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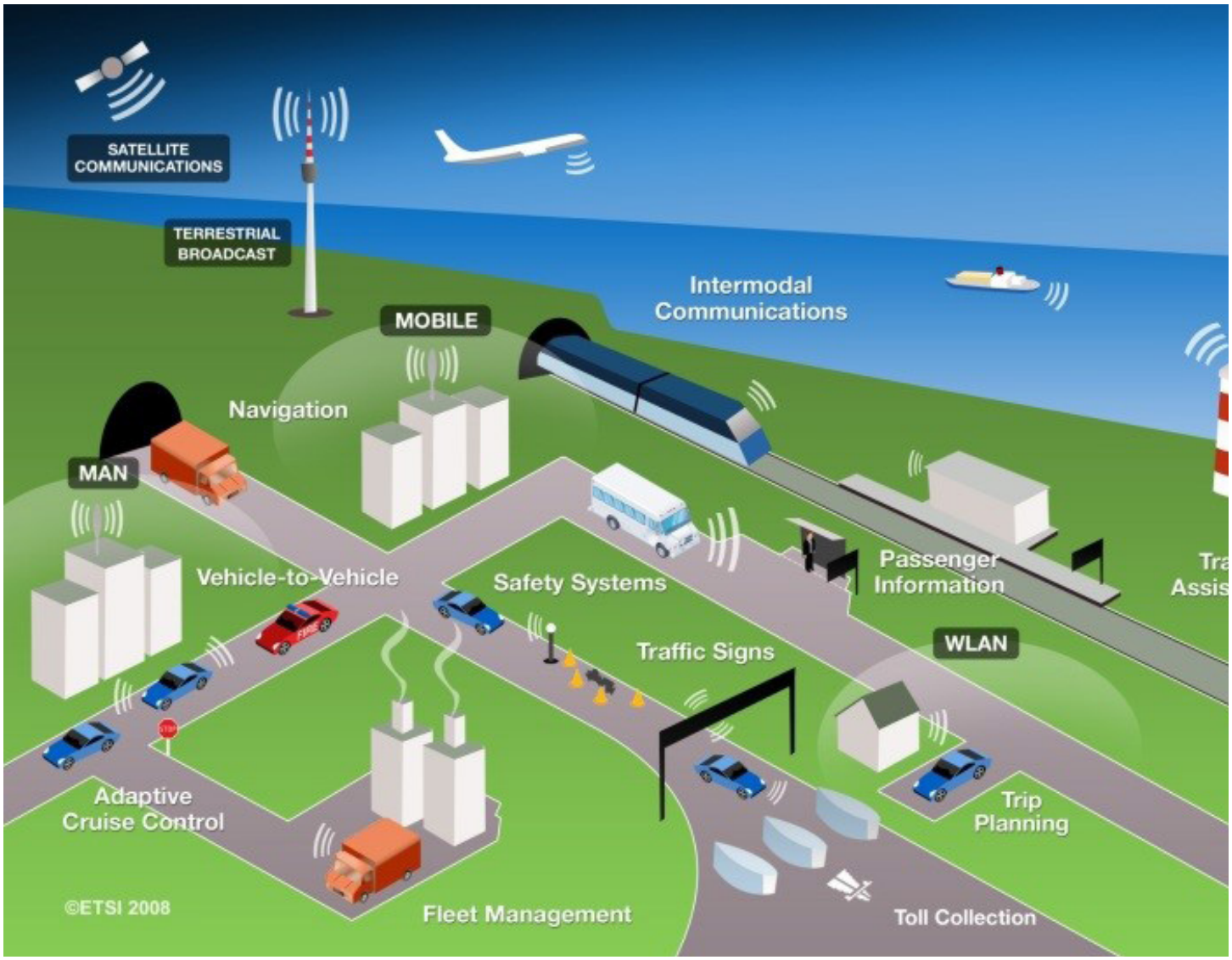

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Preface

This report summarizes the ITS standardisation work in ISO, CEN and ETSI. Each working group of the respective Standards Developing Organisations (SDOs) are shortly covered. Since the standards are under continuous updating, it is important to note that the report gives the standardisation status of today. For deeper understanding, and to follow the work progress, please follow the web-links to working groups and documents of interest.

The aim of the report is to broaden the knowledge of what is going on within ITS standardisation and thereby inspire to follow and take part in ITS developments. Since several SDOs are working with ITS it is difficult to get a good overview if one is not taking direct part in the standardisation work. The aim of the report is to present a structured and readable report of the standardisation developments, highlighting the similarities and some discrepancies between standards from different SDOs covering the same issues.

It is important to note that the same ITS issues are covered in several SDOs and the standards may thus deviate a little on certain issues. This may be a challenge if purchasing equipment from vendors using standards from different SDOs.

An important part of the work has been to highlight issues which in a profound way impacts the Norwegian Public Roads Administration's (NPRA) rollout of ITS. Technological, regulatory and market developments will all be impacted in both the short and long term, and force NPRA and other market actors to adjust to the future digital transport developments.

The work has been carried out by Trond Foss (SINTEF) and Knut Evensen (MobilITS) during the spring of 2019.

Norwegian Public Roads Administration

Jacob Trondsen

Head of Traffic Management

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1 Summary

Standardisation has been important since the start of ITS, and it is now, with the onset of cooperative ITS (C-ITS) in the global market, even more essential. Knowledge about ITS standardisation is thus important for many actors involved in the provision of ITS services. This report is put together to give a broad overview of current standard groups and interest organisations working within the ITS domain. It gives an overall status of the work going on in each of the working groups in CEN, ISO and ETSI. In addition, it also includes tables of standards which can be used for a detailed look-up.

Up until recently most of the ITS standards have been stand-alone standards such as for Electronic Fee Collection and traffic information (RDS-TMC). Today there are standards covering a broad range of services and technologies related to ITS and its cooperative features. There is no doubt that standardisation of ITS services and technologies have been essential in bringing ITS technology to the mass market. EFC and RDS-TMC standards are good examples of this. Development of standards has also resulted in reducing product prices and allowed various ITS services to become interoperable.

ITS is seen as a tool to: reduce accidents, increase transport efficiency, reduce environmental impact, and improve sustainability. This comes in addition to providing an improved user experience within the transport area. Policies are being set both on the national level, on the regional EU level such as EU Directives, and lately also between regions, such as between US and Europe. Some targets are partly conflicting, and therefore national policies will determine the actual mix and balance between the services. From a technical perspective, this means that systems trying to incorporate the service mix will need to handle many parameters and be flexible for the future. Taken together, there is little doubt that the next stage of ITS will see increased complexity. Care must be taken to help users of ITS standards understand how to combine the standards in user friendly ways.

The good news is that the standardisation domain, together with the R&D projects, has taken on this task. There are many organisations at work now, and good standards are being produced.

The not-so-good news is that there are duplications of work between these organisations, and the standards being produced are not necessarily interoperable with each other. This problem has been recognized, and both the European Commission and US DoT, together with other national/state transport authorities, are actively trying to bridge the gaps and fix the overlaps.

The situation up until recently have been that the balance between safety requirements and efficiency requirements was tilted in favour of anti-collision vehicle safety. This was a result of the car makers being a strong group politically and financially, and there were no comparable group from the efficiency/sustainability side to balance the equation.

This situation has changed with the efforts from the C-ITS Deployment platforms and several other EC sponsored activities and mandates. Also, national transport authorities across Europe have become aware of the benefits of ITS in general, and C-ITS specifically, as a prerequisite for automated driving.

The original set of priorities in the ITS Directive has mainly been met, and necessary standards are complete or mearing completion. However, there is a new set of priorities linked into the increased need for support of automated driving and electrification of vehicles. This set of priorities can be found in this document: link

A short list of the new priority areas is:

- Cooperative Intelligent Transport Systems (C-ITS)
- Revision of current specifications for EU-wide real-time traffic information services
- Recharging/refuelling points
- Access to vehicle data for road operation purposes
- eCall — extension to other vehicle categories
- Interoperable payment / ticketing

- Continuity of traffic and freight management services

2 Introduction

2.1 The aim of ITS standardisation

The term Intelligent Transport Systems (ITS) refers to the collection, storage and provision of real-time information and services to maximize the utilisation efficiency, provide convenient safe and secure transport, and reduce energy by applying advanced electronics, information and telecommunication technologies into roads, automobiles and goods.

