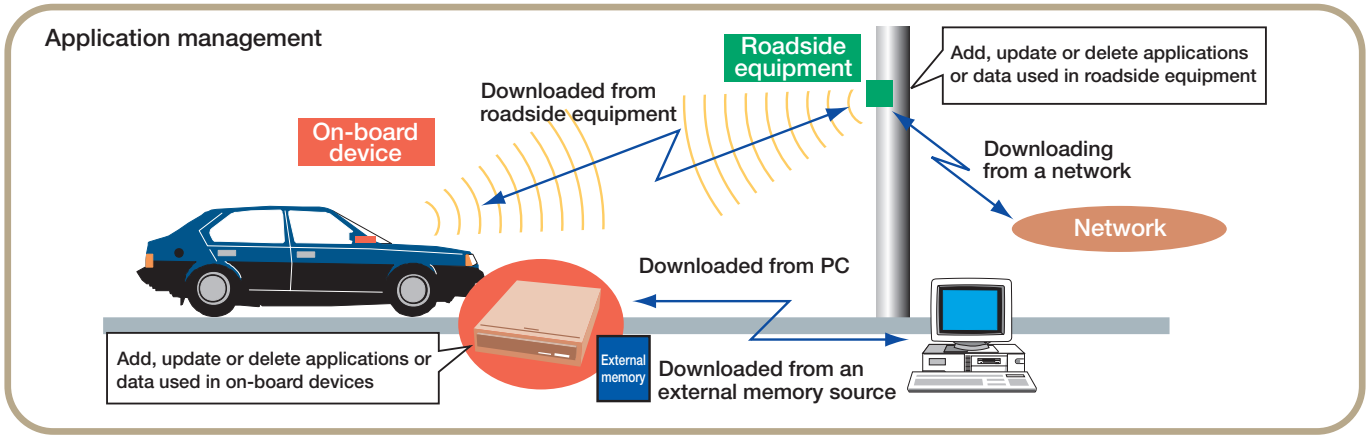
Application management (ISO 24101-1)

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 standard in 2010.



Pre-emption of ITS Communication Networks

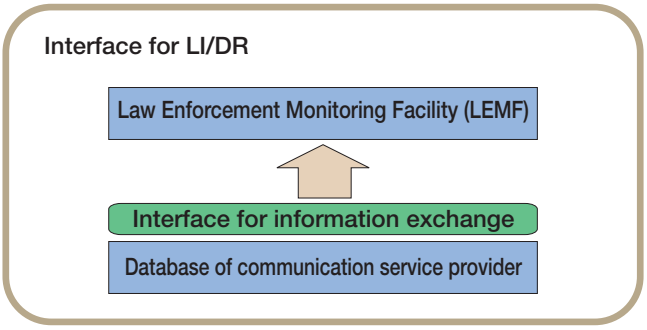
In the wake of the Great East Japan earthquake, this SWG launched a study on securing emergency communications in the event of a disaster, particularly in terms of road traffic. Chaired by Japan, this item worked on possible basic requirements with the close examination of use cases. Disaster recovery 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.

Roles and Functional Models of ITS Communication

Proposed by Japan reflecting the necessity of compiling afresh the roles and functions demanded of ITS communication in response to the advent of MaaS, smart cities, and the like (ITS communication role and functional model (DTR 17732)). Development has been progressing, which is also to contribute the verification of the activity scope of WG 16 discussed internally since 2021.

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.

Currently, this WG considers nomadic devices as key ITS devices that connect people and models, and is discussing services capable of providing convenience in various forms. Under advice received from Advisory Group 4 (AG4) of TC 204, the WG is coordinating with other WGs and is preparing to inaugurate studies into further cross-sectorial services as the affiliated SWG 17.1.

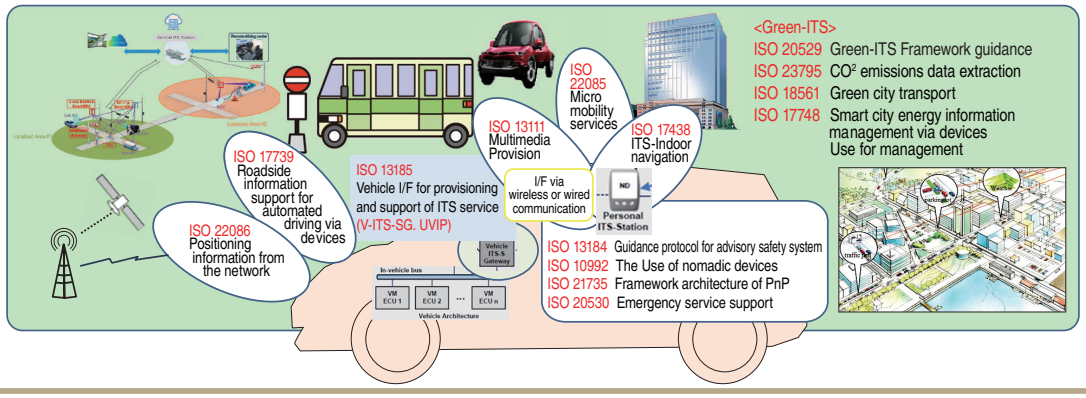
List of WG 17 work items

	Standardization themes	ISO Number	Contents
1	The use of nomadic and portable devices to support ITS services and multimedia provision in vehicles & Part 2: Definition and use cases for mobile service convergence	TR 10992 TR 10992-2	Defines use cases related to the provision of ITS services and multimedia content to nomadic and mobile devices in vehicles. Part 2 specifies definitions and use cases related to platforms for providing services using various devices or the cloud.
2	Vehicle interface for provisioning and support of ITS services – Part 1: General information and use case definition – Part 2: Unified gateway protocol (UGP) requirements and specification for V-ITS-SG*1 I/F – Part 3: Unified vehicle interface protocol (UVIP) server and client API specification – Part 4: Unified vehicle interface protocol (UVIP) conformance test	TR 13185-1 ISO 13185-2 to 4	Part 1 is a TR that describes a series of drafts related to vehicle interfaces for realizing ITS services, and defines general information and use cases for vehicle ITS station gateways (V-ITS-SG). Parts 2 to 4 are IS that define the requirements and specifications related to the V-ITS-SG proposed by WG 17. These Parts define the UVIP application interface protocol between vehicle information interfaces such as V-ITS-SG and nomadic devices as clients, and define the conformance tests for this UVIP protocol.
3	Guidance protocol via personal ITS station for advisory safety systems – Part 1: General information and use case definition – Part 2: Road guidance protocol (RGP) requirements and specification – Part 3: Road guidance protocol(RGP) conformance test specification	TR 13184-1 ISO 13184-2, 3	A series of drafts related to guidance protocols for driving safety support systems that use personal ITS stations. Part 1 is a TR that defines general information and use cases. Parts 2 and 3 define the requirements and specifications for protocols (RGP) and specify the procedures for testing compatibility with these protocols (RGP).
4	The use of personal ITS station to support ITS service provision for travelers – Part 1: General information and use cases definition – Part 2: General requirements for data exchange between personal ITS station and other	ISO 13111-1 to 2	Part 1 defines use cases for provisions of ITS services intended for travelers to nomadic and mobile devices, and Part 2 defines the requirements and specification for data exchange.
5	Indoor navigation for personal and vehicle ITS stations – Part 1: General information and use cases definitions – Part 2: Requirements and specification for indoor maps – Part 3: Requirements and specification for indoor positioning references – Part 4: Requirement and specification for interface between P/V and Central ITS stations – Part 5: Requirements and message specification for C-ITS-S*2 based positioning	ISO 17438-1 NP 17438-2 CD 17438-3 ISO 17438-4 NP 17438-5	Part 1 of the indoor navigation standardization, jointly prepared by WGs 3, 8 and 18, defines general information and use cases. Part 2 defines the requirements and specification for indoor maps and Part 3 examines the requirements and specification for indoor positioning references, while Part 4 defines the requirements and specification for the interface between personal/vehicle and central ITS stations. Part 5 will define the requirements and message specification for central ITS station (C-ITS-S)-based positioning.
6	Urban mobility applications via nomadic device for green transport management – Part 1: Requirements for interface between ITS stations – Part 2: Trip and modal choice applications and specification – Part 3: Mobility integration service applications using hybrid V2X	ISO 18561-1 CD 18561-2 PWI 18561-3	Covers trip planning and management for green (low CO_2 emissions) transport using nomadic devices in specified areas or road sections at international events such as the Olympics or the FIFA World Cup. Part 1 defines general information and use cases and Part 2 defines trip and modal choice applications and specification. Part 3 will provide stipulations covering the increased sophistication of mobility relying on hybrid V2X communication systems.
7	Framework for green ITS (G-ITS) standards – Part 1: General information and use case definitions – Part 2: Trip and modal choice applications and specification	TR 20529-1 ISO 20529-2	The Green ITS standard is intended as foundation to make use of ITS to reduce CO_2 emissions. Part 1 will compile general information, use cases, and guidelines, while Part 2 will establish the foundation for the standard, define integrated applications for mobile services, and formulate the specification.
8	Information for emergency service support via Personal ITS station – Part 1: General requirements and technical definition – Part 2: Service requirement for road accident notification	ISO 20530-1 CD 20530-2	Covers the sending of vehicle emergency information in the event of a collision or other emergency via a nomadic device. Part 1 provides the requirements and technical definition, while Part 2 will specify the service requirements and notifications in the event of an emergency.
9	Nomadic device service platform for micro mobility – Part 1: General information and use case definition – Part 2: Functional requirements and data set definitions – Part 3: Data structure and data exchange procedures	TR 22085-1 DIS 22085-2 DIS 22085-3	Covers service platforms employing nomadic device to make use of micro mobility accommodating one or two riders. Part 1 defines general information and use cases, Part 2 will specify functional requirements and define the data sets, and Part 3 will specify the data structures and the procedures for exchanging data.
10	Collection of agent behavior information and sharing between ITS stations	TR 22087	Defines the requirements and message specifications for the positioning of central ITS stations (C-ITS-S) as Part 5 of the standardization proposal related to indoor navigation being jointly pursued by WGs 3, 8, and 18.
11	Network based precise positioning infrastructure for land transportation – Part 1: General information and use cases definition – Part 2: Functional requirements and data interface via nomadic device	TR 22086-1 NP 22086-2	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 of field tests in South Korea. Part 1 defines general information and use cases, and Part 2 will specify the functional requirements and data interface.
12	Extracting trip data via nomadic device for estimating CO_2 emissions – Part 1: Fuel consumption determination for fleet management – Part 2: Information provision for eco-friendly driving behavior	ISO 23795-1 DIS 23795-2	For extracting travel data via nomadic devices to measure CO_2 emissions, Part 1 provides the specification for estimating fuel consumption to manage platoon driving for trucks or other vehicles, Part 2 provides the information of different events (e.g., speed, sudden acceleration/deceleration, idling, fuel cut, or eco-driving) which in necessary to measure CO_2 emissions related to driving behavior.
13	Seamless positioning for multimodal transportation in ITS stations – Part 1: General information and use case definition – Part 2: Nomadic & mobile device dataset for positioning data fusion	DTR 6029-1 NP 6029-2	Covers seamless indoor and outdoor positioning solutions for multi-modal transportation in ITS. Part 1 defines general information and use cases, and Part 2 specifies the technical requirements related to nomadic device-based positioning data fusion between the three domains of nomadic devices, mobility, and infrastructure.
14	ITS- energy-guided green ITS as a service on nomadic & mobile devices for smart city mobility application – Part 1: General information and use case definition – Part 2: Functional requirements of data platform – part 3: EV-based demand response charging services	PWI 17748-1 PWI 17748-2 PWI 17748-3	Covers energy-related green ITS as the service on nomadic and mobile devices. Part 1 is a TR to define general information and use cases, Part 2 is a TS to specify the technical requirements and data platform concerning energy consumption and the reduction of CO_2 emissions, and Part 3 is an IS to define the exchange requirements for the data used in EV-based demand response charging services. These work items were proposed by SWG 17.2.
15	ITS-roadside infrastructure supported location-based services on nomadic & mobile devices for urban connected automated mobility – Part 1: General information and use cases definition – Part 2: Functional requirement of data platform – Part 3:NO turn on red (NTOR) at signalized infractions – Part 4: Unprotected turn in T-intersections	PWI 17739-1 PWI 17739-2 PWI 17739-3 PWI 17739-4	Covers roadside infrastructure supported location-based services to ensure the safety of vehicles and vulnerable road users. Part 1 is a TR to define general information and use cases and Part 2 is an IS for the functional requirements of a location-based data platform. Parts 3 is studying specific services for signalized intersections, such as those in the US, that do not allow turning on a red light, while Part 4 is studying services for T junctions. These work items were proposed by SWG 17.1.
16	Nomadic & mobile devices – Passenger Care & Monitoring Service On nomadic device using Deep Learning	PWI (TBD)	Specifies service requirements and transmission procedures for using deep learning to analyze the condition of a person requiring care or other passenger based on in-vehicle image monitoring data, and transmitting the results to a cloud server. Work on this item involves liaising with the related WGs 14, 16, 18, 19 and 20.

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

Overview of standardization proposals under discussion by WG 17

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

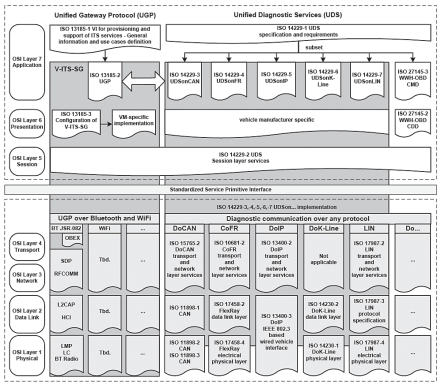


Vehicle Interface for the Provisioning and Support of ITS Services (ISO 13185-1 to 4)

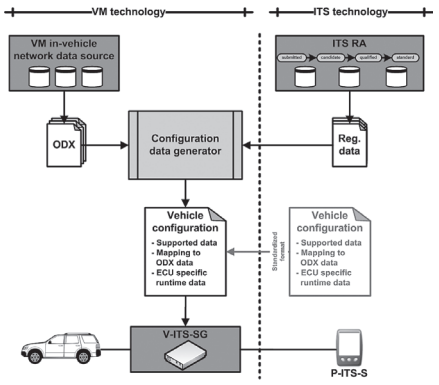
This is a standardization proposal for gateways to allow applications in nomadic devices to use vehicle information. Discussion on this item was conducted in collaboration with TC 22/SC 3/WG 1 (Road vehicles/Electrical devices/Serial data communications, current TC 22/SC 31) that is in charge of standardization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

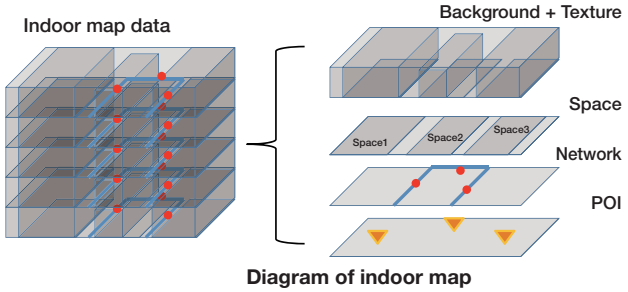
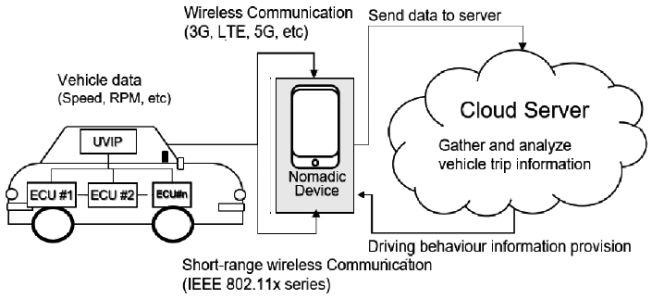


Diagram of indoor map

*POI: Point of Interest

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

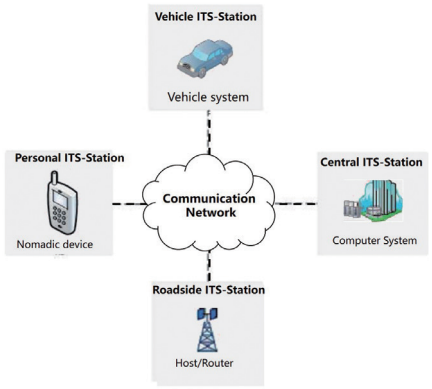
The proposed standard for estimating CO_2 emissions of vehicles using a portable device consists of two parts. Part 1 is the method of estimating by comparing the speed and consumption cycle of virtual vehicles that have accumulated on the network side with actual vehicle speeds. Part 2 stipulates information 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.