ITS can significantly contribute to cleaner, safer and more efficient transport systems. Consequently, ITS have become the focus of several policy and legislative initiatives in Europe. The European Commission has laid down the legal framework in order to accelerate the deployment of these innovative transport technologies across Europe. Furthermore, the European Commission has requested the European Standards Organizations to develop and adopt European standards in support of this legal framework. Not surprisingly there is considerable activity in this area by the European standards organizations CEN, CENELEC and ETSI.

Standardization of technological solutions for road transport is one important aspect to increase the uptake of ITS to obtain the estimated benefits. In addition, ITS standardisation has the following benefits:

- Enable interoperability of systems/services and between different implementations that will give users seamless plug-and-play functionality.
- Encourage innovation, foster enterprise, and open new markets for suppliers.
- Create trust and confidence in products and services. This includes test and quality that will assure that products/solutions are safe, healthy, secure, flexible and of correct quality.
- Expand the market, bring down costs, and increase competition
- Help to prevent duplication of effort, and improve communication
- Assisting Governments, Administrations, and Regulators to support legislation, regulation and policy initiatives
- For the industry, manufacturers, and suppliers of systems standardization brings important benefits including a solid foundation upon which to develop new technologies and an opportunity to share and enhance existing practices, including a. o.:
    - provision of technology stability
    - enabling of multi-market access
    - creation of active markets
    - encouragement of innovation

Knowledge of emerging ITS services through standardisation is important to make optimal use of them through the complete lifecycle of the road transport systems. Optimal use of international standards is in line with National Public Road Administrations and the national governments overall strategy and requirements regarding the development of the road transport systems.

2.2 ITS standardisation organisations

Three Technical Committees (TCs) in three Standards Development Organisations (SDOs) are of special interest for the European ITS domain. These are CEN TC 278, ETSI TC ITS and ISO TC 204.

The European CEN TC 278 and ETSI TC ITS are of interest since the European community has special focus on European legislation, although major parts of the work are developed in ISO TC204, which works jointly together with CEN TC278. The ITS Coordination Group (ITS-CG) between CEN

and ETSI is monitored by the European Commission and has been established to ensure on-going coordination of the standardisation activities within these two SDOs.

ISO, IEC and ITU are global SDOs who standardise ITS on a global level. Many of the working groups (WGs) in CEN TC278 are overlapping with WGs in ISO TC 204. About half of the groups are "joint", meaning standards are developed as combined CEN/ISO standards. To harmonise and obtain a good and fruitful cooperation CEN 278 and ISO TC 204 have full committee meetings twice a year with joint participation.

ITS standardisation is also quite active in USA and other countries in the Asia-Pacific region. An EU-US joint declaration of Intent on Research Cooperation in Cooperative ITS has therefore been active between the EC and US DoT which resulted in significant standards harmonisation.

In addition to the mentioned SDOs there are lots of organisations working with ITS standardisation. It is outside the scope of this document to describe other organisations than the core relevant to Europe.

Note that the number of standards from various SDOs at any stage (published or under active work) changes quite rapidly for several reasons:

- New standards are started that cover aspects of existing standards. In the case of full overlap, existing standards are often withdrawn
- Paradigm shifts like Cooperative ITS (C-ITS) will generate a lot of new standards in a comparatively short time. The new paradigms where this is likely to happen are Urban ITS, Mobility, electrification of cars and self-driving cars
- New and/or changed user requirements will lead to new standards being developed
- Depending on the type of standard, it has a limited lifetime of three to five years after which it needs to be reconsidered and either re-adopted, modified and re-voted, or withdrawn if there is not enough interest

Cooperation between regional and global ITS SDOs is important to achieve harmonised standards providing global interoperability. Detailed cooperation between the SDOs has been initiated in addition to the already existing cross participation by membership in the relevant organisations.

To ensure work progress and cooperation in standard development, the EC has used so called mandates. These were used to ensure that standards were developed within certain high focused areas. The ITS directive is supported by mandate M/453 dealing directly with C-ITS, and even though this mandate has formally ended there are several standards activities still under support by M/453. This mandate process is still ongoing, and the new term is Commission Implementing Decision (CID). A new CID was launched in 2016 called M/546 Urban ITS. This Mandate lead to a new working group (CEN TC278/WG17 Urban ITS) and has generated more than 20 standards in less than three years. The most recent progress is starting a new Working Group in ISO with an even broader scope, namely ISO TC204/WG19 Mobility Integration. Both working groups are under Norwegian lead.

Getting a good understanding of what is being standardised, who is working with what, and the importance and impact of the standardisation for ITS stakeholders is thus important.

2.3 What is being standardised

The scope of what is being standardised is very broad and covers more or less the complete architectural hierarchy in various ITS domains. This includes amongst others:

- Standardisation of architectures for ITS services
- Various radio communications systems
- Formats and structure of message systems and transport
- Security and privacy technologies and system aspects
- Interfaces and reference points

- Database technologies and data file structures
- Service definitions for each singular service
- Testing and validation to prove conformance to each standard

The usage areas of the standards can be grouped into categories (often called services) such as:

- Traveller information systems
- Transport control systems
- Payment services (Tolling and Ticketing)
- Goods transport management
- Public transport
- Safety systems
- Environment protection services

The work in the standards organisations partly follow this pattern of separating technologies from application areas, but please note that this split is not absolute. Instead there are significant overlaps and combinations of services and technologies in one vertical application working group ("silo standards").

2.4 The status and outlook of ITS standardisation

The global trend of ITS means that Cooperative ITS eventually will succeed, but there is a lot of ground to be covered in order to satisfy the needs of authorities, road operators and ITS service users. Even if some car makers' specialists will claim that the goal has been achieved, they are only referring to limited sectors of the total picture.

Another challenge the ITS standardisation work is facing is overlapping standards. Even though policy makers such as the EU-US Task force has issued policies to the contrary, ETSI has continued producing overlapping and partly competing standards with the already existing CEN/ISO set. The same is happening with IEEE and SAE. There are therefore at least three competing full sets of standards that need to be taken into account, and this is an added challenge when designing for a global market.

Another challenge is that the core data models for each service grouping (TMC/TPEG, DATEX II, TRANSMODEL, C-ITS, etc) has expanded into the other sectors to be complete. This has led to overlapping definitions of the same property, e.g. location of object, speed of object, etc. This is currently a challenge since it is hard to translate from one data model to the other, even when they are trying to depict the same physical reality.

To improve this situation, the EC DG CONNECT (INFSO) and US DOT has jointly run a series of Harmonization Task Groups from 2012 up through 2018, and these groups have suggested several measures to bring the diverging elements back together. This work is continuing through Mandates and direct support from both the EC, the USDOT, and various national transport authorities.

A direct result out of the harmonisation work is that there is an active cooperation between the IEEE/SAE and ISO groups to harmonise. An agreement on C-ITS has been reached that folds the IEEE/SAE and ISO standards together in one implementable protocol set. This protocol set is partly referenced by the new C-ITS Delegated Act under the ITS Directive.

2.5 Standardisation impact on national public road administrations' work with ITS Action Plan and ITS Directive

The ITS Directive (2010/40/EU) and its underlying Delegated Acts, supported by Mandates (CIDs), puts forward certain requirements and guidelines for the implementation of ITS to ensure a more rapid implementation of ITS services in Europe. The aim of the European Union's land transport policy is to promote a mobility that is efficient, safe, secure, and environmentally friendly. The directive points out the need for interoperability and homogeneous solutions across borders. It also promotes a layered architecture to ensure better compatibility between communication solutions and services. Trans-national deployment of continuous cross-border services for travel information and traffic management cannot be achieved by Member States alone.

The work on cooperative systems is one major step in this direction. The new standards stemming from this work will directly impact the way Norwegian Public Roads Administrations should develop their infrastructures and system architectures to cope with the upcoming ITS services to ensure compatibility. Usage of DATEX II as a data exchange interface for road related data to improve traffic management as well as to feed traveller information systems is one such step to harmonise transport information across borders. The new C-ITS Delegated Act is another important example.

The global nature of transport related communication implicitly requires interoperability. Actively being engaged in the standardisation groups working with international systems is important and must be continued. Feeding in national requirements to this process is essential to maintain regional special needs. Good cooperation between countries with common borders is thus of high interest.

3 Abbreviations

The following abbreviations are very often used in ITS standardisation.