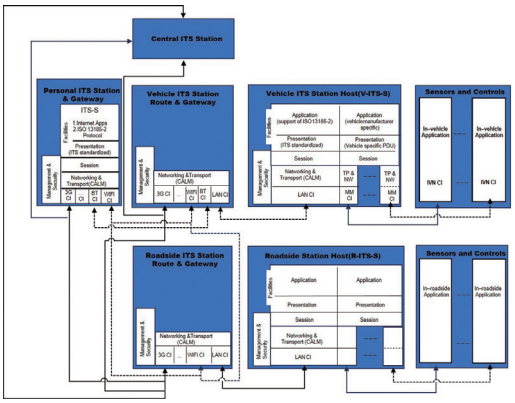
Overview of the service system

Provision of ITS and multimedia services for travelers (ISO 13111-1 and 2)

This standard specifies the interfaces to support various applications for nomadic and mobile devices based on personal ITS stations, as well as the data exchange protocol with vehicle, central, and roadside ITS stations, for the provision of ITS services to travelers. This makes it possible to provide vehicle information, advice to the driver, warning systems, entertainment systems, traffic information, low speed traffic system (non-vehicular transportation) information, and multi-modal navigations services. Part 1 defines use cases, and was published as a TR in 2017. Part 2 defines requirements and specifications for data exchange, and was published as an IS in 2022.



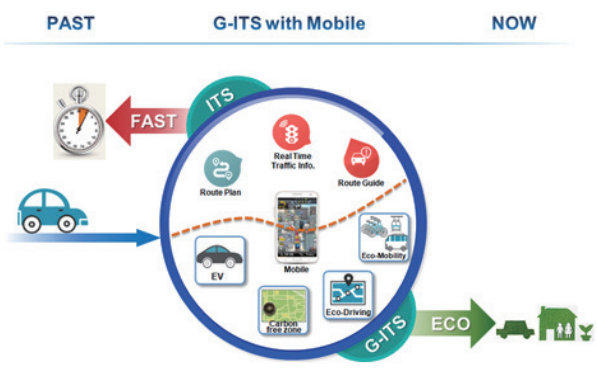
Communication system for ITS



Connections between personal ITS stations and other ITS stations

Framework for Green ITS standards (ISO 20529-1 and 2)

This framework proposes standards that provide a foundation for Green ITS (e.g., CO_2 reduction) activities, including surface transportation with e-mobility. Part 1 consists of a Green ITS standard common framework including gap analysis of existing ITS standards, studies of use cases, and guidelines to facilitate practical implementation by policy makers. It was published as a TR in 2017. Part 2 establishes the foundation for the standard, defines integrated applications for mobile services, and formulates the specification. It was published as an IS in 2021.

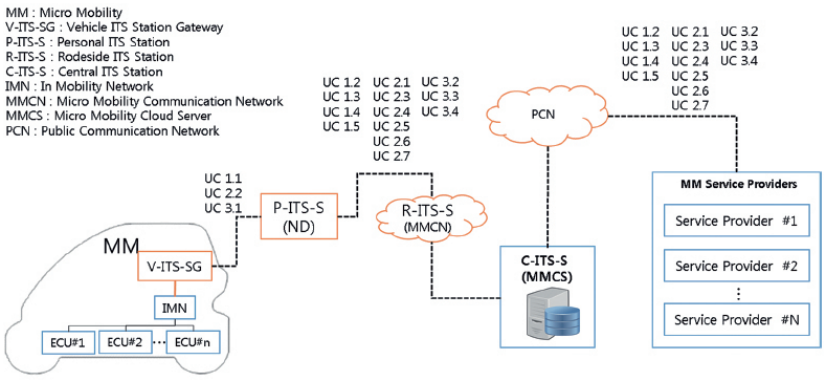


Overview of Green ITS services

Service platform for micro-mobility (ISO 22085-1 to 3)

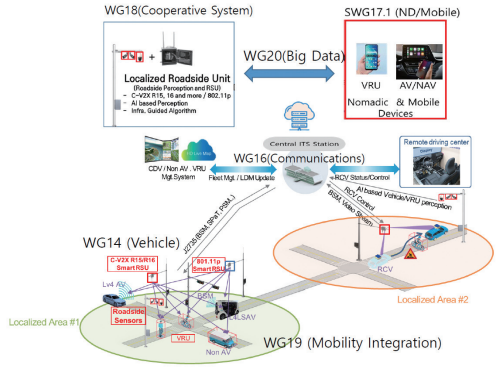
This standard proposes the provision of a service platform that uses nomadic devices for first- and last-mile services connecting public transit routes as micro-mobility carrying one or two passengers for short distance trips becomes increasingly convenient and necessary. Part 1 categorizes the market scale and situations in various countries, and defines functional requirements and use cases. It was published as a TR in 2019. Part 2 specifies the functional requirements and dataset for providing pre-trip information (e.g., available parking place information), necessary en-route information (e.g., route design information), and post-trip information (e.g., parking position information) for micro mobility. It was published as an IS in 2021. Part 3 defines the data structure and data exchange procedure to enable cloud-based mobility services that involve a data exchange interface between micro mobility services and nomadic devices. It is currently at the DIS stage.

Conceptual diagram of general use cases



Roadside infrastructure supported location-based services for automated driving (ISO 17739-1 to 3)

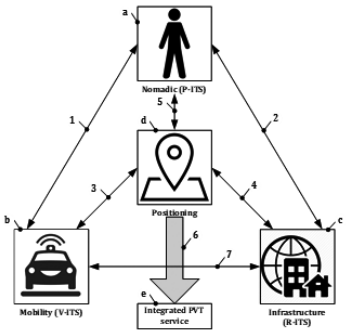
At the 2022 WG 17, SWG 17.1 was established to make a wide ranging study of potential infrastructure guided localization services on nomadic and mobile devices for urban connected mobility. The scope of the SWG study extends beyond the traditional WG 17 area of responsibility to that of other WGs. Consequently, the ISO TC 204 advisory group (AG 4) responsible for coordinating work items between multiple workgroups was tasked with advising the SWG. The ISO 17739 proposed by SWG 17.1 between last year and this year consists of four PWIs. The standard covers roadside infrastructure supported location-based services to ensure the safety of vehicles and vulnerable road users. Part 1 as a TR considers to define general information and use cases. Part 2 as an IS considers the functional requirements of a location-based data platform. Parts 3 studies specific services for signalized intersections, such as those in the US, that do not allow turning on a red light. Lastly, Part 4 studies services for T intersections.



Relationship between SWG 17.1 and other WGs

Seamless positioning for multimodal transportation (ISO 6029-1 to 3)

This standard specifies the data monitoring, collection, and combination processes for the collection and application of external sources required by indoor and outdoor seamless positioning solutions for multi-modal transportation in ITS. Part 1 defines general information and use cases, and Part 2 specifies the technical requirements related to nomadic device-based positioning data fusion between the three domains of nomadic devices (P-ITS-S), mobility (V-ITS-S), and infrastructure (ITS-infrastructure). Currently, Part 1 is at the DTR stage and scheduled to be published as a TR, while Part 2 is under discussion at the NP stage. Part 3 has been newly approved this year as a PWI to specify for sensor interfaces with high security and reliability, and discussion is schedule to begin. These items are related to WG 16 and the workgroups are expected to cooperate on assessments.



1: Data exchange between network environment and mobility services, including the exchange of mobility/personal data with P-ITS-S.
2: Data exchange with the infrastructure, including infrastructure information, as well as the exchange of personal data with P-ITS-S.
3: Data exchange between mobility endpoints and sensor fusion positioning applications.
4: Data exchange between infrastructure endpoints and sensor fusion positioning applications.
5: Data exchange between P-ITS-S and sensor fusion positioning applications.
6: Seamless positioning calculation.
7: Use cases for positioning data exchange.
a: The P-ITS domain is represented by ITS-compliant mobile devices carried by people.
b: The V-ITS domain is represented by ITS-compliant vehicles.
c: The R-ITS domain is represented by ITS-compliant roadside infrastructure devices.
d: Positioning domain for all devices in the P-ITS, V-ITS and R-ITS domains.
e: Results in integrated provision of position-, speed- and time-based services.

Seamless positioning system diagram

WG 18 Cooperative ITS

Cooperative ITS (cooperative systems) integrate vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and infrastructure-to-infrastructure (I2I) communications, and support the provision of extensive ITS services via communication systems.

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	Local dynamic map	ISO 18750:2018	Standard for Local Dynamic Map (LDM)
	6	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
	7	Dictionary of in-vehicle information (IVI) data structures	TS 19321:2020	A data structure dictionary for in-vehicle information (IVI) applications
	8	ITS station security services for secure session establishment and authentication between trusted devices	ISO 21177:2023	Specify ITS station security services for establishing and authenticating secure sessions between trusted devices
	9	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
	10	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
	11	Communication profiles for secure connections between trusted devices	TS 21185:2019	Standard for ensuring the security of communications between vehicles and ITS stations
	12	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
	13	Guidelines on the usage of standards — Part 2: Hybrid communications	TR 21186-2:2021	
	14	Guidelines on the usage of standards — Part 3: Security	TR 21186-3:2021	
★	15	Automated valet parking systems (AVPS) — Part 2: Security integration	DTS 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.

Japanese Framework

The Japanese WG 18 domestic committee was established in August 2010 under the auspices of the Highway Industry Development Organization (HIDO) and, in coordination with existing domestic committees, began its activities in October of the same year.

Systems already scheduled for deployment in Japan are closely related to infrastructure-related applications. Japan therefore present necessary opinions and make appropriate international contributions.

Japan has led SWG 2, which is responsible for identifying and studying the next series of work items.

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) (DTS 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 AVPS is a form of cooperative ITS realized through collaboration between parking facilities and vehicles, this work item belongs to WG 18 under the policy that discussions regarding the security of cooperative ITS should be centralized in this group. However, in reality, experts from WG 14, 16, and 18 are working together on this item.

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.

WG 19 Mobility Integration

In ISO/TC 204, WG 19 constitutes a joint working group that collaborates 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. WG 19 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. Specifically, the working group engages in activities to formulate infrastructure-related international standards. These standards will serve as ITS technology usage guidelines and urban administration policies to resolve the issues holding back the realization of a society that makes use of automated driving systems to address the concentration of the population in cities and provide mobility in sparsely populated areas, improve the urban environment, and solve the population concentration issues. Japan is working on proposals for the international standardization of the digital transformation of smart cities, of the use in low Earth orbit satellite systems in ITS to respond to natural disasters, and even of the automated driving infrastructure.

List of WG 19 Work Items

		Standardization Theme	ISO Number	Content
★	1	1 ITS- Role model of smart city ITS service application	TR 4445	Japanese proposal Summarizes the role model for realizing smart city ITS service applications in a TR
★	2	LSAD system service architecture	TS 5255-1 TR 5255-2	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	Internal document	Gap and overlap analysis of standards relating to mobility integration and compilation of report. Being utilized in the activities of AG 4.
★	4	Intelligent transport systems - Management for Electronic Traffic Regulations (METR) - Part 1: Part 1: Operational concept (ConOps)	PWI/TS 24315-1 PWI/TS 24315-2 PWI/TS 24315-3	Defined the concepts and architecture for electronically storing static and dynamic information about infrastructure, such as road signs, traffic restriction information, and the like Comprised of 8 parts.
★	5	Intelligent transport systems - Urban-ITS - 'Controlled Zone' management using C-ITS	DTS 24311	Specifications for controlled zone management, which manages vehicular access in urban areas.
★	6	Mobility Integration - Vulnerable users and light transport	TR 24317	Compilation of specifications for safety information relating to pedestrians and light modes of transport.
★	7	Mobility Integration concept	TR 4447	TR that acts as a bridge between European MaaS and North American MOD
★	8	Ground-based automated mobility system	PWI/TS 4448	Defines roadside operations for automated vehicles Comprised of 15 parts
★	9	Parking – Part 1: Core data model	TS 5206-1	International standardization of industry APDS standards
★	10	ITS data management, access and mobility issues – Governance using secure interfaces : High level specifications & information resource	DTS 5616	Communication & data standards guidebook. Online collection of links. Comprised of 9 parts.
★	11	Digital infrastructure service role and functional model	TR 7872	Japanese proposal Compiling a service that provides digital infrastructure information to ITS service providers
★	12	ITS data aggregation role and functional model	DTR 12770	Japanese proposal Compiling a service that aggregates ITS data needed by ITS service providers.
★	13	Enterprise view, Physical view (PWI)	TR 7878	Norway Proposal: Compile role models for MaaS, MOD, and IFMS
★	14	Multimodal pricing	PWI/TR 7874-1 PWI/TR 7874-2	US Proposal Compile multimodal payment rules Comprised of 2 parts.
★	15	Role model for mobility service using LEO satellites	DTR 17783	Japan proposal Summarizes the role model for LEO satellite use in ITS.

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

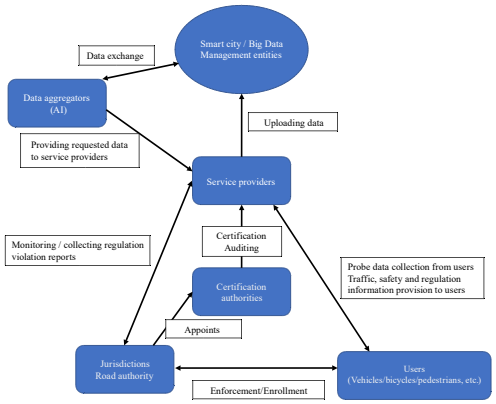
Role Model for Smart City ITS Service Applications (TR 4445)

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.

WG 19 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 WG 19 expands on this objective while referring to the WG 7-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 adminis-

trative 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.

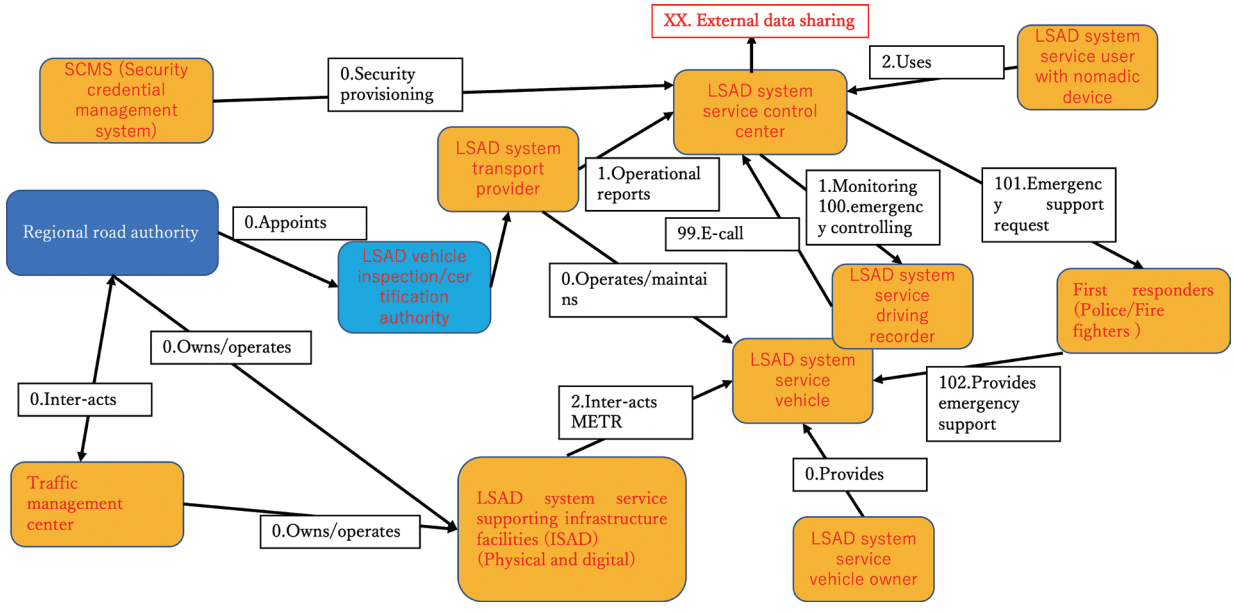
A draft concept for smart city core architecture



System services role function model for LSAD driving systems (TS 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



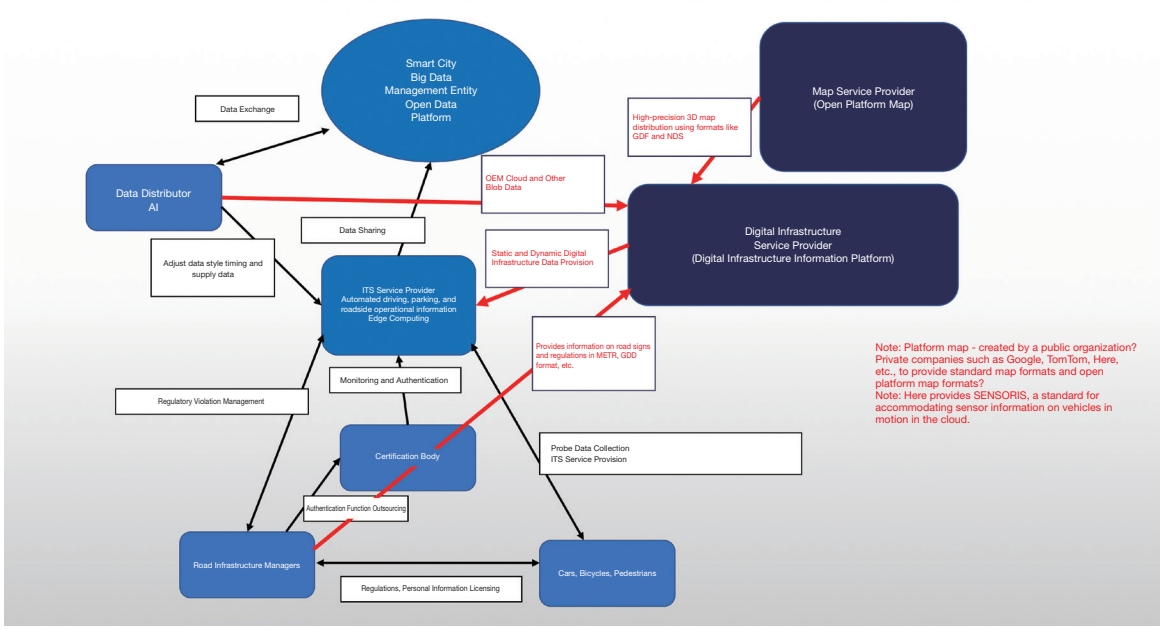
Operational physical layerData flow

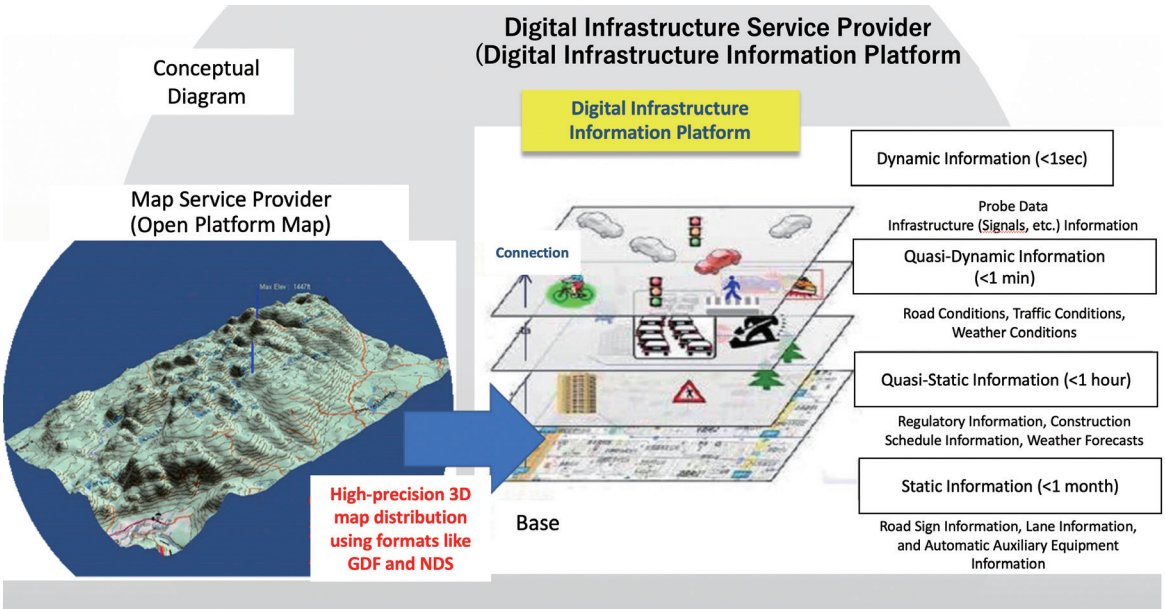
Source: ISO/TC204/WG19

Role Functional Model for Digital Infrastructure Services (TR 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 TC 204's international standardization work. Furthermore, this proposal adds a new Digital Infrastructure Service Architecture role to the basic role model work item ISO/TR 4445, a Japanese proposal. This action aims to clarify the roles required for the deployment of ITS mobility service applications that require digital infrastructure support. 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 adminis

ITS Digital Infrastructure Service Architecture Role Model Diagram (Draft)

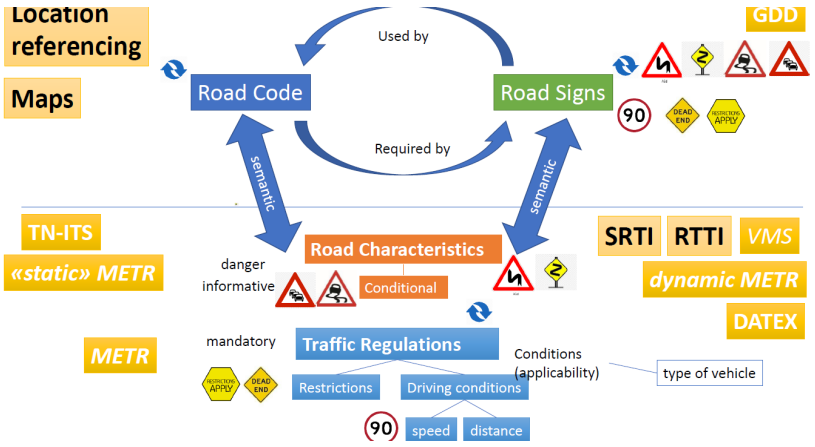


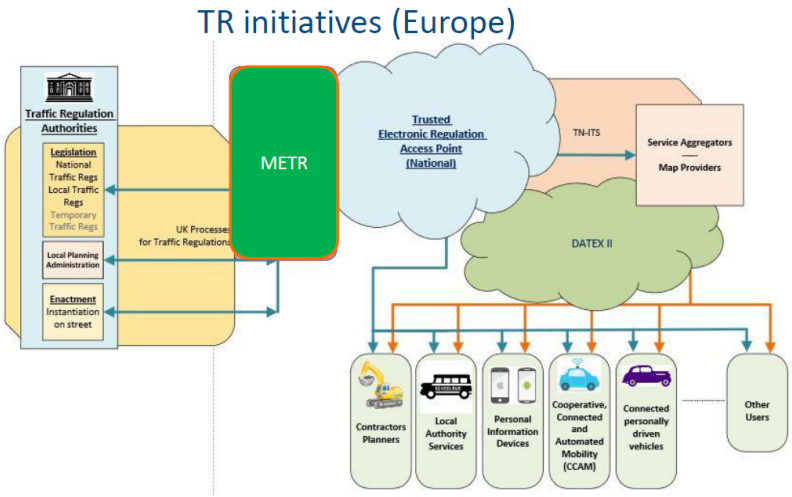


Source: ISO/TC204/WG 19

Management of Electronic Traffic Regulations (PWI 24315-1)

This work item, newly proposed by 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/TC204/WG19

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

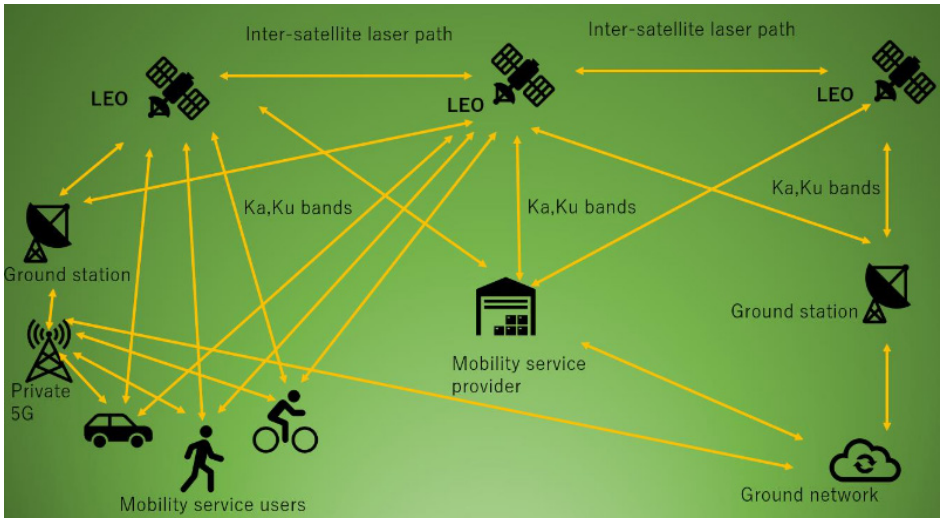
This work item was newly proposed by UK and approved as NP at the international meeting in April 2020. It was achieved by requesting that the Alliance for Parking Data Standards (APDS) utilize the shared terminology and definitions they created for the parking industry data using UML, creating an international 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 (TR 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.

Role model for the use of low Earth orbit satellites in ITS (DTR 17783)

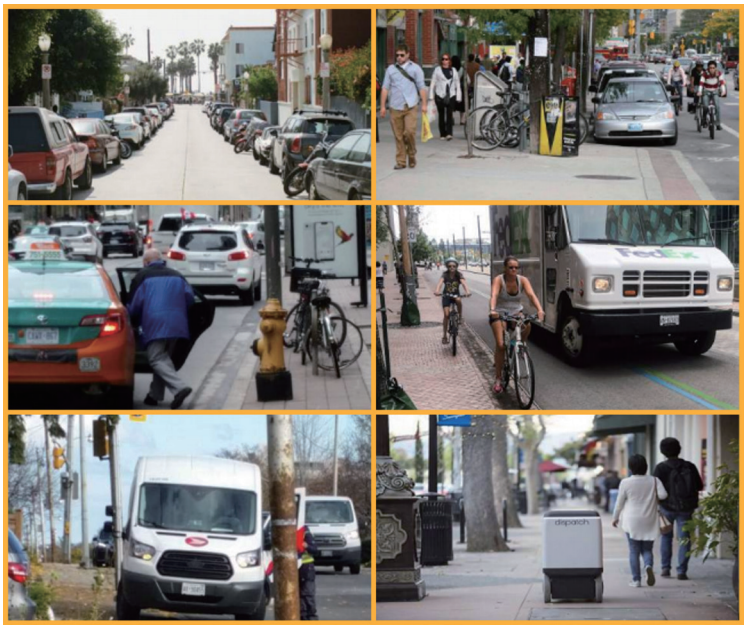
This aims at using low Earth orbit satellite systems for ITS services in situations such as when the terrestrial network cannot be used after a natural disaster or other catastrophe.



Source: ISO/TC204/WG19 document

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

WG 20 Big data and Artificial Intelligence supporting ITS

Since 2019, standardization concerning AI and big data in the ITS field had been studied by an advisory group (AG 1) established under TC 204. AG 1 found that with standardization of AI and big data is gaining impetus across various fields, it had become necessary to study ITS-specific use cases to ensure appropriate standardization for the ITS field. This led to the creation of WG 20 in 2021.

At the same time, it was decided that WG 20 cooperates closely with ISO/IEC JTC 1/SC 42 (Artificial intelligence), which is similarly studying AI and big data use cases in the transportation field.

List of WG 20 Work Items

	Standardization themes	ISO Number	Content
1	Big data and artificial intelligence supporting intelligent transport systems – Use cases	WD TR 12786	Definition of use cases related to the utilization of big data and AI in ITS

JWG 1 City data model transportation planning

The development of ISO/IEC-5087-3 (Transportation planning), which was part of the three-part of the ISO/IEC 5087 standard being developed by ISO/IEC JTC 1/WG 11 (Smart cities), is now being conducted by the initiative of transportation experts. Consequently, a new joint working group was established in 2023 at the proposal of the US, and TC 204-led standard development has begun.

In Japan, the Mobility Integration Working Group corresponding to WG 19 is responsible for this joint working group.

List of JWG 21 Work Items

	Standardization themes	ISO Number	Content
1	City data model – Service level concepts – Transportation planning	AWI 5087-3	Specify an ontology to represent city structures and activities Part 3 specifies the service level (transportation planning)

Working groups that have been discontinued

In response to technological, social, and business changes in the standardization environment for ITS, TC 204 not only establishes new working groups, but also merges or disbands existing ones. The list below presents working groups that have ceased their activities.

Working Groups that have stopped activities

WG Name	Main Activities	Change in Situation
WG 2 Quality and Reliability	Considerations on standardization for quality and reliability relating to systems.	Effectively disbanded in 1998
WG 4 Automatic Vehicle and Equipment Identification	Considering automatic identification systems for cars or freight using on-board devices or simple media.	Disbanded in 2018
WG 6 General Fleet Management	Considerations on standardization for general items relating to fleet management.	Merged into WG 7 in 1997
WG 11 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
WG 12 Parking Management	Considerations on standardization for parking lots.	Disbanded in 1998
WG 13 Man-Machine Interface	Considerations on standardization for the human factor and the machine interface.	Transferred to TC 22 (Road vehicles) in 1995 Disbanded under TC 204
WG 15 Dedicated Short-Range Communications	Considering standardization of dedicated short-range communication methods for roadside unit-to-vehicle	Disbanded in 2014 WG 16 has taken over the management of published standards

Introduction to Related Standardization Activities

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. WG 17 project teams include PT 1701 to PT 1711, as well as PT 1712 that was newly created in 2020. These teams have developed the European ITS communications and information protocols (EU ICIP). WG 17 aims to develop a toolkit for governments to realize smart cities. Joint working group (JWG) meetings with WG 19 Mobility integration, established at the ISO/TC 204 Budapest plenary meeting in September 2018, are held frequently.

List of CEN/TC 278 working groups

	CEN/TC 278 Working Group	Working Group	Lead Country	Corresponding TC 204 Working Group
★	WG 1	Electronic Fee Collection (EFC)	Sweden	WG 5
	WG 2	Freight and Fleet Management systems (FFMS)	Dormant	WG 7
	WG 3	Public Transport (PT)	France	WG 8
★	WG 4	Traffic and Traveler Information (TTI)	United Kingdom	WG 10
	WG 5	Traffic Control Systems (TC)	Dormant	WG 9
	WG 6	Parking management	Dormant	
	WG 7	ITS Spatial data	Germany	WG 3
	WG 8	Road Traffic Data (RTD)	Netherlands	
	WG 9	Dedicated Short Range Communications (DSRC)	Dormant	WG 16 (abolished WG 15)
	WG 10	Man-Machine Interfacing	Dormant	(TC 22/SC 39/WG 8)
	WG 11	Subsystem and intersystem interfaces	Dormant	
	WG 12	Automatic Vehicle and Equipment Identification	Dormant	WG 4 (abolished)
	WG 13	ITS Architecture	Dormant	WG 1
	WG 14	Recovery of Stolen Vehicles	Dormant	
	WG 15	eSafety / eCall	United Kingdom	
★	WG 16	Cooperative ITS	Germany	WG 18
★	WG 17	Mobility inegration (formerly Urban ITS)	Norway	WG 19

★JWG

Source: https://www.itsstandards.eu/25-2/

●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.