Term	Explanation and link
API	Application Programmers Interface, in the case of C-ITS this is the interface for applications residing on top of the ITS-S facilities layer, i.e. the API that implements the functionality of the FA-SAP, MA-SAP, and SA-SAP.
C2C-CC	Car-to-car communications consortium, a group started by OEMs
CAM	Cooperative Awareness Message defined by ETSI, carrying data from the ETSI basic data dictionary. CAMs are broadcast from vehicles and roadsides with a frequency of up to 10 times per second
CAMP	Crash Avoidance Metrics Partnership is a US project of mainly US car makers supported by the US DoT. GM and Ford were the founders of this cooperation, and there are many similarities to the European C2C-CC.
CEN	The European Standardisation Committee, with 27 European Nation States as members.
C-ITS	Cooperative Intelligent Transport Systems. The paradigm of ITS involving communications and sharing of information between different applications.
CVIS	Cooperative Vehicle-Infrastructure System. This was the largest European integrated project in the field of C-ITS, and had significant influence on standardisation
DENM	Decentralized Environmental Notification Message. Defined by ETSI. This is an message that is broadcast from a vehicle or a roadside to notify an event, e.g. ice spot, panic braking in my vehicle, crash happened
DSRC	Dedicated Short Range Communication. ***Note that this is an ambiguous term.*** CEN DSRC is the 5.8 GHz system developed by CEN TC278 WG9 and used for tolling systems around the world, e.g. the AutoPASS system in Norway. This is the original meaning from 1992. DSRC is now also used in America as a synonym for WAVE (5.9 GHz IEEE 802.11p) systems since 2005. This understanding is sometimes used by European car makers as well.
EC DG	European Commission – Directorate General Several departments are involved in ITS Standardisation. The main ones are: CONNECT – responsible for spectrum and communications, in particular 5G MOVE – responsible for transport regulatory matters such as the ITS Directive GROW – responsible for financing standardisation activites, also responsible for vehicle regulations in combination with UN ECE WP.29
EFC	Electronic Fee Collection, payment systems such as AutoPASS

Term	Explanation and link
EN	European Norm; the full European standard that has been voted through the CEN, CENELEC or ETSI national members
ERI	Electronic Registration Identifier, identification system for vehicles including electronic license plates and electronic registration papers.
G5A	ETSI terminology for European 5.9 GHz operation based on IEEE 802.11p protocols. G5A indicates the channels from 5.875-5.905 GHz allocated in Europe. The so-called Control Channel (CCH) is allocated at 5.895-5.905 GHz.
IPR	Intellectual Property Rights, this covers patents and other ownership claims. Usually the standards shall be either free of IPR, or where this cannot be avoided, the IPR holder has to sign a declaration of FRAND (Free, Reasonable and Non-Discriminatory)
ISO	International Standards Organisation, the global SDO with almost all Nation States as members.
ITS Station	First defined in ISO 21217, and later reproduced in ETSI EN 302 665. Identifying functionality in a station used in ITS. An implementation of the ITS station is named an ITS station unit, e. g. units installed in vehicles, at the road side, in traffic control/management centres, in service centres, or hand-held units.
LDM	Local Dynamic Map. One of the main concepts coming out to the CVIS and SAFESPOT projects. The LDM, a relational database, stores information that is referenced at least by time and position. Accepted to be one of the core blocks of C-ITS enabling sharing of data between applications.
NSO	National Standards Organisation, the body responsible for voting and selling standards in each country. An NSO can also provide national Standards and will then be a national SDO.
OEM	Original Equipment Manufacturers; in the case of ITS this is often used as a synonym for car makers, e.g. Daimler, Ford, GM, Toyota.
PT	Project Team, a small group of experts financed by European Commission to draft a standard for CEN in a short time.
SA Project	Support Action projects are small, special European Framework R&D projects that will facilitate and support coordination of other projects. Are usually funded 100%. Examples are COMeSafety and iCar Support who have standardisation support as part of their task.
SAE	Society of Automotive Engineers
SDO	Standards Developing Organisation, the generic term for CEN, ETSI, ISO, IEEE and so on.
STF	Specialist Task Force, a small group of experts financed by European Commission to draft a standard for ETSI in a short time.

Term	Explanation and link
STREP	Specific Targeted Research Projects. A “regular” European Framework R&D project, which can get up to 67% EC funding support. Examples are GeoNet, EVI and RCI
US DoT RITA/JPO	United States Department of Transportation - Research and Innovative Technology Administration – Joint Programs Office. See this link for an overview This is the federal administration responsible for ITS research and standardisation
VA	Vienna Agreement, the cooperation agreement between CEN and ISO. It basically regulates that CEN shall not start work where ISO is already working on a subject, and vice versa. The end result is no duplication or overlapping standards.
WAVE	Wireless Access in the Vehicular Environment. The name of an IEEE project (multi-part standard) with document number 1609.

4 CEN/TC 278 Intelligent transport systems

4.1 Introduction

CEN/TC278 Intelligent transport systems is the European ITS committee. It started in 1992 with the name of Road Transport and Traffic Telematics (RTTT) but changed to ITS in 2013. This was the first ITS standardisation body in the world, and TC278 has laid the groundwork for global ITS standards. The initial ideas came from the European framework programme called DRIVE, where it became clear that standardisation had to be started.

In general, CEN/TC278 has a good representation and participation from industry, service providers, public bodies and road operators/authorities, but less from car makers.

CEN/TC278 has a home page with a good overview of ITS standardisation and search facilities for TC278 items. The site will be kept updated close to the official CEN/ISO database. The link to the homepage of CEN/TC278 ITS is here.

CEN/TC278 has:

- Good connection to European R&D
- Cooperation between market players: industries, service providers, governments
- 33 national members, with over 300 participating experts
- 158+ ITS standards in use (2019)

The European Commission has set the legal framework to accelerate the deployment of these innovative transport technologies across Europe. Furthermore, the European Commission has requested the European Standards Organizations to develop and adopt European standards in support of this legal framework. Not surprisingly there is considerable activity in this area by the standards organizations CEN, CENELEC and ETSI. The following documents (2019) are relevant for the standardization work in CEN/TC 278:

- Directive 2004/52/EC (EFC directive) on the interoperability of electronic road toll systems in the Community
- Directive 2010/40/EU (ITS directive) on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport
- Commission Decision 2009/750/EC on the definition of the European Electronic Toll Service and its technical elements
- Mandate M/338 on Electronic Fee Collection in support of Interoperability of electronic road toll systems in Europe
- Mandate M/453 on Co-operative systems for Intelligent Transport in the field of information and communication technologies to support interoperability of cooperative systems for intelligent transport in Europe
- Mandate M/546 on Urban ITS on Intelligent Transport Systems (ITS) in urban areas in support of Directive 2010/40/EU on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport
- The EC Rolling plan for ICT standardization provides an overview of the needs for preliminary or complementary ICT standardisation activities to be undertaken in support of EU policy activities

4.2 ITS Application areas

CEN/TC 278 has several Working Groups (WG), each responsible for a specific ITS area as shown in Figure 1.

Figure 1: CEN/TC 278 working groups in 2019 (source: www.itsstandards.eu/wgs)

The following working groups are dormant (2019):

- WG 2 Freight
- WG 5 Traffic control
- WG 6 Parking Management
- WG 9 Dedicated Short-Range Communication (DSRC)
- WG 11 Subsystem and intersystem interfaces
- WG 12 Vehicle identification
- WG 13 ITS architecture
- WG 14 Recovery of stolen vehicles

4.3 CEN/TC 278 WG 1 Electronic Fee Collection (EFC)

Road User Charging (RUC) in transport is used all over Europe for raising revenue, dealing with congestion and internalizing transport costs. Concerns over escalating congestion, pollution and carbon dioxide issues, i.e. the sustainability of road transport, put even more emphasis on fair pricing schemes in European traffic.

Photo: Trond Foss

Electronic Fee Collection (EFC) is a collective name for IT technologies that allow for electronic charging of road users (as opposed to manual systems, such as paying at a toll booth). EFC systems offer the possibility of charging road vehicles in a flexible way and allow for targeted infrastructure charging policies. There are three basic technologies in use in European EFC today:

- EFC based on 5,8 GHz semi-passive transponder technology Dedicated Short Range Communication (DSRC) at a toll station.
- Autonomous EFC systems using in-vehicle devices for positioning (e.g. GNSS-based EFC).
- Video-based charging (i.e. registering the number plate automatically by video recognition).

WG1 has been studying how EFC will be affected by Cooperative ITS, and there is a report available outlining the possibilities. The idea is that EFC will become an application residing in an in-vehicle C-ITS platform, and the boundaries between the different EFC types will gradually disappear because of the local flexibility given by downloading applications to cover local requirements.

There are many EFC systems in Europe today, however, most of them have been developed and expanded on a regional basis creating different variants between different nations. In order to reap the full benefits of EFC systems they need to be interoperable, allowing a vehicle to pay charges in different countries using one on-board equipment (OBE) and a single contract. For this reason, the European Commission is setting up a common EFC service for Europe called the EETS (European Electronic Toll Service). Directive 2004/52/EC lays down the conditions for this service and the emergence of cross border interoperability of electronic road toll systems in the European Union.