References
(1) https://boss.cen.eu/media/CEN/ref/va_guidelines_implementation.pdf
(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_471.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 996 TC 22-published international standards as of July 2023, and 185 draft standards are currently under development.

Scope and structure of TC 22

ISO/TC 22

Chair: France
P member: 36 countries
O member: 45 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	US
SC 35	Lighting and visibility	Italy
SC 36	Safety and impact tests	US
SC 37	Electrically propelled vehicles	Germany
SC 38	Motorcycles and mopeds	Japan
SC 39	Ergonomics	US
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)

●Standardization Activities Related to Automated Driving

Recently, TC 22 has also been highly actively involved in standardization related to automated driving. This section introduces the particularly relevant SCs and WGs, as well as the main work items.

SC	WG	Work Items
SC 31	WG 9 Sensor data interface for automated driving functions	ISO 23150 Data communication between sensors and data fusion unit for automated driving functions – Logical interface
SC 32	WG 8 Functional safety	ISO 21448 Safety of the intended functionality
	WG 11 Cybersecurity	ISO/SAE 21434 Cybersecurity engineering
	WG 12 Software update	ISO 24089 Software update engineering
	WG 13 Safety for driving automation systems	CD TS 5083 Safety for automated driving systems – Design, verification and validation
	WG 14 Safety and Artificial Intelligence	AWI PAS 8800 Safety and artificial intelligence
SC 33	WG 3 Driver assistance and active safety functions	ISO/DPAS 11585 Partial driving automation – Technical characteristics of conditional hands-free driving systems
	WG 9 Test scenarios of automated driving systems	ISO 34501 Test scenarios for automated driving systems – Vocabulary ISO 34502 Test scenarios for automated driving systems – Scenario based safety evaluation framework ISO 34503 Test scenarios for automated driving systems – Taxonomy for operational design domain DIS 34504 Test scenarios for automated driving systems – Scenario categorization
SC 35	WG 3 Visibility	DIS 24650 Sensors for automated driving under adverse weather conditions – Assessment of the cleaning system
SC 39	WG 3 Controls, displays, and tell-tale localization	PWI 7999 HMI specifications for software updates Over the Air (OTA)
	WG 8 TICS on-board-MMI	AWI TR 5283-1 Driver readiness and intervention management — Part 1: Partial automation (Level 2) AWI TR 5283-2 Driver readiness and intervention management — Part 2: Conditional automation (Level 3) AWI PAS 23735 Ergonomic design guidance for external visual communication from automated vehicles to other road users

●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/SC 33/WG 16 (Active safety test equipment) has published the pedestrian dummy standards (ISO 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.

ISO/TC 268 Standardization Activities

●TC 268/SC 2 Sustainable mobility and transportation subcommittee

ISO/TC 268 (Sustainable cities and communities) was established in February 2012 and has been working on international standardization in this field since then. TC 268/SC 1 (Smart community infrastructures) was established at the same time based on a proposal from Japan and has been advancing the standardization of infrastructure technologies related to energy, transportation, natural disaster measures, etc.

In the spring of 2020, SC 1/WG 3 (Smart transportation) proposed the formation of a subcommittee (SC) to carry out standardization related to organizational issues, infrastructure, and services in the mobility and transportation options for cities and communities, including new technologies such as electric, hydrogen, and automated driving. In the fall of 2021, SC 2 (Sustainable mobility and transportation) was established, and in 2022 working groups were established based on the respective proposals of France and Japan, kicking off activities to develop standards.

Inside Japan, the national committee corresponding to TC 268/SC 2 has been organized with the Japanese Standards Association (JSA) serving as the Secretariat. There is wide participation in this national committee from research institutes, academic experts, business operators in the automotive, train, and transportation services fields, and business groups as well as the Ministry of Economy, Trade and Industry (METI), Ministry of Land, Infrastructure, Transport and Tourism (MLIT), and the Digital Agency.

Committee Structure

(International)

- ISO/TC 268 Sustainable cities and communities — Secretariat/chair: France
  - TC 268/WGs
  - TC 268/SC 1 Smart community infrastructures — Secretariat/chair: Japan
    - TC 268/SC 1/WGs
  - TC 268/SC 2 Sustainable mobility and transportation — Secretariat/chair: Japan
    - TC 268/SC 2/WG 1 Digital governance — Convener: France
    - TC 268/SC 2/WG 2 Platform and services — Convener: Japan
  - ISO/TC 22
  - ISO/TC 204
  - ISO/TC 269
  - IEC/TC 9
  - IEC/SyC/Smart Cities

  Liaison committees

(Japan)

- TC 268/SC 2 Japanese committee
  - Secretariat: Japanese Standards Association
  - Japanese subcommittee supporting the WGs

Japanese committee
16 participating organizations (20 people) (as of July 2023)

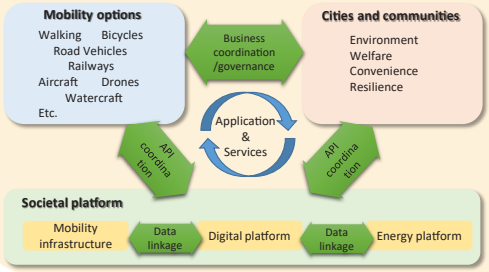
Scope of committee activities

ISO/TC 268:
- Standardization in the field of sustainable cities and communities.
- Includes the development of requirements, frameworks, guidance, and supporting techniques and tools related to the achievement of sustainable development considering smartness and resilience.

ISO/TC 268/SC 1:
- Standardization related to urban infrastructure (water management, energy, ICT, waste processing, etc) that will play a major role in supporting smart cities and resolving urban issues.
- The creation of environments in which advanced Japanese technology can be assessed appropriately, and the promotion of contributions and involvement from Japan toward urban development around the world.
- The promotion of the global and the vitalization of international exchange about urban infrastructure.

ISO/TC 268/SC 2:
- Standardization in the fields of sustainable mobility and transportation will promote of a multi-sectorial integrated approach for cities and communities.
- The consideration of organizational issues, infrastructures, and services in the mobility and transportation options for cities and communities, including those related to new technologies (i.e. electric, hydrogen, autonomous).
- Requirements, frameworks, guidance, as well as supporting techniques and tools with a long-term vision to plan, develop, operate, maintain, and manage sustainable mobility and transportation systems and services.
- Excluded: Road vehicles covered by ISO/TC 22, intelligent transport systems covered by ISO/TC 204, railway applications covered by ISO/TC 269, and electrical equipment and systems for railways covered by IEC/TC 9.

Target Business Areas for Standardization by ISO/TC 268/SC 2



Stakeholders in each area

Cities and communities:
- Local government officers
- Public agencies
- Citizens
- Visitors

Mobility options:
- Mobility providers
- Associated industries

Societal platform:
- Road operators
- Service providers
- Utility companies

Main standards under development at ISO/TC 268/SC 2

WG	Reference	Title	Overview
WG 1	PWI 16481	Sustainable mobility and transportation – Strategic needs regarding the ISO 37101 purposes of sustainability	A vision related to functional and environmental needs of component mobility systems.
WG 1	PWI 16483	Sustainable mobility and transportation – Terminology and indicators	Metrics capable of quantifying the evolution of sustainable mobility systems.
WG 2	TR 16497-1	Sustainable mobility and transportation – Sustainable Mobility Services – Part 1: Use Cases	Extraction of future standardization needs by collecting and organizing cases of MaaS and other smart transportation initiatives from Japan, US, and Europe, and analyzing the mutual gaps between them.
WG 2	PWI TR 16497-2	Sustainable mobility and transportation – Sustainable Mobility Services – Part 2: Gap and overlap analysis	Analyzes the use cases collected in Part 1.
WG 2	PWI 16499-1	Sustainable mobility and transportation – Automated mobility using physical and digital infrastructure – Part 1: Service role architecture	Definition of electric road systems equipped with a dynamic charging function for BEVs.
WG 2	PWI 4078-1	Sustainable mobility and transportation – Roadside feeding electric road system – Part 1: Service role architecture	Definition of electric road systems equipped with a dynamic charging function for BEVs.
WG 2	PWI 23098-1	Sustainable mobility and transportation – Mobility monitoring and services by data sharing platform – Part 1: Role model	Describes a functional role model for mobility monitoring services that use a data sharing platform.

●Policy for Collecting and Organizing Cases of Sustainable Mobility

The table to the right indicates the main categories to collect sustainable mobility initiatives carried in countries and territories around the world, which will dedicate future discussions on standardization.

- Involvement of related bodies (public, private, other)
- Connection with political objectives (care and assistance, education, disaster preparedness, environment, tourism, economic revitalization, etc.)

Policy targets	Environment	
	Equity and Inclusion	
	Economic growth	
	Others	
Travel modes considered	Existing modes	Private modes
		Public transport
		Others
	New Mobility services	Sharing services
		On-demand services
		Others
Organization involved (style of collaboration)	Local municipality (local government)	
	Transport operators	
	NPO	
	Other public sectors	
	Other private sectors	
	Others	
Impacts on social issues	Contribution to decarbonization policy	
	Contribution to support for outings for the elderly	
	Contribution to the revitalization of local small cities	
	Contribution to school commuting support	
	Contribution to utilizing with existing public transportation	
Overview	Outline	
	System image	
	introduction effects	

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 July 2023. 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). SG 5 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. SG 12 (Performance), SG 16 (Multimedia applications), and SG 17 (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, US, 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.

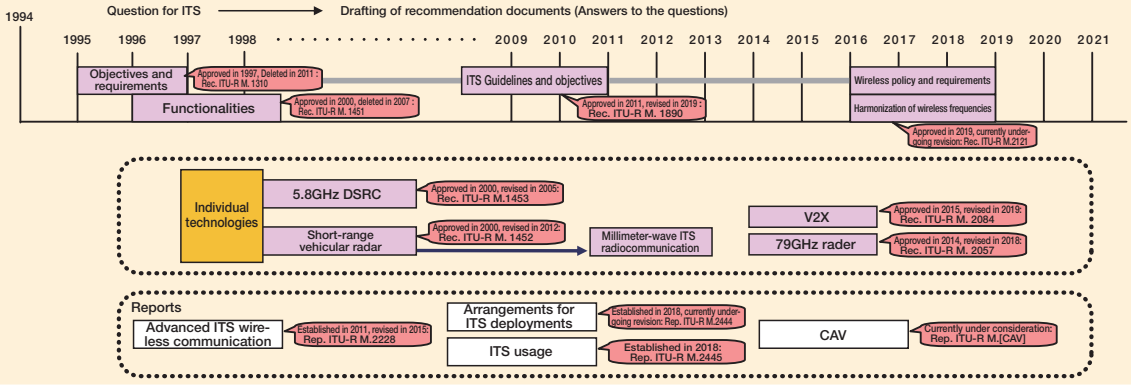
At the WRC (World Radio communication Conference)-19, held in 2019, it was decided to recommend that the use of globally or regionally harmonized spectrum should be considered for ITS planning and deployment, and that coexistence with existing services should be considered where necessary.

Consequently, Recommendation M.2121 (Harmonization of frequency bands for Intelligent Transport Systems in the mobile service) was drawn up alongside the related 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, the creation of a report related to the wireless communication requirements for connected automated vehicles (CAVs) were started in 2020 and a sub-working group for ITS-related discussions (SWG-ITS) was established in 2021.

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.2084-1	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, focus groups (FGs) enabling non-members to participate in preliminary discussions were established. Four FGs were set up between 2007 and 2013: 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. The outcomes of those discussions led to related recommendation developments in SG 12 (Quality). The FG on Vehicular Multimedia (FG-VM) was established between 2018 and 2022 to study the extraction, organization and resolving of issues concerning the standardization of multimedia related to automobiles. Similarly, the FG on AI for Autonomous & Assisted Driving (FG-AI4AD) was established between 2020 and 2022 to study AI for automated driving. Turning the outcomes from those two focus groups into recommendations is now being considered in SG 16 (multimedia). Two items were already turned into recommendations.

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: https://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
SG 12 (Performance, QoS and QoE)	Performance, QoS (Quality of Service) and QoE (Quality of Experience) of the info-communication network.Discussing standardization on in-vehicle communication via handover, etc.
SG 16 (Multimedia)	Multimedia applications using the info-communication network Discussing on requirements and architecture (including gateway platform) to the info-communication network from the point of view of various applications including ITS communications
SG 17 (Security)	Security of the info-communication network Discussing on security technology in ITS communication and its related standardization

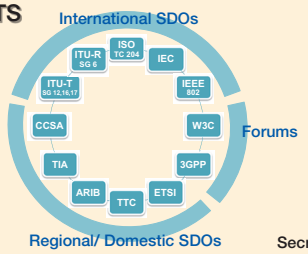
Outline of recommendations

SG	Name of the document	Document number	Content
SG 12	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
SG 16	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
	Vehicle domain service - General information and use case definitions	ITU-T F.749.5	Defines general information and use cases for vehicle domain services
	Requirements of vehicle information for automated driving in vehicle gateway platforms	ITU-T F.749.6	Vehicle information requirements for vehicle gateways in automated driving
	Architecture and functional entities of vehicle gateway platforms	ITU-T H.550	Architecture and functional entities of in-vehicle gateway platforms
	Architecture of Vehicle Multimedia Systems	ITU-T H.551	Architecture for vehicle multimedia systems
	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
SG 17	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 (currently under revision)
	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
	Guidelines for an intrusion prevention system for connected vehicles	ITU-T X.1377	Guidelines for systems that prevent external intrusion in connected cars
	Security requirements for roadside units in intelligent transportation systems	ITU-T X.1379	Security requirements for ITS roadside units
	Security guidelines for cloud-based event data recorders in automotive environments	ITU-T X.1380	Security guidelines for automotive cloud-based event data recorders
	Security guidelines for Ethernet-based in-vehicle networks	ITU-T X.1381	Security guidelines for in-vehicle Ethernet
	Guidelines for sharing security threat information on connected vehicles	ITU-T X.1382	Guidelines for sharing information on security threats to connected cars
	Security requirements for categorized data in vehicle-to-everything (V2X) communication	ITU-T X.1383	Security requirements for methods of categorizing data handled in V2X communication and for the types of data

●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 SG 16 in August 2011, 32 CITS meetings have been held as of March 2023, 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. Task Group p, established in 2004, developed IEEE 802.11p, a protocol modified IEEE 802.11a, which is used for wireless LAN, to suit ITS usage environment. 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, US allocated the 5.9 GHz band for ITS communication, and a number of field operational tests (FOTs) have been conducted using IEEE 802.11p, which was still being standardized at the time. IEEE 802.11p was finally published in 2010.

Subsequently, an extension of IEEE 802.11p was studied under the title Next Generation Vehicular (NGV), and Task Group bd was established in 2019.

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

IEEE 802.11bd uses IEEE 802.11ac and ax technology, which has been used for wireless LANs in recent years, to increase speed. It also uses the 60 GHz millimeter wave frequency band as an option, enabling even higher capacity communications. The IEEE 802.11bd standard was published in 2023.

The 5.9 GHz band was also allocated in Europe in 2008 in anticipation of the use of IEEE 802.11p, and a number of FOTs were conducted. In 2009, the European Telecommunications Standards Institute (ETSI)'s ITS Technical Committee defined ITS-G5, a communication standard using IEEE 802.11p. TC 204/WG 16 also standardized the IEEE 802.11p communication media as ISO 21215.

●Standardizations in IEEE 1609 Project

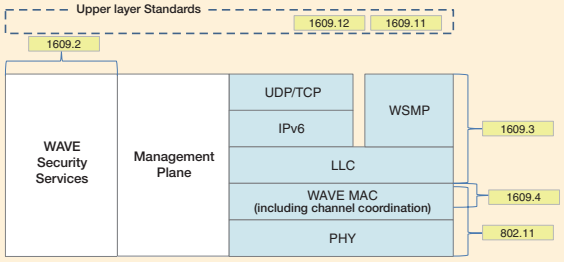
In the IEEE 1609 project in US, progress is being made toward the standardization of Wireless Access in Vehicular Environments (WAVE), which uses IEEE 802.11p as the communication media. Even systems utilizing LTE-V2X based on the Third Generation Partnership Project (3GPP) Release 14 are now partially using the IEEE 1609 standard.

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)

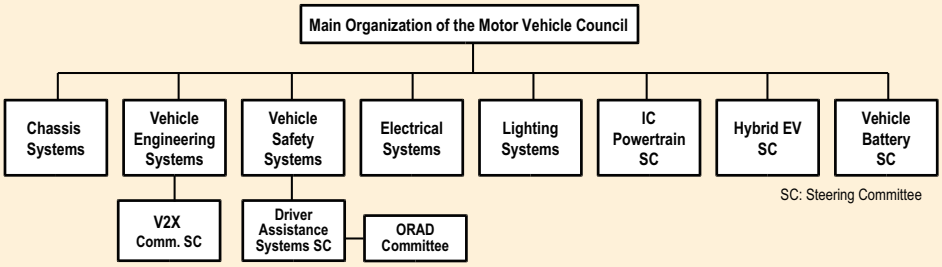
Overall WAVE architecture



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. The SAE and TC 22 have continued to work together toward the development of standards related to "Automotive Security Engineering". Furthermore, the SAE and TC 204 have also made progress in the development of 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.

TC 204 List of Work Items and Progress Stages as of July 2023

WG	ISO Numberr	Title	Stage						Pub-lished
			PWI	NP	WD	CD	DIS	FDIS	
ISO/TC 204	ISO/PWI 26048-1	Intelligent transport systems — Field device SNMP data interface — Part 1: Part 1: Global objects	○						
ISO/TC 204	ISO/PWI 26048-2	Intelligent transport systems — Field device SNMP data interface — Part 2: Part 3: Variable and dynamic message signs	○						
ISO/TC 204	ISO/PWI TS 26048-18	Intelligent transport systems — Field device SNMP data interface — Part 18: Part 18: Roadside units	○						
ISO/TC 204	ISO 24535:2007	Intelligent transport systems — Automatic vehicle identification — Basic electronic registration identification (Basic ERI)							○
ISO/TC 204	ISO 24534-1:2010	Automatic vehicle and equipment identification — Electronic registration identification (ERI) for vehicles — Part 1: Architecture							○
ISO/TC 204	ISO 24534-2:2010	Automatic vehicle and equipment identification — Electronic registration identification (ERI) for vehicles — Part 2: Operational requirements							○
ISO/TC 204	ISO 24534-3:2016	Intelligent transport systems — Automatic vehicle and equipment identification — Electronic registration identification (ERI) for vehicles — Part 3: Vehicle data							○
ISO/TC 204	ISO 24534-4:2010	Automatic vehicle and equipment identification — Electronic registration identification (ERI) for vehicles — Part 4: Secure communications using asymmetrical techniques							○
ISO/TC 204	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							○
ISO/TC 204	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							○
ISO/TC 204	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							○
ISO/TC 204	ISO/PWI 22261-2	Intelligent transport systems — Field device SNMP data interface — Part 2: Part 1: Global objects	○						
ISO/TC 204	ISO/PWI 22260	Intelligent transport systems – Public transport - Emergency recovery service for automated public transport systems	○						
ISO/TC 204	ISO/PWI TS 21867-1	Intelligent transport systems - Application programming interface for map updating — Part 1: Part 1: Requirements	○						
ISO/TC 204	ISO/PWI TS 21827-2	Intelligent transport systems - Application programming interface for map updating — Part 2: Part 2: Architecture and platform-independent data model	○						
ISO/TC 204	ISO/PWI TR 17739-1	Intelligent transport systems — Roadside infrastructure supported location-based services on nomadic and mobile devices for urban connected automated mobility — Part 1: General information and use cases definition	○						
ISO/TC 204	ISO/TR 17384:2008	Intelligent transport systems — Interactive centrally determined route guidance (CDRG) — Air interface message set, contents and format							○
ISO/TC 204	ISO 17264:2009	Intelligent transport systems — Automatic vehicle and equipment identification — Interfaces							○
ISO/TC 204	ISO 17264:2009/ Amd 1:2019	Intelligent transport systems — Automatic vehicle and equipment identification — Interfaces — Amendment 1							○
ISO/TC 204	ISO 17263:2012	Intelligent transport systems — Automatic vehicle and equipment identification — System parameters							○
ISO/TC 204	ISO 17263:2012/Cor 1:2013	Intelligent transport systems — Automatic vehicle and equipment identification — System parameters — Technical Corrigendum 1							○
ISO/TC 204	ISO 17262:2012	Intelligent transport systems — Automatic vehicle and equipment identification — Numbering and data structures							○
ISO/TC 204	ISO 17262:2012/ Amd 1:2019	Intelligent transport systems — Automatic vehicle and equipment identification — Numbering and data structures — Amendment 1							○
ISO/TC 204	ISO 17262:2012/Cor 1:2013	Intelligent transport systems — Automatic vehicle and equipment identification — Numbering and data structures — Technical Corrigendum 1							○
ISO/TC 204	ISO 17261:2012	Intelligent transport systems — Automatic vehicle and equipment identification — Intermodal goods transport architecture and terminology							○
ISO/TC 204	ISO 15075:2003	Transport information and control systems — In-vehicle navigation systems — Communications message set requirements							○
ISO/TC 204	ISO 14816:2005	Road transport and traffic telematics — Automatic vehicle and equipment identification — Numbering and data structure							○
ISO/TC 204	ISO 14816:2005/ Amd 1:2019	Road transport and traffic telematics — Automatic vehicle and equipment identification — Numbering and data structure — Amendment 1							○
ISO/TC 204	ISO 14815:2005	Road transport and traffic telematics — Automatic vehicle and equipment identification — System specifications							○
ISO/TC 204	ISO 14814:2006	Road transport and traffic telematics — Automatic vehicle and equipment identification — Reference architecture and terminology							○
ISO/TC 204/JWG 1	ISO/AWI TS 5087-3	Information technology — City data model — Part 3: Part 3: Service level concepts -Transportation planning			○				
ISO/TC 204/WG 1	ISO/TR 25104:2008	Intelligent transport systems — System architecture, taxonomy, terminology and data modelling — Training requirements for ITS architecture							○
ISO/TC 204/WG 1	ISO/TR 25102:2008	Intelligent transport systems — System architecture — 'Use Case' pro-forma template							○
ISO/TC 204/WG 1	ISO/TR 25100:2012	Intelligent transport systems — Systems architecture — Harmonization of ITS data concepts							○

WG	ISO Numberr	Title	Stage						Pub-lished
			PWI	NP	WD	CD	DIS	FDIS	
ISO/TC 204/WG 1	ISO 24531:2013	Intelligent transport systems — System architecture, taxonomy and terminology — Using XML in ITS standards, data registries and data dictionaries							○
ISO/TC 204/WG 1	ISO/TR 24529:2008	Intelligent transport systems — Systems architecture — Use of unified modelling language (UML) in ITS International Standards and deliverables							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/WG 1	ISO/TR 23255:2022	Intelligent transport systems — Architecture — Applicability of data distribution technologies within ITS							○
ISO/TC 204/WG 1	ISO/TR 17465-1:2014	Intelligent transport systems — Cooperative ITS — Part 1: Terms and definitions							○
ISO/TC 204/WG 1	ISO/TR 17465-2:2015	Intelligent transport systems — Cooperative ITS — Part 2: Guidelines for standards documents							○
ISO/TC 204/WG 1	ISO/TR 17465-3:2015	Intelligent transport systems — Cooperative ITS — Part 3: Release procedures for standards documents							○
ISO/TC 204/WG 1	ISO 14817-1:2015	Intelligent transport systems — ITS central data dictionaries — Part 1: Requirements for ITS data definitions							○
ISO/TC 204/WG 1	ISO 14817-2:2015	Intelligent transport systems — ITS central data dictionaries — Part 2: Governance of the Central ITS Data Concept Registry							○
ISO/TC 204/WG 1	ISO 14817-3:2017	Intelligent transport systems — ITS data dictionaries — Part 3: Object identifier assignments for ITS data concepts							○
ISO/TC 204/WG 1	ISO/DIS 14813-1	Intelligent transport systems — Reference model architecture(s) for the ITS sector — Part 1: ITS service domains, service groups and services					○		
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/WG 1	ISO 14813-6:2017	Intelligent transport systems — Reference model architecture(s) for the ITS sector — Part 6: Use of ASN.1							○
ISO/TC 204/WG 1	ISO/AWI TS 14812	Intelligent transport systems — Vocabulary			○				
ISO/TC 204/WG 1	ISO/TS 14812:2022	Intelligent transport systems — Vocabulary							○
ISO/TC 204/WG 1	ISO/TR 12859:2009	Intelligent transport systems — System architecture — Privacy aspects in ITS standards and systems							○
ISO/TC 204/WG 1	ISO 5345:2022	Intelligent transport systems — Identifiers							○
ISO/TC 204/WG 3	ISO 24099:2011	Navigation data delivery structures and protocols							○
ISO/TC 204/WG 3	ISO/TS 22726-1:2023	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							○
ISO/TC 204/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			○				
ISO/TC 204/WG 3	ISO/TR 21718:2019	Intelligent transport systems — Spatio-temporal data dictionary for cooperative ITS and automated driving systems 2.0							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/WG 3	ISO 19297-1:2019	Intelligent transport systems — Shareable geospatial databases for ITS applications — Part 1: Framework							○
ISO/TC 204/WG 3	ISO 17572-1:2022	Intelligent transport systems (ITS) — Location referencing for geographic databases — Part 1: General requirements and conceptual model							○
ISO/TC 204/WG 3	ISO 17572-2:2018	Intelligent transport systems (ITS) — Location referencing for geographic databases — Part 2: Pre-coded location references (pre-coded profile)							○
ISO/TC 204/WG 3	ISO 17572-3:2015	Intelligent transport systems (ITS) — Location referencing for geographic databases — Part 3: Dynamic location references (dynamic profile)							○
ISO/TC 204/WG 3	ISO 17572-4:2020	Intelligent transport systems (ITS) — Location referencing for geographic databases — Part 4: Precise relative location references (precise relative profile)							○
ISO/TC 204/WG 3	ISO 17267:2009	Intelligent transport systems — Navigation systems — Application programming interface (API)							○
ISO/TC 204/WG 3	ISO 14296:2016	Intelligent transport systems — Extension of map database specifications for applications of cooperative ITS							○
ISO/TC 204/WG 5	ISO/TS 37444:2023	Electronic fee collection — Charging performance framework							○
ISO/TC 204/WG 5	ISO 25110:2017	Electronic fee collection — Interface definition for on-board account using integrated circuit card (ICC)							○
ISO/TC 204/WG 5	ISO/TS 21719-1:2018	Electronic fee collection — Personalization of on-board equipment (OBE) — Part 1: Framework							○
ISO/TC 204/WG 5	ISO/TS 21719-2:2022	Electronic fee collection — Personalization of on-board equipment (OBE) — Part 2: Using dedicated short-range communication							○
ISO/TC 204/WG 5	ISO/TS 21719-3:2021	Electronic fee collection — Personalization of on-board equipment (OBE) — Part 3: Using integrated circuit(s) cards							○

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			PWI	NP	WD	CD	DIS	FDIS	
ISO/TC 204/WG 5	ISO/TS 21193:2019	Electronic fee collection — Requirements for EFC application interfaces on common media							○
ISO/TC 204/WG 5	ISO/TS 21192:2019	Electronic fee collection — Support for traffic management							○
ISO/TC 204/WG 5	ISO/TR 21190:2018	Electronic fee collection — Investigation of charging policies and technologies for future standardization							○
ISO/TC 204/WG 5	ISO/TR 19639:2015	Electronic fee collection — Investigation of EFC standards for common payment schemes for multi-modal transport services							○
ISO/TC 204/WG 5	ISO 19299:2020	Electronic fee collection — Security framework							○
ISO/TC 204/WG 5	ISO 17575-1:2016	Electronic fee collection — Application interface definition for autonomous systems — Part 1: Charging							○
ISO/TC 204/WG 5	ISO 17575-2:2016	Electronic fee collection — Application interface definition for autonomous systems — Part 2: Communication and connection to the lower layers							○
ISO/TC 204/WG 5	ISO 17575-3:2016	Electronic fee collection — Application interface definition for autonomous systems — Part 3: Context data							○
ISO/TC 204/WG 5	ISO/TS 17574:2017	Electronic fee collection — Guidelines for security protection profiles							○
ISO/TC 204/WG 5	ISO 17573-1:2019	Electronic fee collection — System architecture for vehicle-related tolling — Part 1: Reference model							○
ISO/TC 204/WG 5	ISO/TS 17573-2:2020	Electronic fee collection — System architecture for vehicle related tolling — Part 2: Vocabulary							○
ISO/TC 204/WG 5	ISO 17573-3	Electronic fee collection — System architecture for vehicle-related tolling — Part 3: Data dictionary						○	
ISO/TC 204/WG 5	ISO/TS 17573-3:2021	Electronic fee collection — System architecture for vehicle-related tolling — Part 3: Data dictionary							○
ISO/TC 204/WG 5	ISO/TS 16785:2020	Electronic Fee Collection (EFC) — Application interface definition between DSRC-OBE and external in-vehicle devices							○
ISO/TC 204/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							○
ISO/TC 204/WG 5	ISO 16410-2:2018	Electronic fee collection — Evaluation of equipment for conformity to ISO 17575-3 — Part 2: Abstract test suite							○
ISO/TC 204/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							○
ISO/TC 204/WG 5	ISO 16407-2:2018	Electronic fee collection — Evaluation of equipment for conformity to ISO 17575-1 — Part 2: Abstract test suite							○
ISO/TC 204/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							○
ISO/TC 204/WG 5	ISO/TR 16401-2:2018	Electronic fee collection — Evaluation of equipment for conformity to ISO 17575-2 — Part 2: Abstract test suite							○
ISO/TC 204/WG 5	ISO 14907-1:2020	Electronic fee collection — Test procedures for user and fixed equipment — Part 1: Description of test procedures							○
ISO/TC 204/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							○
ISO/TC 204/WG 5	ISO 14906:2022	Electronic fee collection — Application interface definition for dedicated short-range communication							○
ISO/TC 204/WG 5	ISO/CD 13143-1	Electronic fee collection — Evaluation of on-board and roadside equipment for conformity to ISO 12813 — Part 1: Test suite structure and test purposes				○			
ISO/TC 204/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							○
ISO/TC 204/WG 5	ISO/DIS 13141	Electronic fee collection — Localisation augmentation communication for autonomous systems					○		
ISO/TC 204/WG 5	ISO 13141:2015	Electronic fee collection — Localisation augmentation communication for autonomous systems							○
ISO/TC 204/WG 5	ISO 13141:2015/ Amd 1:2017	Electronic fee collection — Localisation augmentation communication for autonomous systems — Amendment 1							○
ISO/TC 204/WG 5	ISO/PWI 13140	Electronic fee collection — Conformity evaluation of on-board and roadside equipment to ISO 13141	○						
ISO/TC 204/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							○
ISO/TC 204/WG 5	ISO 12855:2022	Electronic fee collection — Information exchange between service provision and toll charging							○
ISO/TC 204/WG 5	ISO/FDIS 12813	Electronic fee collection — Compliance check communication for autonomous systems						○	
ISO/TC 204/WG 5	ISO 12813:2019	Electronic fee collection — Compliance check communication for autonomous systems							○
ISO/TC 204/WG 5	ISO/TR 6026:2022	Electronic fee collection — Pre-study on the use of vehicle licence plate information and automatic number plate recognition (ANPR) technologies							○
ISO/TC 204/WG 7	ISO 26683-1:2013	Intelligent transport systems — Freight land conveyance content identification and communication — Part 1: Context, architecture and referenced standards							○
ISO/TC 204/WG 7	ISO 26683-2:2013	Intelligent transport systems — Freight land conveyance content identification and communication — Part 2: Application interface profiles							○
ISO/TC 204/WG 7	ISO 26683-3:2019	Intelligent transport systems — Freight land conveyance content identification and communication — Part 3: Monitoring cargo condition information during transport							○
ISO/TC 204/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							○
ISO/TC 204/WG 7	ISO/DIS 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							○