The demand for interoperability calls for strong measures in standardization. Open and common standards are necessary for creating interoperable systems and services. This will also create better opportunities for market development in road user charging and electronic fee collection. EFC-standards provide the building blocks for the EETS as well as other tolling schemes in Europe and strengthen the competitiveness of European industry in the global EFC technology market.

This is one of the most productive WGs in CEN TC278. The work is divided in three sub-groups currently, and the WG usually have 3 - 4 meetings per year with 2 days per meeting. Most of the meetings are held in Europe, but some of the meetings are held in conjunction the ISO TC204 meeting week which happens twice per year around the world.

The main field from the start was CEN DSRC based tag-and-reader systems, and this was done in a cooperation with WG9 and WG12. The EC supported the original set of standards through a mandate and several Project Teams (PTs). The basic standards from WG1 have been incorporated in the EFC Directive, and are also referenced by all national EFC specifications, such as the Norwegian AutoPASS specification. The new wave of standards has been designed to support the EFC directive even more, and a new mandate (M/338) has been active for a while. This leads up to GNSS/CN based system specifications (called "autonomous" in WG1) with related conformance testing standards developed by SG5, and further work on conformance testing also for DSRC-based systems. Architecture, back-office operations and value-added services are other areas of work.

Table 1 below shows the status of the WG1 EFC standards (January 2019).

Table 1: WG1 EFC Standards per January 2019

Standard title	**Status**
WG1 Electronic Fee Collection	
CEN ISO/TR 16401-1:2018 (WI=00278417) Electronic fee collection - Evaluation of equipment for conformity to ISO/TS 17575-2 - Part 1: Test suite structure and test purposes (ISO/TR 16401-1:2018)	Published
CEN ISO/TS 14907-1:2015 (WI=00278388) Electronic fee collection - Test procedures for user and fixed equipment - Part 1: Description of test procedures (ISO/TS 14907-1:2015)	Published
CEN ISO/TS 14907-2:2016 (WI=00278410) Electronic fee collection - Test procedures for user and fixed equipment - Part 2: Conformance test for the on-board unit application interface (ISO/TS 14907-2:2016)	Published
CEN ISO/TS 17444-1:2017 (WI=00278432) Electronic fee collection - Charging performance - Part 1: Metrics (ISO/TS 17444-1:2017)	Published

Standard title	Status
WG1 Electronic Fee Collection	
CEN ISO/TS 17444-2:2017 (WI=00278433) Electronic fee collection - Charging performance - Part 2: Examination framework (ISO/TS 17444-2:2017)	Published
CEN ISO/TS 17574:2017 (WI=00278416) Electronic fee collection - Guidelines for security protection profiles (ISO/TS 17574:2017)	Published
CEN ISO/TS 19299:2015 (WI=00278358) Electronic fee collection - Security framework (ISO/TS 19299:2015)	Published
CEN ISO/TS 21719-1:2018 (WI=00278455) Electronic fee collection - Personalization of on-board equipment (OBE) - Part 1: Framework (ISO/TS 21719-1:2018)	Published
CEN ISO/TS 21719-2:2018 (WI=00278456) Electronic fee collection - Personalization of on-board equipment (OBE) - Part 2: Using dedicated short-range communication (ISO/TS 21719-2:2018)	Published
CEN/ISO TR 16401-2:2018 (WI=00278418) Electronic fee collection - Evaluation of equipment for conformity to ISO/TS 17575-2 - Part 2: Abstract test suite (ISO/TR 16401-2:2018)	Published
CEN/TR 15762:2008 (WI=00278215) Road transport and traffic telematics - Electronic fee collection (EFC) - Ensuring the correct function of EFC equipment installed behind metallised windshield	Published
CEN/TR 16040:2010 (WI=00278251) Electronic fee collection - Requirements for urban dedicated short-range communication	Published
CEN/TR 16092:2011 (WI=00278252) Electronic fee collection - Requirements for pre-payment systems	Published

Standard title	Status
WG1 Electronic Fee Collection	
CEN/TR 16152:2011 (WI=00278250) Electronic fee collection - Personalisation and mounting of first mount OBE	Published
CEN/TR 16219:2011 (WI=00278259) Electronic Fee Collection - Value added services based on EFC on-board equipment	Published
CEN/TR 16690:2014 (WI=00278315) Electronic fee collection - Guidelines for EFC applications based on in-vehicle ITS stations	Published
CEN/TR 16968:2016 (WI=00278381) Electronic Fee Collection - Assessment of security measures for applications using Dedicated Short-Range Communication	Published
CEN/TS 16331:2012 (WI=00278272) Electronic fee collection - Interoperable application profiles for autonomous systems	Published
CEN/TS 16702-1:2014 (WI=00278282) Electronic fee collection - Secure monitoring for autonomous toll systems - Part 1: Compliance checking	Published
CEN/TS 16702-2:2015 (WI=00278338) Electronic fee collection - Secure monitoring for autonomous toll systems - Part 2: Trusted recorder	Published
CEN/TS 16986:2016 (WI=00278348) Electronic Fee Collection - Interoperable application profiles for information exchange between Service Provision and Toll Charging	Published
CEN/TS 16986:2016/AC:2017 (WI=00278C11) Electronic Fee Collection - Interoperable application profiles for information exchange between Service Provision and Toll Charging	Published

Standard title	Status
WG1 Electronic Fee Collection	
EN 15876-1:2016 (WI=00278406) Electronic fee collection - Evaluation of on-board and roadside equipment for conformity to EN 15509 - Part 1: Test suite structure and test purposes	Published
EN 15876-2:2016 (WI=00278407) Electronic fee collection - Evaluation of on-board and roadside equipment for conformity to EN 15509 - Part 2: Abstract test suite	Published
EN 15509:2014 (WI=00278327) Electronic fee collection - Interoperability application profile for DSRC	Published
EN ISO 12813:2015 (WI=00278362) Electronic fee collection - Compliance check communication for autonomous systems (ISO 12813:2015)	Published
EN ISO 12813:2015/A1:2017 (WI=00278411) Electronic fee collection - Compliance check communication for autonomous systems - Amendment 1 (ISO 12813:2015/Amd 1:2017)	Published
EN ISO 12855:2015 (WI=00278353) Electronic fee collection - Information exchange between service provision and toll charging (ISO 12855:2015)	Published
EN ISO 13140-1:2016 (WI=00278390) Electronic fee collection - Evaluation of on-board and roadside equipment for conformity to ISO 13141 - Part 1: Test suite structure and test purposes (ISO 13140-1:2016)	Published
EN ISO 13140-2:2016 (WI=00278413) Electronic fee collection - Evaluation of on-board and roadside equipment for conformity to ISO 13141 - Part 2: Abstract test suite (ISO 13140-2:2016)	Published
EN ISO 13141:2015 (WI=00278363) Electronic fee collection - Localisation augmentation communication for autonomous systems (ISO 13141:2015)	Published

Standard title	Status
WG1 Electronic Fee Collection	
EN ISO 13141:2015/A1:2017 (WI=00278412) Electronic fee collection - Localisation augmentation communication for autonomous systems - Amendment 1 (ISO 13141:2015/Amd 1:2017)	Published
EN ISO 13143-1:2016 (WI=00278391) Electronic fee collection - Evaluation of on-board and roadside equipment for conformity to ISO 12813 - Part 1: Test suite structure and test purposes (ISO 13143-1:2016)	Published
EN ISO 13143-2:2016 (WI=00278392) Electronic fee collection - Evaluation of on-board and roadside equipment for conformity to ISO 12813 - Part 2: Abstract test suite (ISO 13143-2:2016)	Published
EN ISO 16407-1:2017 (WI=00278408) Electronic fee collection - Evaluation of equipment for conformity to ISO 17575-1 - Part 1: Test suite structure and test purposes (ISO 16407-1:2017)	Published
EN ISO 16407-2:2018 (WI=00278414) Electronic fee collection - Evaluation of equipment for conformity to ISO 17575-1 - Part 2: Abstract test suite (ISO 16407-2:2018)	Published
EN ISO 16410-1:2017 (WI=00278409) Electronic fee collection - Evaluation of equipment for conformity to ISO 17575-3 - Part 1: Test suite structure and test purposes (ISO 16410-1:2017)	Published
EN ISO 16410-2:2018 (WI=00278415) Electronic fee collection - Evaluation of equipment for conformity to ISO 17575-3 - Part 2: Abstract test suite (ISO 16410-2:2018)	Published
EN ISO 14906:2018 (WI=00278425) Electronic fee collection - Application interface definition for dedicated short-range communication (ISO 14906:2018)	Published
EN ISO 17575-1:2016 (WI=00278356) Electronic fee collection - Application interface definition for autonomous systems - Part 1: Charging (ISO 17575-1:2016)	Published