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ISO/TC 204/WG 7	ISO 24533-2:2022	Intelligent transport systems — Electronic information exchange to facilitate the movement of freight and its intermodal transfer — Part 2: Common reporting system							○
ISO/TC 204/WG 7	ISO 18495-1:2016	Intelligent transport systems — Commercial freight — Automotive visibility in the distribution supply chain — Part 1: Architecture and data definitions							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/WG 7	ISO 15638-6:2014	Intelligent transport systems — Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) — Part 6: Regulated applications							○
ISO/TC 204/WG 7	ISO 15638-7:2013	Intelligent transport systems — Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) — Part 7: Other applications							○
ISO/TC 204/WG 7	ISO 15638-8:2014	Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 8: Vehicle access management							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/WG 7	ISO 15638-11:2014	Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 11: Driver work records							○
ISO/TC 204/WG 7	ISO 15638-12:2014	Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 12: Vehicle mass monitoring							○
ISO/TC 204/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							○
ISO/TC 204/WG 7	ISO 15638-14:2014	Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 14: Vehicle access control							○
ISO/TC 204/WG 7	ISO 15638-15:2014	Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 15: Vehicle location monitoring							○
ISO/TC 204/WG 7	ISO 15638-16:2014	Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 16: Vehicle speed monitoring							○
ISO/TC 204/WG 7	ISO 15638-17:2014	Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 17: Consignment and location monitoring							○
ISO/TC 204/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)							○
ISO/TC 204/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)							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/WG 7	ISO/DIS 15638-23	Intelligent transport systems — Framework for collaborative telematics applications for regulated commercial freight vehicles (TARV) — Part 23: Tyre pressure monitoring (TPM)					○		
ISO/TC 204/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							○
ISO/TC 204/WG 7	ISO/DIS 15638-25	Intelligent transport systems — Framework for collaborative telematics applications for regulated commercial freight vehicles (TARV) — Part 25: Overhead clearance monitoring					○		
ISO/TC 204/WG 7	ISO/NP TS 15638-26	Intelligent transport systems — Framework for cooperative telematics applications for regulated vehicles (TARV) — Part 26: Part 26: Electric vehicle dynamic charging monitoring		○					
ISO/TC 204/WG 7	ISO/PWI TS 15638-26	Intelligent transport systems - Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) — Part 26: Part 26: Electric vehicle dynamic charging monitoring	○						
ISO/TC 204/WG 7	ISO/CD 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				○			
ISO/TC 204/WG 7	ISO/CD 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				○			
ISO/TC 204/WG 8	ISO/CD 24298.2	Intelligent transport systems — Public transport — Light emitting diode (LED) destination board system for public transport buses				○			
ISO/TC 204/WG 8	ISO 24014-1:2021	Public transport — Interoperable fare management system — Part 1: Architecture							○
ISO/TC 204/WG 8	ISO/TR 24014-2:2013	Public transport — Interoperable fare management system — Part 2: Business practices							○
ISO/TC 204/WG 8	ISO/TR 24014-3:2013	Public transport — Interoperable fare management system — Part 3: Complementary concepts to Part 1 for multi-application media							○
ISO/TC 204/WG 8	ISO 22951:2009	Data dictionary and message sets for preemption and prioritization signal systems for emergency and public transport vehicles (PRESTO)							○

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			PWI	NP	WD	CD	DIS	FDIS	
ISO/TC 204/WG 8	ISO 21734-1:2022	Intelligent transport systems — Performance testing for connectivity and safety functions of automated driving buses in public transport — Part 1: General framework							○
ISO/TC 204/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			○				
ISO/TC 204/WG 8	ISO/CD TR 21734-3	Public transport — Performance testing for connectivity and safety functions of automated driving bus — Part 3: Service framework and use cases				○			
ISO/TC 204/WG 8	ISO/TR 21724-1:2020	Intelligent transport systems — Common Transport Service Account Systems — Part 1: Framework and use cases							○
ISO/TC 204/WG 8	ISO/TR 20527:2022	Intelligent transport systems — Interoperability between interoperable fare management (IFM) systems and near field communication (NFC) mobile devices							○
ISO/TC 204/WG 8	ISO/TR 20526:2017	Account-based ticketing state of the art report							○
ISO/TC 204/WG 8	ISO/TR 19083-1:2016	Intelligent transport systems — Emergency evacuation and disaster response and recovery — Part 1: Framework and concept of operation							○
ISO/TC 204/WG 8	ISO 17185-1:2014	Intelligent transport systems — Public transport user information — Part 1: Standards framework for public information systems							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/WG 8	ISO/TR 14806:2013	Intelligent transport systems — Public transport requirements for the use of payment applications for fare media							○
ISO/TC 204/WG 8	ISO/TS 4398:2022	Intelligent transport systems — Guided transportation service planning data exchange							○
ISO/TC 204/WG 9	ISO 22741-1:2022	Intelligent transport systems — Roadside modules AP-DATEX data interface — Part 1: Overview							○
ISO/TC 204/WG 9	ISO/NP TS 22741-2.2	Intelligent transport systems — Roadside equipment AP-DATEX data interface — Part 2: Part 2: Generalised field device — basic management		○					
ISO/TC 204/WG 9	ISO/CD TS 22741-10	Intelligent transport systems — Roadside modules AP-DATEX data interface — Part 10: Variable message signs				○			
ISO/TC 204/WG 9	ISO/TR 21707:2008	Intelligent transport systems — Integrated transport information, management and control — Data quality in ITS systems							○
ISO/TC 204/WG 9	ISO 20684-1:2021	Intelligent transport systems — Roadside modules SNMP data interface — Part 1: Overview							○
ISO/TC 204/WG 9	ISO/TS 20684-2:2021	Intelligent transport systems — Roadside modules SNMP data interface — Part 2: Generalized field device basic management							○
ISO/TC 204/WG 9	ISO/TS 20684-3:2022	Intelligent transport systems — Roadside modules SNMP data interface — Part 3: Triggers							○
ISO/TC 204/WG 9	ISO/TS 20684-4:2022	Intelligent transport systems — Roadside modules SNMP data interface — Part 4: Notifications							○
ISO/TC 204/WG 9	ISO/TS 20684-5:2022	Intelligent transport systems — Roadside modules SNMP data interface — Part 5: Logs							○
ISO/TC 204/WG 9	ISO/TS 20684-6:2022	Intelligent transport systems — Roadside modules SNMP data interface — Part 6: Commands							○
ISO/TC 204/WG 9	ISO/TS 20684-7:2022	Intelligent transport systems — Roadside modules SNMP data interface — Part 7: Support features							○
ISO/TC 204/WG 9	ISO/TS 20684-10:2021	Intelligent transport systems — Roadside modules SNMP data interface — Part 10: Variable message signs							○
ISO/TC 204/WG 9	ISO/PWI TR 19482	Intelligent transport systems — Smart streetlighting management platform for road traffic safety enhancement	○						
ISO/TC 204/WG 9	ISO/TS 19468:2022	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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/WG 9	ISO/CD 15784-2	Intelligent transport systems (ITS) — Data exchange involving roadside modules communication — Part 2: Centre to field device communications using SNMP				○			
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/WG 9	ISO 15784-3:2008	Intelligent transport systems (ITS) — Data exchange involving roadside modules communication — Part 3: Application profile-data exchange (AP-DATEX)							○
ISO/TC 204/WG 9	ISO 14827-2:2022	Intelligent transport systems — Data interfaces between centres for transport information and control systems — Part 2: AP-DATEX							○
ISO/TC 204/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)							○
ISO/TC 204/WG 9	ISO/TS 14827-4:2022	Intelligent transport systems — Data interfaces between centres for transport information and control systems — Part 4: Data interfaces between centres for Intelligent transport systems (ITS) using XML (Profile B)							○
ISO/TC 204/WG 9	ISO 10711:2012	Intelligent Transport Systems — Interface Protocol and Message Set Definition between Traffic Signal Controllers and Detectors							○
ISO/TC 204/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							○
ISO/TC 204/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							○

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ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/WG 10	ISO 21219-1:2023	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 1: Introduction, numbering and versions (TPEG2-INV)							○
ISO/TC 204/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)							○
ISO/TC 204/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)							○
ISO/TC 204/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							○
ISO/TC 204/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)							○
ISO/TC 204/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)							○
ISO/TC 204/WG 10	ISO/DIS 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)					○		
ISO/TC 204/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)							○
ISO/TC 204/WG 10	ISO 21219-9:2023	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 9: Service and network information (TPEG2-SNI)							○
ISO/TC 204/WG 10	ISO 21219-10:2023	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 10: Conditional access information (TPEG2-CAI)							○
ISO/TC 204/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)				○			
ISO/TC 204/WG 10	ISO 21219-14:2023	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 14: Parking information (TPEG2-PKI)							○
ISO/TC 204/WG 10	ISO 21219-15:2023	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 15: Traffic event compact (TPEG2-TEC)							○
ISO/TC 204/WG 10	ISO 21219-16:2023	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 16: Fuel price information and availability (TPEG2-FPI)							○
ISO/TC 204/WG 10	ISO 21219-17:2023	Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 2 (TPEG2) — Part 17: Speed information (TPEG2-SPI)							○
ISO/TC 204/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)							○
ISO/TC 204/WG 10	ISO 21219-19:2023	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 19: Weather information (TPEG2-WEA)							○
ISO/TC 204/WG 10	ISO/DIS 21219-21	Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 21: Geographic location referencing (TPEG-GLR)					○		
ISO/TC 204/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)							○
ISO/TC 204/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)							○
ISO/TC 204/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)							○
ISO/TC 204/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)							○
ISO/TC 204/WG 10	ISO/DIS 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)					○		
ISO/TC 204/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)							○
ISO/TC 204/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)							○
ISO/TC 204/WG 10	ISO/PWI TS 21219-27	Intelligent transport systems — Traffic and travel information via transport protocol experts group, generation 2 (TPEG2) — Part 27: Part 27: Driving restriction regulations (TPEG2-DRR)	○						
ISO/TC 204/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)							○
ISO/TC 204/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)							○
ISO/TC 204/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)							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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)							○
ISO/TC 204/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)							○
ISO/TC 204/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)							○
ISO/TC 204/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)							○
ISO/TC 204/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)							○

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ISO/TC 204/WG 10	ISO 14823:2017	Intelligent transport systems — Graphic data dictionary							○
ISO/TC 204/WG 10	ISO/PRF 14823-1	Intelligent transport systems — Graphic data dictionary — Part 1: Specification						○	
ISO/TC 204/WG 10	ISO/TR 14823-2:2019	Intelligent transport systems — Graphic data dictionary — Part 2: Examples							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/WG 14	ISO 26684:2015	Intelligent transport systems (ITS) — Cooperative intersection signal information and violation warning systems (CIWS) — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO/DIS 23793-1	Intelligent transport systems — Minimal Risk Maneuver (MRM) for automated driving — Part 1: Framework, straight-stop and in-lane stop					○		
ISO/TC 204/WG 14	ISO/PWI 23793-2	Intelligent transport systems — Minimal risk manoeuvre for automated driving — Part 2: Part 2: Road shoulder stop - Minimum requirements and test procedures	○						
ISO/TC 204/WG 14	ISO/NP 23792-1	Intelligent transport systems — Motorway chauffeur systems (MCS) — Part 1: Framework and general requirements		○					
ISO/TC 204/WG 14	ISO/TS 23792-1:2023	Intelligent transport systems — Motorway chauffeur systems (MCS) — Part 1: Framework and general requirements							○
ISO/TC 204/WG 14	ISO/AWI 23792-2	Intelligent transport systems — Motorway chauffeur systems (MCS) — Part 2: Requirements and test procedures for discretionary lane change			○				
ISO/TC 204/WG 14	ISO 23376:2021	Intelligent transport systems — Vehicle-to-vehicle intersection collision warning systems (VVICW) — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO 23375:2023	Intelligent transport systems — Collision evasive lateral manoeuvre systems (CELM) — Requirements and test procedures							○
ISO/TC 204/WG 14	ISO 23374-1:2023	Intelligent transport systems — Automated valet parking systems (AVPS) — Part 1: System framework, requirements for automated driving and for communications interface							○
ISO/TC 204/WG 14	ISO/PWI 23097	Road vehicles Test method to evaluate the performance of Acceleration Control Pedal Error (ACPE)	○						
ISO/TC 204/WG 14	ISO 22840:2010	Intelligent transport systems — Devices to aid reverse manoeuvres — Extended-range backing aid systems (ERBA)							○
ISO/TC 204/WG 14	ISO 22839:2013	Intelligent transport systems — Forward vehicle collision mitigation systems — Operation, performance, and verification requirements							○
ISO/TC 204/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							○
ISO/TC 204/WG 14	ISO/SAE PAS 22736:2021	Taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles							○
ISO/TC 204/WG 14	ISO/SAE PWI TS 22736	Taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles	○						
ISO/TC 204/WG 14	ISO 22078:2020	Intelligent transport systems — Bicyclist detection and collision mitigation systems (BDCMS) — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO 21717:2018	Intelligent transport systems — Partially Automated In-Lane Driving Systems (PADS) — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO 21202:2020	Intelligent transport systems — Partially automated lane change systems (PALS) — Functional / operational requirements and test procedures							○
ISO/TC 204/WG 14	ISO 20901:2020	Intelligent transport systems — Emergency electronic brake light systems (EEBL) — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO 20900:2023	Intelligent transport systems — Partially-automated parking systems (PAPS) — Performance requirements and test procedures							○
ISO/TC 204/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							○
ISO/TC 204/WG 14	ISO 20035:2019	Intelligent transport systems — Cooperative adaptive cruise control systems (CACC) — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO 19638:2018	Intelligent transport systems — Road boundary departure prevention systems (RBDPS) — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO/AWI TR 19560	Intelligent transport systems — Information interface framework between automated driving system and user			○				
ISO/TC 204/WG 14	ISO/AWI PAS 19486	Intelligent transport systems - Acceleration control for pedal error (ACPE) - Performance, requirements and test procedures			○				
ISO/TC 204/WG 14	ISO/NP 19484	Intelligent transport systems — Automated driving system for motorways (M-ADS)		○					
ISO/TC 204/WG 14	ISO 19237:2017	Intelligent transport systems — Pedestrian detection and collision mitigation systems (PDCMS) — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO 18682:2016	Intelligent transport systems — External hazard detection and notification systems — Basic requirements							○
ISO/TC 204/WG 14	ISO/AWI TR 17720	Intelligent transport systems — Guidance for Definition and Application of Operational Design Domain for Automated Driving System			○				
ISO/TC 204/WG 14	ISO 17387:2008	Intelligent transport systems — Lane change decision aid systems (LCDAS) — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO 17386:2023	Intelligent transport systems — Manoeuvring aids for low-speed operation (MALSO) — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO 17361:2017	Intelligent transport systems — Lane departure warning systems — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO 17361:2017/DAmd 1	Intelligent transport systems — Lane departure warning systems — Performance requirements and test procedures — Amendment 1					○		