Standard title	Status
WG1 Electronic Fee Collection	
EN ISO 17575-2:2016 (WI=00278364) Electronic fee collection - Application interface definition for autonomous systems - Part 2: Communication and connection to the lower layers (ISO 17575-2:2016)	Published
EN ISO 17575-3:2016 (WI=00278365) Electronic fee collection - Application interface definition for autonomous systems - Part 3: Context data (ISO 17575-3:2016)	Published
EN ISO 25110:2017 (WI=00278434) Electronic fee collection - Interface definition for on-board account using integrated circuit card (ICC) (ISO 25110:2017)	Published
FprCEN/TS 17154-1 (WI=00278421) Electronic fee collection - Evaluation of implementation for conformity to CEN/TS 16986 - Part 1: Test suite structure and purposes	Under Approval
FprCEN/TS 17154-2 (WI=00278422) Electronic fee collection - Evaluation of implementation for conformity to CEN/TS 16986 - Part 2: Abstract test suite	Under Approval
prCEN/TS 16702-1 rev (WI=00278465) Electronic fee collection - Secure monitoring for autonomous toll systems - Part 1: Compliance checking	Under Drafting
prCEN/TS 16702-2 rev (WI=00278486) Electronic fee collection - Secure monitoring for autonomous toll systems - Part 2: Trusted recorder	Under Drafting
prEN ISO 17573-1 (WI=00278485) Electronic fee collection - System architecture for vehicle related tolling - Part 1: Reference model (ISO/DIS 17573-1:2018)	Under Approval
prEN ISO 12813 (WI=00278495) Electronic fee collection - Compliance check communication for autonomous systems (ISO/DIS 12813:2018)	Under Enquiry

4.4 CEN/TC 278 WP 2 Freight and Fleet management

The working group is dormant and has not published any standards.

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4.5 CEN/TC 278 WP 3 Public Transport

WG3 is producing standards in several areas. The primary ones are:

- Internal data networks in public transport vehicles that will connect sensors, indicators, ticket machines, etc. (FIP, CAN, IP/Ethernet, Messages and Data contents)
- Man-machine interfaces for drivers, platform validators and on-board validators.
- Information systems - real-time and multimodal network and time table exchange as an addition on top of Transmodel
- Ticketing systems including the full business chain from electronic tickets to exchange between back-office systems

Photo: AtB AS

As seen from the list below the main aspects are concerned with real time status information and ticketing. Most of the members are coming from the public transport industry, but with some regulators/authorities sitting in. There is a good cooperation with other WGs such as WG1 (EFC). The cooperation with the ISO equivalent (WG8) has also picked up the last year, with open discussions over joint areas of interest, e.g. on Interoperable Fare Management Systems and Account based

ticketing. In ISO TC204 the group is also focused on emergency situations linked to public transport which is an important issue to follow, even though this dimension is less prominent in the European area.

Table 2 below shows the status of the WG 3 Public Transport standards (January 2019).

Table 2: WG 3 Public Transport standards per January 2019

Standard title	**Status**
WG3 Public Transport	
CEN/TS 16614-1:2014 (WI=00278307) Public transport - Network and Timetable Exchange (NeTEx) - Part 1: Public transport network topology exchange format	Published
CEN/TS 16614-2:2014 (WI=00278308) Public transport - Network and Timetable Exchange (NeTEx) - Part 2: Public transport scheduled timetables exchange format	Published
CEN/TS 16614-3:2016 (WI=00278330) Public transport - Network and Timetable Exchange (NeTEx) - Part 3: Public transport fares exchange format	Published
(WI=00278457) Public transport - Network and Timetable Exchange (NeTEx) - Passenger information European profile	Under Drafting
CEN/TR 16959:2016 (WI=00278389) Public transport - Network and Timetable Exchange (NeTEx) - Examples, guidelines and explanatory materials	Published
prCEN/TS 16614-1 rev (WI=00278489) Public transport - Network and Timetable Exchange (NeTEx) - Part 1: Network topology exchange format	Under Drafting
prCEN/TS 16614-2 rev (WI=00278490) Public transport - Network and Timetable Exchange (NeTEx) - Part 2: Scheduled timetables exchange format	Under Drafting

Standard title	Status
WG3 Public Transport	
prCEN/TS 16614-3 rev (WI=00278488) Public transport - Network and Timetable Exchange (NeTEx) - Part 3: Fares exchange format	Under Drafting
EN 13149-1:2004 (WI=00278169) Public transport - Road vehicle scheduling and control systems - Part 1: WORLDFIP definition and application rules for onboard data transmission	Published
EN 13149-2:2004 (WI=00278170) Public transport - Road vehicle scheduling and control systems - Part 2: WORLDFIP cabling specifications	Published
CEN/TS 13149-3:2007 (WI=00278196) Public transport - Road vehicle scheduling and control systems - Part 3: WorldFIP message content	Published
EN 13149-4:2004 (WI=00278175) Public transport - Road vehicle scheduling and control systems - Part 4: General application rules for CANopen transmission buses	Published
EN 13149-5:2004 (WI=00278176) Public transport - Road vehicle scheduling and control systems - Part 5: CANopen cabling specifications	Published
CEN/TS 13149-6:2005 (WI=00278125) Public transport - Road vehicle scheduling and control systems - Part 6: CAN message content	Published
CEN/TS 13149-7:2015 (WI=00278380) Public transport - Road vehicle scheduling and control systems - Part 7: System and Network Architecture	Published
prCEN/TS 13149-7 rev (WI=00278513) Public transport - Road vehicle scheduling and control systems - Part 7: System and network architecture	Under Drafting

Standard title	Status
WG3 Public Transport	
CEN/TS 13149-8:2013 (WI=00278332) Public transport - Road vehicle scheduling and control systems - Part 8: Physical layer for IP communication	Published
(WI=00278516) Public transport - Road vehicle scheduling and control systems - Part 9: Time service	Under Drafting
(WI=00278515) Public transport - Road vehicle scheduling and control systems - Part 10: Location service	Under Drafting
(WI=00278514) Public transport - Road vehicle scheduling and control systems - Part 11: Vehicle platform interface service	Under Drafting
EN ISO 24014-1:2015 (WI=00278346) Public transport - Interoperable fare management system - Part 1: Architecture (ISO 24014-1:2015)	Published
prEN 24014-1 rev (WI=00278435) Public transport - Interoperable fare management system - Part 1: Architecture	Under Drafting
CEN ISO/TR 24014-2:2013 (WI=00278222) Public transport - Interoperable fare management system - Part 2: Business practices (ISO/TR 24014-2:2013)	Published
CEN ISO/TR 24014-3:2013 (WI=00278339) Public transport - Interoperable fare management system - Part 3: Complementary concepts to Part 1 for multi-application media (ISO/TR 24014-3:2013)	Published
FprCEN/TR 12896-9 (WI=00278475) Public transport - Reference data model - Part 9: Informative documentation	Under Drafting

Standard title	Status
WG3 Public Transport	
CEN/TR 12896-9:2016 (WI=00278387) Public transport - Reference data model - Part 9: Informative documentation	Published
CEN/TR 16427:2013 (WI=00278309) Intelligent transport systems - Public transport - Traveller Information for Visually Impaired People (TI-VIP)	Published
CEN/TS 15504:2007 (WI=00278195) Public transport - Road vehicles - Visible variable passenger information devices inside the vehicle	Published
CEN/TS 15531-4:2011 (WI=00278218) Public transport - Service interface for real-time information relating to public transport operations - Part 4: Functional service interfaces: Facility Monitoring	Published
CEN/TS 15531-5:2016 (WI=00278383) Public transport - Service interface for real-time information relating to public transport operations - Part 5: Functional service interfaces situation exchange: Situation Exchange	Published
CEN/TS 16406:2013 (WI=00278319) Intelligent transport systems - Public transport - Indirect Fulfilment for Rail	Published
CEN/TS 16794-1:2017 (WI=00278404) Public transport - Communication between contactless readers and fare media - Part 1: Implementation requirements for ISO/IEC 14443	Published
CEN/TS 16794-2:2017 (WI=00278405) Public transport - Communication between contactless readers and fare media - Part 2: Test plan for ISO/IEC 14443	Published
CEN/TS 17118:2017 (WI=00278420) Intelligent transport systems - Public transport - Open API for distributed journey planning	Published

Standard title	Status
WG3 Public Transport	
EN 12896-1:2016 (WI=00278371) Public transport - Reference data model - Part 1: Common concepts	Published
EN 12896-2:2016 (WI=00278367) Public transport - Reference data model - Part 2: Public transport network	Published
EN 12896-3:2016 (WI=00278368) Public transport - Reference data model - Part 3: Timing information and vehicle scheduling	Published
EN 15531-1:2015 (WI=00278340) Public transport - Service interface for real-time information relating to public transport operations - Part 1: Context and framework	Published
EN 15531-2:2015 (WI=00278341) Public transport - Service interface for real-time information relating to public transport operations - Part 2: Communications	Published
EN 15531-3:2015 (WI=00278342) Public transport - Service interface for real-time information relating to public transport operations - Part 3: Functional service interfaces	Published
ENV 12796:1997 (WI=00278079) Road transport and traffic telematics - Public transport - Validators	Published
ENV 13093:1998 (WI=00278078) Public transport - Road vehicles - Driver's console mechanical interface requirements - Minimum display and keypad parameters	Published
FprCEN/TR 17311 (WI=00278451) Public transport - Interoperable fare management system - Bluetooth low energy ticketing use cases and guidelines	Under Approval
FprCEN/TR 17370 (WI=00278429) Public transport - Operating raw data and statistics exchange	Under Approval

Standard title	Status
WG3 Public Transport	
FprCEN/TS 16794-1 (WI=00278481) Public transport - Communication between contactless readers and fare media - Part 1: Implementation requirements for ISO/IEC 14443	Under Approval
FprCEN/TS 16794-2 (WI=00278482) Public transport - Communication between contactless readers and fare media - Part 2: Test plan for ISO/IEC 14443	Under Approval
prEN 12896-4 (WI=00278477) Public transport - Reference data model - Part 4: Operations monitoring and control	Under Enquiry
prEN 12896-5 (WI=00278497) Public transport - Reference data model - Part 5: Fare management	Under Enquiry
prEN 12896-6 (WI=00278498) Public transport - Reference data model - Part 6: Passenger information	Under Enquiry
prEN 12896-7 (WI=00278499) Public transport - Reference data model - Part 7: Driver management	Under Enquiry
prEN 12896-8 (WI=00278500) Public transport - Reference data model - Part 8 : Management information & statistics	Under Enquiry
prCEN/TS 13149-7 rev (WI=00278513) Public transport - Road vehicle scheduling and control systems - Part 7: System and network architecture	Under Drafting

4.6 CEN/TC 278 WG 4 Traffic and Travel Information (TTI)

WG 4 was recently put in a dormant state in CEN TC278 whilst the work continues in ISO WG10. This is done to avoid the extra work involved under the Vienna agreement. The technical work is progressing with full European participation and leadership, so this measure is purely to aid efficiency in the development process.

Source: Håndbok V321 Variable trafikkskilt

The following description therefore applies for ISO TC204 WG10.

WG4 has been very active in the past, but the activity is mostly moved to TISA (Traveller Information Services Association) which is a European non-profit organisation for TPEG, RDS-TMC (Alert C) and Graphic Data Dictionary. The main work is related to definition of data sets and transport protocols for sending traffic related information, mostly via public broadcast systems, but also via other media.

This is one of the most productive WGs with around 35 developing + published standards and considered to be one of the most successful global sets of ITS standards, on par with CEN DSRC/EFC.

TPEG is a standard that allow relatively large data volumes to be sent to on-board devices. It is based on DAB radio communication and it will arguably take over for RDS-TMC. TPEG messages including location references can be cross-translated to DATEX II.

Table 3 below shows the status of the WG 4 Traffic and Travel information standards (January 2019).

Table 3: WG 4 Traffic and Travel Information standards per January 2019

Standard title	Status
WG4 Traffic and Travel information	
EN ISO 14819-1:2013 (WI=00278300) 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 14819-1:2013)	Published
EN ISO 14819-2:2013 (WI=00278197) 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 14819-2:2013)	Published
EN ISO 14819-3:2013 (WI=00278301) 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 14819-3:2013)	Published
ENV 12313-4:2000 (WI=00278116) Traffic and Traveller Information (TTI) - TTI Messages via Traffic Message Coding - Part 4: Coding Protocol for Radio Data System - Traffic Message Channel (RDS-TMC) - RDS-TMC using ALERT Plus with ALERT C	Published
EN ISO 14819-6:2006 (WI=00278158) Traffic and Traveller Information (TTI) - TTI messages via traffic message coding - Part 6: Encryption and conditional access for the Radio Data System - Traffic Message Channel ALERT C coding (ISO 14819-6:2006)	Published
prEN ISO 14819-1 rev (WI=00278504) 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	Under Drafting
prEN ISO 14819-2 rev (WI=00278505) 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	Under Drafting

Standard title	Status
WG4 Traffic and Travel information	
prEN ISO 14819-3 rev (WI=00278506) 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	Under Drafting
prEN ISO 14819-6 rev (WI=00278507) Traffic and Traveller Information (TTI) - TTI messages via traffic message coding - Part 6: Encryption and conditional access for the Radio Data System - Traffic Message Channel ALERT C coding	Under Drafting
EN ISO 14823:2017 (WI=00278394) Intelligent transport systems - Graphic data dictionary (ISO 14823:2017)	Published

4.7 CEN/TC 278 WG 5 Traffic Control

Dormant WG with no active standards or work items.

Some of the ideas are taken up by ISO TC204 WG9.

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4.8 CEN/TC 278 WG 6 Parking Management

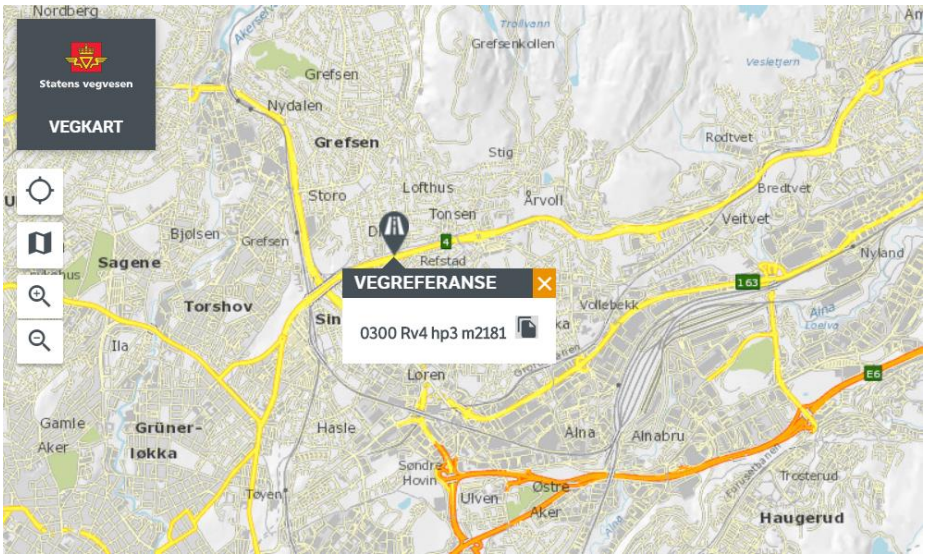
Dormant WG with no active standards or work items. This work has recently been taken up in ISO TC204 under European leadership.

Photo: Pars Arc

4.9 CEN/TC 278 WG 7 ITS Spatial Data

This WG has been dormant for a period, and the previous products have been handled by ISO TC 204 WG3. WG7 ITS Spatial Data has recently been active with a new area of work: How to transfer changes in the road attributes from the road authorities and operators, to actors who need these updates such as map makers. There is one new standard produced under this new initiative. Please see the text below the figure for more details.

Previous products were mainly belonging to the Geographical Data Files (GDF) family. Various versions (GDF 3.0, GDF 4.0) are used in modified versions by map providers, with unfortunately little interoperability as a result. New developments of GDF have been taken over by ISO TC204 WG3 where there is significant activity. Please see ISO TC204 WG3 for more information.