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ISO/TC 204/WG 14	ISO 16787:2017	Intelligent transport systems — Assisted parking system (APS) — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO/TS 15624:2001	Transport information and control systems — Traffic Impediment Warning Systems (TIWS) — System requirements							○
ISO/TC 204/WG 14	ISO 15623:2013	Intelligent transport systems — Forward vehicle collision warning systems — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO 15622:2018	Intelligent transport systems — Adaptive cruise control systems — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO/AWI 12768-1	Intelligent transport systems — Automated Valet Driving Systems (AVDS) — Part 1: Part 1: Requirements, System Framework, Communication Interfaces and Test Procedures			○				
ISO/TC 204/WG 14	ISO/NP 12768-2	Intelligent transport systems — Automated Valet Driving Systems (AVDS) — Part 2: Part 2: System framework, security procedures and requirements		○					
ISO/TC 204/WG 14	ISO 11270:2014	Intelligent transport systems — Lane keeping assistance systems (LKAS) — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO 11067:2015	Intelligent transport systems — Curve speed warning systems (CSWS) — Performance requirements and test procedures							○
ISO/TC 204/WG 14	ISO/CD 7856	Intelligent transport systems — Remote support for LSAD system (RS-LSADS) — Performance requirements, system requirements and performance test procedures				○			
ISO/TC 204/WG 14	ISO/DIS 4273	Intelligent transport systems — Automated braking during low speed manoeuvring (ABLS) — Requirements and test procedures					○		
ISO/TC 204/WG 14	ISO 4272:2022	Intelligent transport systems — Truck platooning systems (TPS) — Functional and operational requirements							○
ISO/TC 204/WG 16	ISO/TS 29284:2012	Intelligent transport systems — Event-based probe vehicle data							○
ISO/TC 204/WG 16	ISO 29283:2011	ITS CALM Mobile Wireless Broadband applications using Communications in accordance with IEEE 802.20							○
ISO/TC 204/WG 16	ISO 29282:2011	Intelligent transport systems — Communications access for land mobiles (CALM) — Satellite networks							○
ISO/TC 204/WG 16	ISO 29281-1:2018	Intelligent transport systems — Localized communications — Part 1: Fast networking & transport layer protocol (FNTP)							○
ISO/TC 204/WG 16	ISO 29281-2:2019	Intelligent transport systems — Localized communications — Part 2: Legacy system support							○
ISO/TC 204/WG 16	ISO/TS 25114:2010	Intelligent transport systems — Probe data reporting management (PDRM)							○
ISO/TC 204/WG 16	ISO 25113:2010	Intelligent transport systems — Communications access for land mobiles (CALM) — Mobile wireless broadband using HC-SDMA							○
ISO/TC 204/WG 16	ISO 25112:2010	Intelligent transport systems — Communications access for land mobiles (CALM) — Mobile wireless broadband using IEEE 802.16							○
ISO/TC 204/WG 16	ISO 25111:2009	Intelligent transport systems — Communications access for land mobiles (CALM) — General requirements for using public networks							○
ISO/TC 204/WG 16	ISO 24978:2009	Intelligent transport systems — ITS Safety and emergency messages using any available wireless media — Data registry procedures							○
ISO/TC 204/WG 16	ISO 24103:2009	Intelligent transport systems — Communications access for land mobiles (CALM) — Media adapted interface layer (MAIL)							○
ISO/TC 204/WG 16	ISO 24102-1:2018	Intelligent transport systems — ITS station management — Part 1: Local management							○
ISO/TC 204/WG 16	ISO 24102-2:2018	Intelligent transport systems — ITS station management — Part 2: Remote management of ITS-SCUs							○
ISO/TC 204/WG 16	ISO 24102-3:2018	Intelligent transport systems — ITS station management — Part 3: Service access points							○
ISO/TC 204/WG 16	ISO 24102-4:2018	Intelligent transport systems — ITS station management — Part 4: Station-internal management communications							○
ISO/TC 204/WG 16	ISO 24102-6:2018	Intelligent transport systems — Communications access for land mobiles (CALM) — ITS station management — Part 6: Path and flow management							○
ISO/TC 204/WG 16	ISO 24101-1:2008	Intelligent transport systems — Communications access for land mobiles (CALM) — Application management — Part 1: General requirements							○
ISO/TC 204/WG 16	ISO 24101-2:2010	Intelligent transport systems — Communications access for land mobiles (CALM) — Application management — Part 2: Conformance test							○
ISO/TC 204/WG 16	ISO 24100:2010	Intelligent transport systems — Basic principles for personal data protection in probe vehicle information services							○
ISO/TC 204/WG 16	ISO 22837:2009	Vehicle probe data for wide area communications							○
ISO/TC 204/WG 16	ISO 22738:2020	Intelligent transport systems — Localized communications — Optical camera communication							○
ISO/TC 204/WG 16	ISO 22418:2020	Intelligent transport systems — Fast service announcement protocol (FSAP) for general purposes in ITS							○
ISO/TC 204/WG 16	ISO 21218:2018	Intelligent transport systems — Hybrid communications — Access technology support							○
ISO/TC 204/WG 16	ISO 21217:2020	Intelligent transport systems — Station and communication architecture							○
ISO/TC 204/WG 16	ISO 21216:2012	Intelligent transport systems — Communication access for land mobiles (CALM) — Millimetre wave air interface							○
ISO/TC 204/WG 16	ISO 21215:2018	Intelligent transport systems — Localized communications — ITS-M5							○
ISO/TC 204/WG 16	ISO 21214:2015	Intelligent transport systems — Communications access for land mobiles (CALM) — Infra-red systems							○
ISO/TC 204/WG 16	ISO 21213:2008	Intelligent transport systems — Communications access for land mobiles (CALM) — 3G Cellular systems							○

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ISO/TC 204/WG 16	ISO 21212:2008	Intelligent transport systems — Communications access for land mobiles (CALM) — 2G Cellular systems							○
ISO/TC 204/WG 16	ISO 21210:2012	Intelligent transport systems — Communications access for land mobiles (CALM) — IPv6 Networking							○
ISO/TC 204/WG 16	ISO 21210:2012/ Amd 1:2017	Intelligent transport systems — Communications access for land mobiles (CALM) — IPv6 Networking — Amendment 1							○
ISO/TC 204/WG 16	ISO 19414:2020	Intelligent transport systems — Service architecture of probe vehicle systems							○
ISO/TC 204/WG 16	ISO 19080:2016	Intelligent transport systems — Communications access for land mobiles (CALM) — CoAP facility							○
ISO/TC 204/WG 16	ISO 19079:2016	Intelligent transport systems — Communications access for land mobiles (CALM) — 6LoWPAN networking							○
ISO/TC 204/WG 16	ISO/TR 18317:2017	Intelligent transport systems — Pre-emption of ITS communication networks for disaster and emergency communication — Use case scenarios							○
ISO/TC 204/WG 16	ISO/CD TR 17732	Intelligent transport systems — Communications — ITS communication role and functional model				○			
ISO/TC 204/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							○
ISO/TC 204/WG 16	ISO 17515-2:2020	Intelligent transport systems — Evolved universal terrestrial radio access network (E-UTRAN) — Part 2: Device to device communications (D2D)							○
ISO/TC 204/WG 16	ISO 17515-3:2019	Intelligent transport systems — Evolved-universal terrestrial radio access network — Part 3: LTE-V2X							○
ISO/TC 204/WG 16	ISO 16461:2018	Intelligent transport systems — Criteria for privacy and integrity protection in probe vehicle information systems							○
ISO/TC 204/WG 16	ISO 16460:2021	Intelligent transport systems — Localized communications — Communication protocol messages for global usage							○
ISO/TC 204/WG 16	ISO 15662:2006	Intelligent transport systems — Wide area communication — Protocol management information							○
ISO/TC 204/WG 16	ISO 15628:2013	Intelligent transport systems — Dedicated short range communication (DSRC) — DSRC application layer							○
ISO/TC 204/WG 16	ISO 13183:2012	Intelligent transport systems — Communications access for land mobiles (CALM) — Using broadcast communications							○
ISO/TC 204/WG 16	ISO/TR 11769:2010	Intelligent transport systems — Communications access for land mobiles (CALM) — Data retention for law enforcement							○
ISO/TC 204/WG 16	ISO/TR 11766:2010	Intelligent transport systems — Communications access for land mobiles (CALM) — Security considerations for lawful interception							○
ISO/TC 204/WG 16	ISO/PWI 7869	Intelligent transport systems — Networked communications — LoRa	○						
ISO/TC 204/WG 16	ISO/PWI 7865	Intelligent transport systems — Localized communications — Bluetooth	○						
ISO/TC 204/WG 16	ISO 4426:2021	Intelligent transport systems — Lower layer protocols for usage in the European digital tachograph							○
ISO/TC 204/WG 16	ISO/TR 4286:2021	Intelligent transport systems — Use cases for sharing of probe data							○
ISO/TC 204/WG 17	ISO 23795-1:2022	Intelligent transport systems — Extracting trip data using nomadic and mobile devices for estimating C0₂ emissions — Part 1: Fuel consumption determination for fleet management							○
ISO/TC 204/WG 17	ISO/DIS 23795-2	Intelligent transport systems (ITS) — Extracting trip data using nomadic and mobile devices for estimating CO₂ emissions — Part 2: Information provision for eco-friendly driving behaviour					○		
ISO/TC 204/WG 17	ISO/PWI 22577	Intelligent transport systems - Nomadic and mobile devices - In-vehicle passenger monitoring and care services using deep learning technology	○						
ISO/TC 204/WG 17	ISO/PWI TR 22087.2	Intelligent transport systems — Collection of agent behaviour information and sharing between ITS stations	○						
ISO/TC 204/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							○
ISO/TC 204/WG 17	ISO/CD 22086-2	Intelligent transport systems (ITS) — Network based precise positioning infrastructure for land transportation — Part 2: Functional requirements and data interface via nomadic device				○			
ISO/TC 204/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							○
ISO/TC 204/WG 17	ISO 22085-2:2021	Intelligent transport systems (ITS) — Nomadic device service platform for micro mobility — Part 2: Functional requirements and dataset definitions							○
ISO/TC 204/WG 17	ISO 22085-3:2022	Intelligent transport systems (ITS) — Nomadic device service platform for micro mobility — Part 3: Data structure and data exchange procedures							○
ISO/TC 204/WG 17	ISO/TR 21735:2019	Intelligent transport systems — Framework architecture for plug and play (PnP) functionality in vehicles utilizing nomadic devices							○
ISO/TC 204/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							○
ISO/TC 204/WG 17	ISO/DIS 20530-2	Intelligent transport systems — Information for emergency service support for nomadic and mobile devices — Part 2: Service requirements for vehicle incident notification					○		
ISO/TC 204/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							○
ISO/TC 204/WG 17	ISO 20529-2:2021	Intelligent transport systems — Framework for Green ITS (G-ITS) standards — Part 2: Integrated mobile service applications							○
ISO/TC 204/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							○
ISO/TC 204/WG 17	ISO/DIS 18561-2	Intelligent transport systems — Urban mobility applications via nomadic device for green transport management — Part 2: Functional requirements and specifications for trip and modal choice application					○		

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ISO/TC 204/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	○						
ISO/TC 204/WG 17	ISO/PWI TR 17748-1	Intelligent transport systems — Energy-guided green ITS services on nomadic and mobile devices for smart city mobility applicaitons — Part 1: General information and use cases definition	○						
ISO/TC 204/WG 17	ISO/PWI 17748-2	Intelligent transport systems - Nomadic and mobile devices - Energybased green ITS services for smart city mobility applications — Part 2: Part 2: Functional requirements of data platform	○						
ISO/TC 204/WG 17	ISO/PWI 17748-3	Intelligent transport systems - Energy-based green ITS services for smart city mobility applications via nomadic and mobile devices — Part 3: Part 3: Data exchange requirements for electric vehicles (EV)-based demand response charging services	○						
ISO/TC 204/WG 17	ISO/PWI 17739-2	Intelligent transport systems - Nomadic & mobile devices - Roadside infrastructure supported location-based services for connected automated mobility — Part 2: Part 2: Data structure and message set definition	○						
ISO/TC 204/WG 17	ISO/PWI 17739-3	Intelligent transport systems - Roadside infrastructure supported locationbased services for connected automated mobility via nomadic and mobile devices — Part 3: Part 3: No turn on red (NTOR) at junctions with traffic signals	○						
ISO/TC 204/WG 17	ISO/PWI 17739-4	Intelligent transport systems - Roadside infrastructure supported locationbased services for connected automated mobility via nomadic and mobile devices — Part 4: Part 4: Unprotected turn at T-junctions	○						
ISO/TC 204/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							○
ISO/TC 204/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			○				
ISO/TC 204/WG 17	ISO/CD 17438-3	Intelligent transport systems — Indoor navigation for personal and vehicle ITS stations — Part 3: Requirements and specification for indoor positioning reference data				○			
ISO/TC 204/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							○
ISO/TC 204/WG 17	ISO/AWI 17438-5	Intelligent transport systems — Indoor navigation for personal and vehicle ITS stations — Part 5: Requirements and message specification for central ITS station (C-ITS-S) based positioning			○				
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/WG 17	ISO 13111-2:2022	Intelligent transport systems (ITS) — The use of personal ITS stations to support ITS service provision for travellers — Part 2: General requirements for data exchange between ITS stations							○
ISO/TC 204/WG 17	ISO/TR 10992:2011	Intelligent transport systems — Use of nomadic and portable devices to support ITS service and multimedia provision in vehicles							○
ISO/TC 204/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							○
ISO/TC 204/WG 17	ISO/DIS 6029-1	Intelligent transport systems — Seamless positioning for multimodal transportation in ITS stations — Part 1: General information and use case definition					○		
ISO/TC 204/WG 17	ISO/NP 6029-2	Intelligent transport systems — Seamless positioning for multimodal transportation in ITS stations — Part 2: Nomadic and mobile device dataset for positioning data fusion		○					
ISO/TC 204/WG 17	ISO/PWI 6029-3	Intelligent transport systems - Seamless positioning for multimodal transport in ITS stations via nomadic and mobile devices — Part 3: Part 3: Secured and trusted sensor interfaces	○						
ISO/TC 204/WG 18	ISO/DTS 23374-2	Intelligent transport systems — Automated valet parking systems (AVPS) — Part 2: Security integration for type 3 AVP						○	
ISO/TC 204/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							○
ISO/TC 204/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							○
ISO/TC 204/WG 18	ISO/TR 21186-2:2021	Cooperative intelligent transport systems (C-ITS) — Guidelines on the usage of standards — Part 2: Hybrid communications							○
ISO/TC 204/WG 18	ISO/TR 21186-3:2021	Cooperative intelligent transport systems (C-ITS) — Guidelines on the usage of standards — Part 3: Security							○
ISO/TC 204/WG 18	ISO/TS 21185:2019	Intelligent transport systems — Communication profiles for secure connections between trusted devices							○
ISO/TC 204/WG 18	ISO/TS 21184:2021	Cooperative intelligent transport systems (C-ITS) — Global transport data management (GTDM) framework							○
ISO/TC 204/WG 18	ISO/CD 21177	Intelligent transport systems — ITS station security services for secure session establishment and authentication between trusted devices				○			
ISO/TC 204/WG 18	ISO 21177:2023	Intelligent transport systems — ITS station security services for secure session establishment and authentication between trusted devices							○
ISO/TC 204/WG 18	ISO/TS 21176:2020	Cooperative intelligent transport systems (C-ITS) — Position, velocity and time functionality in the ITS station							○
ISO/TC 204/WG 18	ISO/TS 20026:2017	Intelligent transport systems — Cooperative ITS — Test architecture							○
ISO/TC 204/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	
ISO/TC 204/WG 18	ISO/TS 19321:2020	Intelligent transport systems — Cooperative ITS — Dictionary of in-vehicle information (IVI) data structures							○
ISO/TC 204/WG 18	ISO/PWI TS 19091	Intelligent transport systems — Cooperative ITS — Using V2I and I2V communications for applications related to signalized intersections	○						
ISO/TC 204/WG 18	ISO/TS 19091:2019	Intelligent transport systems — Cooperative ITS — Using V2I and I2V communications for applications related to signalized intersections							○
ISO/TC 204/WG 18	ISO 18750:2018	Intelligent transport systems — Co-operative ITS — Local dynamic map							○
ISO/TC 204/WG 18	ISO/TS 17429:2017	Intelligent transport systems — Cooperative ITS — ITS station facilities for the transfer of information between ITS stations							○
ISO/TC 204/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)							○
ISO/TC 204/WG 18	ISO/TR 17427-2:2015	Intelligent transport systems — Cooperative ITS — Part 2: Framework overview							○
ISO/TC 204/WG 18	ISO/TR 17427-3:2015	Intelligent transport systems — Cooperative ITS — Part 3: Concept of operations (ConOps) for 'core' systems							○
ISO/TC 204/WG 18	ISO/TR 17427-4:2015	Intelligent transport systems — Cooperative ITS — Part 4: Minimum system requirements and behaviour for core systems							○
ISO/TC 204/WG 18	ISO/TR 17427-6:2015	Intelligent transport systems — Cooperative ITS — Part 6: 'Core system' risk assessment methodology							○
ISO/TC 204/WG 18	ISO/TR 17427-7:2015	Intelligent transport systems — Cooperative ITS — Part 7: Privacy aspects							○
ISO/TC 204/WG 18	ISO/TR 17427-8:2015	Intelligent transport systems — Cooperative ITS — Part 8: Liability aspects							○
ISO/TC 204/WG 18	ISO/TR 17427-9:2015	Intelligent transport systems — Cooperative ITS — Part 9: Compliance and enforcement aspects							○
ISO/TC 204/WG 18	ISO/TR 17427-10:2015	Intelligent transport systems — Cooperative ITS — Part 10: Driver distraction and information display							○
ISO/TC 204/WG 18	ISO/TS 17426:2016	Intelligent transport systems — Cooperative systems — Contextual speeds							○
ISO/TC 204/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							○
ISO/TC 204/WG 18	ISO/TR 17424:2015	Intelligent transport systems — Cooperative systems — State of the art of Local Dynamic Maps concepts							○
ISO/TC 204/WG 18	ISO 17423:2018	Intelligent transport systems — Cooperative systems — Application requirements and objectives							○
ISO/TC 204/WG 18	ISO 17419:2018	Intelligent transport systems — Cooperative systems — Globally unique identification							○
ISO/TC 204/WG 18	ISO 17419:2018/DAmd 1	Intelligent transport systems — Cooperative systems — Globally unique identification — Amendment 1: Regions of a closed polygon in a plane					○		
ISO/TC 204/WG 19	ISO/PRF TR 24317	Intelligent transport systems — Mobility integration — Mobility integration needs for vulnerable users and light modes of transport						○	
ISO/TC 204/WG 19	ISO/AWI TS 24315-1	Intelligent transport systems — Management of electronic traffic regulations (METR) — Part 1: Operational concept (ConOps)			○				
ISO/TC 204/WG 19	ISO/PWI TS 24315-2	Intelligent transport systems — Management of electronic travel regulations (METR) — Part 2: Operational concepts (ConOps)	○						
ISO/TC 204/WG 19	ISO/DIS 24311	Intelligent transport systems — Mobility integration — 'Controlled zone' management for UVARs using C-ITS					○		
ISO/TC 204/WG 19	ISO/CD TR 23797	Intelligent transport systems — Mobility integration — Gap and overlap analysis of ISO/TC 204 work programme for mobility integration				○			
ISO/TC 204/WG 19	ISO/PWI TR 22625	Intelligent transport systems — Mobility integration — Physical architecture view of mobility integration service	○						
ISO/TC 204/WG 19	ISO/DTR 17783	Intelligent transport systems — Mobility integration — Role model using Low Earth Orbit (LEO) satellites						○	
ISO/TC 204/WG 19	ISO/DTR 12770	Intelligent transport systems — Mobility integration — ITS data aggregation role and functional model						○	
ISO/TC 204/WG 19	ISO/TR 7878:2023	Intelligent transport systems — Mobility integration — Enterprise view							○
ISO/TC 204/WG 19	ISO/AWI TR 7874-1	Intelligent transport systems — Mobility integration multimodal pricing — Part 1: Framework		○					
ISO/TC 204/WG 19	ISO/PWI TR 7874-2	Intelligent transport systems — Mobility integration multimodal pricing — Part 2: Comparison/mapping of modal product rules	○						
ISO/TC 204/WG 19	ISO/PWI TS 7874-3	Intelligent transport systems — Mobility integration multimodal pricing — Part 3: Guidance for using framework to MaaS (mobility as a service) marketplace	○						
ISO/TC 204/WG 19	ISO/TR 7872:2022	Intelligent transport systems — Mobility integration — Digital infrastructure service role and functional model for urban ITS service applications							○
ISO/TC 204/WG 19	ISO/CD TS 5616-1	Intelligent transport systems — Secure interfaces governance — Part 1: Context and overview				○			
ISO/TC 204/WG 19	ISO/CD TR 5616-2	Intelligent transport systems — Secure interfaces governance — Part 2: Example governance reference architecture				○			
ISO/TC 204/WG 19	ISO/CD TR 5616-3	Intelligent transport systems — Secure interfaces governance — Part 3: Governance principles				○			
ISO/TC 204/WG 19	ISO/CD TS 5616-4	Intelligent transport systems — Secure interfaces governance — Part 4: Governance process for secure ITS data management				○			
ISO/TC 204/WG 19	ISO/CD TS 5616-5	Intelligent transport systems — Secure interfaces governance — Part 5: Governance of ITS data management architecture				○			