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New scope was proposed for the re-establishment of WG7: Specification of a framework for an efficient and quality-ensured supply chain for information on safety-related static road attributes, from public authorities to commercial map providers and other road data users, with a focus on changes in the concerned attributes rather than full data sets. Preliminary work was carried out in the EU-funded ROSATTE project. The intended framework will consist of the following parts: (1) a conceptual specification of the data content (the information model); (2) a physical exchange format to specify a coding for the various types of data listed under the conceptual model; (3) a service specification to facilitate the actual data flow between the various actors. The specification will be aligned with the INSPIRE project as an extension for ITS spatial data of the theme Transport Networks, while adding elements that are essential for ITS spatial data but not currently offered by INSPIRE, such as maintenance of the data, quality control and location referencing.

Table 4 below shows the status of the WG 7 ITS Spatial Data standards (January 2019).

Table 4: WG 7 ITS Spatial Data Standards per January 2019

Standard title	**Status**
WG 7 ITS Spatial data	
CEN/TS 17268:2018 (WI=00278479) Intelligent transport systems - ITS spatial data - Data exchange on changes in road attributes	Published

4.10 CEN/TC 278 WG 8 Road Traffic Data

The working group has an extensive description of its working domain found on https://www.itsstandards.eu/rtd

> *Working group 8 is responsible for the multi part DATEX II standard; With the aim to support sustainable mobility in Europe, the European Commission has been supporting the development of information exchange mainly between the actors of the road traffic management domain for a number of years. In the road sector, DATEX II has been long in fruition, with the European Commission being fundamental to its development through an initial contract and subsequent co-funding through the Euro-Regional projects. With this standardisation of DATEX II there is a real basis for common exchange between the actors of the traffic and travel information sector. DATEX II defines a common set of data exchange specifications to support the vision of a seamless interoperable exchange of traffic and travel information across boundaries, including national, urban, interurban, road administrations, infrastructure providers and service providers. Standardisation in this context is a vital constituent to ensure interoperability, reduction of risk, reduction of the cost base, promotion of open marketplaces and many social, economic and community benefits to be gained from more informed travellers, network managers and transport operators. The focus of DATEX II standardisation is on the information content. Part 1 defines the modelling methodology and rules for extension. Parts 2-7 define the content according to this methodology. Note that the actual mechanisms for Centre-to-Centre exchange (C2C) are yet to follow. Substantial work on exchange has already been performed with the ambition to take up its standardisation at the ISO level. For this there is an on-going cooperation between CEN TC278/WG8 and ISO TC204/WG9.*

datex2.eu

One challenge is the fact that ISO and CEN are developing DATEX standards diverging on essential points. In ISO TC204 WG9, the name is DATEX-ASN, and the contents and structure is quite different from DATEX II. Efforts should be taken to inform users regarding these differences. Furthermore, efforts are on-going to align the work of ISO and CEN. It should also be mentioned that there are significant overlaps with a standard from the US, called NTCIP.

Table 5 below shows the status of the WG 8 Road Traffic Data (DATEX) standards (January 2019).

Table 5: WG 8 Road Traffic Data (DATEX) standards per January 2019

Standard title	Status
WG8 Road Traffic Data (DATEX)	
CEN ISO/TS 18234-1:2013 (WI=00278322) 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/TS 18234-1:2013)	Published
CEN ISO/TS 18234-2:2013 (WI=00278326) 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/TS 18234-2:2013)	Published
CEN ISO/TS 18234-3:2013 (WI=00278312) 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/TS 18234-3:2013)	Published
CEN ISO/TS 18234-4:2006 (WI=00278150) Traffic and Travel Information (TTI) - TTI via Transport Protocol Expert Group (TPEG) data-streams - Part 4: Road Traffic Message (RTM) application (ISO/TS 18234-4:2006)	Published
CEN ISO/TS 18234-5:2006 (WI=00278159) Traffic and Travel Information (TTI) - TTI via Transport Protocol Expert Group (TPEG) data-streams - Part 5: Public Transport Information (PTI) application (ISO/TS 18234-5:2006)	Published
CEN ISO/TS 18234-6:2006 (WI=00278160) Traffic and Travel Information (TTI) - TTI via Transport Protocol Expert Group (TPEG) data-streams - Part 6: Location referencing applications (ISO/TS 18234-6:2006)	Published
CEN ISO/TS 18234-7:2013 (WI=00278321) 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/TS 18234-7.2013)	Published
CEN ISO/TS 18234-9:2013 (WI=00278323) Intelligent transport systems - Traffic and travel information via transport	Published

Standard title	Status
WG8 Road Traffic Data (DATEX)	
protocol experts group, generation 1 (TPEG1) binary data format - Part 9: Traffic event compact (TPEG1-TEC) (ISO/TS 18234-9:2013)	
CEN ISO/TS 18234-10:2013 (WI=00278324) 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/TS 18234-10:2013)	Published
CEN ISO/TS 18234-11:2013 (WI=00278313) 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) (ISO/TS 18234-11:2013)	Published
CEN ISO/TS 24530-1:2006 (WI=00278161) 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/TS 24530-1:2006)	Published
CEN ISO/TS 24530-2:2006 (WI=00278162) Traffic and Travel Information (TTI) - TTI via Transport Protocol Experts Group (TPEG) Extensible Markup Language (XML) - Part 2: tpeg-locML (ISO/TS 24530-2:2006)	Published
CEN ISO/TS 24530-3:2006 (WI=00278163) Traffic and Travel Information (TTI) - TTI via Transport Protocol Experts Group (TPEG) Extensible Markup Language (XML) - Part 3: tpeg-rtmML (ISO/TS 24530-3:2006)	Published
CEN ISO/TS 24530-4:2006 (WI=00278164) Traffic and Travel Information (TTI) - TTI via Transport Protocol Experts Group (TPEG) Extensible Markup Language (XML) - Part 4: tpeg-ptiML (ISO/TS 24530-4:2006)	Published
EN 16157-1:2018 (WI=00278423) Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 1: Context and framework	Published

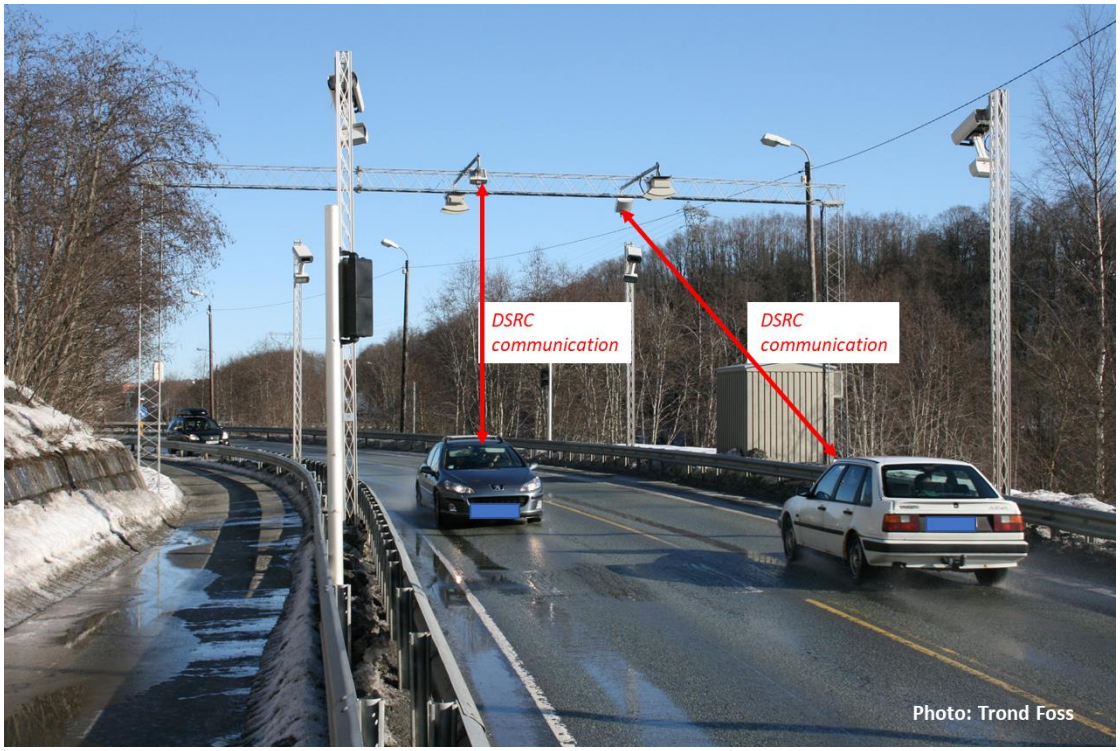
Standard title	Status
WG8 Road Traffic Data (DATEX)	
CEN/TS 16157-2:2011 (WI=00278226) Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 2: Location referencing	Published
FprEN 16157-2 (WI=00278398) Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 2: Location referencing	Approved
EN 16157-3:2018 (WI=00278399) Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 3: Situation Publication	Published
CEN/TS 16157-4:2014 (WI=00278318) Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 4: Variable Message Sign (VMS) Publications	Published
prEN 16157-4 (WI=00278503) Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 4: VMS publication	Under Drafting
CEN/TS 16157-5:2014 (WI=00278320) Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 5: Measured and elaborated data publications	Published
prEN 16157-5 (WI=00278502) Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 5: Measured and elaborated data publications	Under Drafting
CEN/TS 16157-6:2015 (WI=00278351) Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 6: Parking Publications	Published

Standard title	Status
WG8 Road Traffic Data (DATEX)	
EN 16157-7:2018 (WI=00278424) Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 7: Common data elements	Published
EN ISO 14825:2011 (WI=00278256) Intelligent transport systems - Geographic Data Files (GDF) - GDF5.0 (ISO 14825:2011)	Published

4.11 CEN/TC 278 WG 9 Dedicated Short-range Communication (DSRC)

WG 9 DSRC is a dormant WG. This WG used to be joint with ISO TC204 WG15 which is also dormant.