WG	ISO Number	Title	Stage						Published
			PWI	NP	WD	CD	DIS	FDIS	
ISO/TC 204/WG 19	ISO/CD TS 5616-6	Intelligent transport systems — Secure interfaces governance — Part 6: Governance techniques and protocols (GTP) for communications aspects				○			
ISO/TC 204/WG 19	ISO/CD TS 5616-7	Intelligent transport systems — Secure interfaces governance — Part 7: Governance techniques and protocols (GTP) for ITS applications, generic aspects				○			
ISO/TC 204/WG 19	ISO/CD TS 5616-8	Intelligent transport systems — Secure interfaces governance — Part 8: Application domain policy decision making				○			
ISO/TC 204/WG 19	ISO/CD TR 5616-9	Intelligent transport systems — Secure interfaces governance — Part 9: Business model aspects				○			
ISO/TC 204/WG 19	ISO/TS 5255-1:2022	Intelligent transport systems — Low-speed automated driving system (LSADS) service — Part 1: Role and functional model							○
ISO/TC 204/WG 19	ISO/TR 5255-2:2023	Intelligent transport systems — Low-speed automated driving system (LSADS) service — Part 2: Gap analysis							○
ISO/TC 204/WG 19	ISO/TS 5206-1:2023	Intelligent transport systems — Parking — Part 1: Core data model							○
ISO/TC 204/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	○						
ISO/TC 204/WG 19	ISO/PWI TS 4448-6	Intelligent transport systems — Ground-based automated mobility systems — Part 6: Automated device behaviour on footways	○						
ISO/TC 204/WG 19	ISO/PWI TS 4448-7	Intelligent transport systems — Ground-based automated mobility systems — Part 7: Integration of kerbside and footway deployment	○						
ISO/TC 204/WG 19	ISO/PWI TS 4448-8	Intelligent transport systems — Ground-based automated mobility systems — Part 8: Social communication by automated devices on footways	○						
ISO/TC 204/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	○						
ISO/TC 204/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	○						
ISO/TC 204/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	○						
ISO/TC 204/WG 19	ISO/PWI TS 4448-12	Intelligent transport systems — Ground-based automated mobility systems — Part 12: Crash procedures	○						
ISO/TC 204/WG 19	ISO/PWI TS 4448-13	Intelligent transport systems — Ground-based automated mobility systems — Part 13: Mapping procedures	○						
ISO/TC 204/WG 19	ISO/PWI TS 4448-14	Intelligent transport systems — Ground-based automated mobility systems — Part 14: Personal assistant public mobile robots (PMR) for goods	○						
ISO/TC 204/WG 19	ISO/PWI TS 4448-15	Intelligent transport systems — Ground-based automated mobility systems — Part 15: Personal assistant public mobile robots (PMR) for passengers	○						
ISO/TC 204/WG 19	ISO/PWI TS 4448-17	Intelligent transport systems — Ground-based automated mobility systems — Part 17: Data for public mobile robots (PMR) deployment	○						
ISO/TC 204/WG 19	ISO/PWI TS 4448-18	Intelligent transport systems — Ground-based automated mobility systems — Part 18: Data for public mobile robots (PMR) deployment	○						
ISO/TC 204/WG 19	ISO/PWI TS 4448-19	Intelligent transport systems — Ground-based automated mobility systems — Part 19: Data for public mobile robots (PMR) deployment	○						
ISO/TC 204/WG 19	ISO/PWI TS 4448-20	Intelligent transport systems — Ground-based automated mobility systems — Part 20: Journey data recorder for public mobile robots (PMR)	○						
ISO/TC 204/WG 19	ISO/TR 4447:2022	Intelligent transport systems — Mobility integration — Comparison of two mainstream integrated mobility concepts							○
ISO/TC 204/WG 19	ISO/TR 4445:2021	Intelligent transport systems — Mobility integration — Role model of ITS service application in smart cities							○
ISO/TC 204/WG 20	ISO/WD TR 12786	Intelligent transport systems — Big data and artificial intelligence supporting intelligent transport systems — Use cases			○				

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 Five meetings from April 2020 through April 2022 were held online.

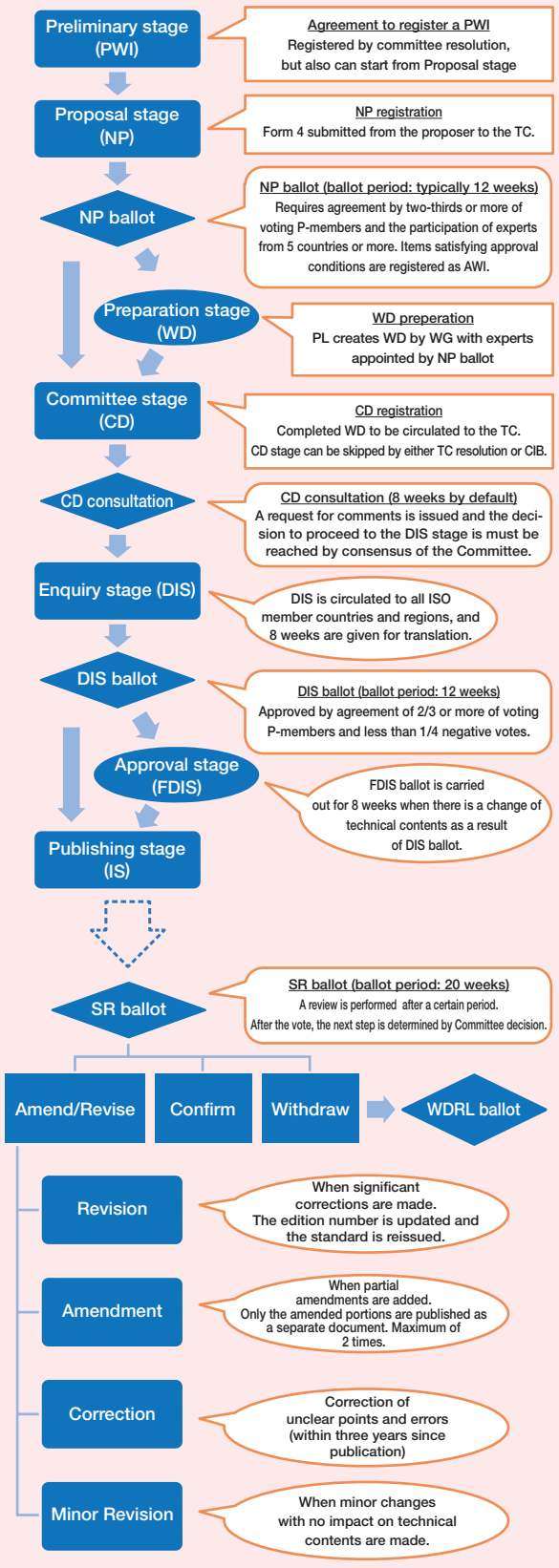
Number of times	Year/ month	Venue	Country
1st	1993.04	Washington	US
Special Meeting	1993.06	Stuttgart	Germany
2nd	1993.11	Tokyo	Japan
3rd	1994.04	Atlanta	US
4th	1994.12	Paris	France
5th	1995.05	Sidney	Australia
6th	1995.11	Yokohama	Japan
7th	1996.05	London	UK
8th	1996.10	Orland	US
9th	1997.03	Noosa	Australia
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	US
18th	2001.10	Queensland	Australia
19th	2002.05	London	UK
20th	2002.10	Chicago	US
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	US
27th	2006.04	Busan	Korea
28th	2006.11	Cape Town	South Africa
29th	2007.04	Lexington	US
30th	2007.11	Qingdao	China

Number of times	Year/ month	Venue	Country
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	US
36th	2010.11	Jeju	Korea
37th	2011.04	Prague	Czech Rep.
38th	2011.10	Tampa	US
39th	2012.04	Melbourne	Australia
40th	2012.10	Moscow	Russia
41st	2013.04	Seattle	US
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	US
48th	2016.10	Auckland	New Zealand
49th	2017.04	Paris	France
50th	2017.10	San Antonio	US
51st	2018.04	Seoul	Korea
52nd	2018.09	Budapest	Hungary
53rd	2019.04	Kennedy Space Center	US
54th	2019.10	Singapore	Singapore
55th	2020.04	Held online	
56th	2020.10	Held online	
57th	2021.04	Held online	
58th	2021.10	Held online	
59th	2022.04	Held online	
60th*	2022.10	Tampere	Finland
61th*	2023.05	San Antonio	US

*Hybrid meetings

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
IS : 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 Korea	www.itskorea.kr
ITS Asia-Pacific	itsasia-pacific.com	ITS Malaysia	www.itsmalaysia.com.my
ITS Australia	www.its-australia.com.au	REAM (Malaysia)	www.ream.org.my/
ITS Austria	www.austriatech.at	ITS Netherlands (Connekt)	www.connekt.nl
ITS Canada	www.itscanada.ca	ITS Norway	www.its-norway.no
ITS China	www.its-china.org.cn	ITS Singapore	www.itssingapore.org.sg
China ITS Industry Alliance	www.c-its.org.cn/en/	ITS South Africa	https://www.intelligenttransport.com/organisations/its-south-africa/
ITS Finland	www.its-finland.fi	ITS Spain	www.itsspain.es/
ITS France	www.atec-itsfrance.net	ITS Sweden	www.its-sweden.se
ITS Germany	www.itsgermany.org	ITS & S (Czech Republic)	www.sdt.cz
ITS Hong Kong	www.itshk.org	ITS Taiwan	www.its-taiwan.org.tw
ITS Indonesia	www.its-indonesia.org	ITS Thailand	www.its.in.th
ITS Italia	www.ttsitalia.it	ITS United Kingdom	www.its-uk.org.uk
ITS Japan	www.its-jp.org		

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

Ministries and organizations involved in standardization of ITS (Japan)

Cabinet Office	www.cao.go.jp	Vehicle Information and Communication System Center	www.vics.or.jp
Ministry of Internal Affairs and Communications	www.soumu.go.jp	ITS Technology Enhancement Association	www.its-tea.or.jp
Ministry of Economy, Trade and Industry	www.meti.go.jp	Highway Industry Development Organization	www.hido.or.jp
Ministry of Land, Infrastructure, Transport and Tourism	www.mlit.go.jp	Japanese Standards Association	www.jsa.or.jp
National Police Agency	www.npa.go.jp	Japan Traffic Management Technology Association	www.tmt.or.jp
Japanese Industry Standard Committee	www.jisc.go.jp	Japan Automobile Research Institute	www.jari.or.jp
Japan Institute of Country-ology and Engineering	www.jice.or.jp	JIPDEC	www.jipdec.or.jp
Society of Automotive Engineers of Japan	www.jsae.or.jp	Japan Digital Road Map Association	www.drm.jp
Japan Electronics and Information Technology Industries Association	www.jeita.or.jp	ITS Info-communications Forum	www.itsforum.gr.jp
Association of Radio Industries and Businesses	www.arib.or.jp	UTMS Society of Japan	www.utms.or.jp
Telecommunication Technology Committee	www.ttc.or.jp	Japan Automobile Manufacturers Association	www.jama.or.jp

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