In the end the WG produced 4 basic standards from 1993-2001, and these four still provide the basics of tolling systems around the world. More than 51 million units are in daily use around the world ranging from New Zealand to Iceland, and from Chile to Russia. This is without doubt the most successful example of ITS standardisation.



The four standards EN12253(L1), EN12795(L2), EN12834(L7) and EN13372(Profile) are now maintained by CEN TC278 itself.

Conformance validation standards are managed by ETSI TC ITS WG2, whilst the radio parameters are maintained by ETSI TC ITS WG4.

Table 6 below shows the status of the WG 9 DSRC standards.

Table 6: WG 9 DSRC standards per January 2019

Standard title	Status
WG9 DSRC	
EN 12253:2004 (WI=00278141) Road transport and traffic telematics - Dedicated short-range communication - Physical layer using microwave at 5,8 GHz	Published
EN 12795:2003 (WI=00278142) Road transport and traffic telematics - Dedicated Short Range Communication (DSRC) - DSRC data link layer: medium access and logical link control	Published
EN 12834:2003 (WI=00278143) Road transport and traffic telematics - Dedicated Short Range Communication (DSRC) - DSRC application layer	Published
EN 13372:2004 (WI=00278144) Road Transport and Traffic Telematics (RTTT) - Dedicated short-range communication - Profiles for RTTT applications	Published

4.12 CEN/TC 278 WG 10 Human – Machine interfacing

This WG was initially transferred to ISO TC22 SC13 WG8 since it was mainly related to in-vehicle systems which are in the scope of ISO TC22 (Road Vehicles). The WG has produced five ENs which deals with HMI testability and symbols. During the re-farming of TC22, the responsibility is now under ISO/TC 22/SC 39/WG 8 **TICS on-board-MMI**.

There is no direct ISO TC204 parallel group, but some relations with ISO TC204 WG14 and WG17.

Some key words for this WG: Dialogue Management, Auditory Information Presentation, Measurement of Driver Visual Behaviour, Visual Information Presentation, Process requirements for driver system integration such as Warning Systems in Vehicles.

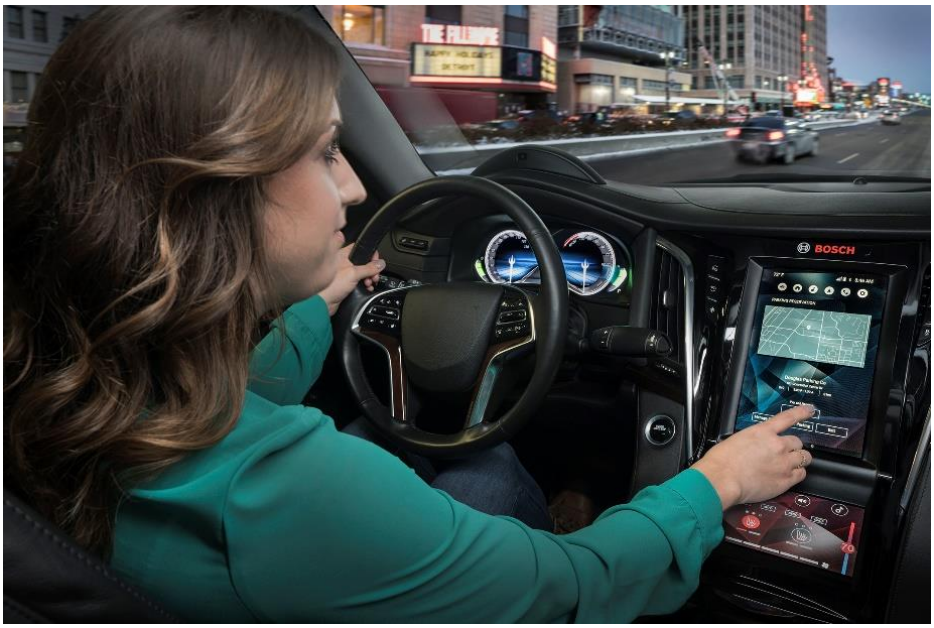


Photo: ww.bosch-presse.de/pressportal

Most of the work in this WG is finished with published reports. There seems to be little activity in SC39/WG8

Table 7 below shows the status of the WG 10 Human – Machine interfacing (January 2019).

Table 7: WG 10 HMI standards per January 2019

Standard title	**Status**
WG10 Human-Machine Interfacing	
EN ISO 15005:2017 (WI=00278402) Road vehicles - Ergonomic aspects of transportation and control systems - Dialogue management principles and compliance procedures (ISO 15005:2017)	Published

EN ISO 15006:2011 (WI=00278271) Road vehicles - Ergonomic aspects of transport information and control systems - Specifications for in-vehicle auditory presentation (ISO 15006:2011)	Published
EN ISO 15007-1:2014 (WI=00278280) Road vehicles - Measurement of driver visual behaviour with respect to transport information and control systems - Part 1: Definitions and parameters (ISO 15007-1:2014)	Published
EN ISO 15008:2017 (WI=00278345) Road vehicles - Ergonomic aspects of transport information and control systems - Specifications and test procedures for in-vehicle visual presentation (ISO 15008:2017)	Published
EN ISO 17287:2003 (WI=00278128) Road vehicles - Ergonomic aspects of transport information and control systems - Procedure for assessing suitability for use while driving (ISO 17287:2003)	Published

4.13 CEN/TC 278 WG 11 Subsystem and intersystem interfaces

The WG 11 is dormant.

4.14 CEN/TC 278 WG 12 Automatic Vehicle Identification (AVI) and Automatic Equipment Identification (AEI)

The WG is now dormant but was one of the earliest WG working with highly relevant ITS technologies for the time. The WG did run all meetings jointly in CEN and ISO. Identification in its various forms is still essential for many applications, requiring a good cooperation with other WGs. The registration regime defined in ISO14816 that was created by WG12 is for example used directly in the core Electronic Fee Collection standards. The details for registration can be found at https://www.tc278.eu/index.php/14816-register.

Photo: www.nedapidentification.com

There are three main groupings of AVI/AEI standards: The basic set of AVI/AEI standards for road vehicles (ISO 14814, 14815 and 14816), the intermodal freight standards (17261, 17262, 17263), and the Electronic Registration Identifier (ERI) series (17264, 24534-1/-4, 24535). Finally, an Interoperability Application Profile that specify how to apply AVI and ERI on top of CEN DSRC protocol is published as a European Standard (EN 16312) and a ISO standard (EN ISO 19061).

The Electronic registration Identification work may be of special interest since this work is directly aimed at public authorities. The idea is to combine electronic license plates and electronic registration papers in a way that respect European privacy laws. Vehicle identification is obviously sensitive for privacy issues, so careful attention has been made for cryptographic solutions that will manage privacy according to European legislation.

All the standards containing machine readable elements (ASN.1 code) were rewritten in 2015 to put the ASN.1 annexes freely available on the Internet. This is expected to improve the take-up and ease interoperability across the industry and the users.

Table 8 below shows the status of the WG 12 AVE/AEI standard (January 2019).

Table 8: WG 12 AVI/AEI standards per January 2019

Standard title	**Status**
WG12 AVI/AEI	
EN 16312:2013 (WI=00278285) Intelligent transport systems - Automatic Vehicle and Equipment Registration (AVI/AEI) - Interoperable application profile for AVI/AEI and Electronic Register Identification using dedicated short range communication	Published

Standard title	Status
WG12 AVI/AEI	
EN ISO 14814:2006 (WI=00278157) Road transport and traffic telematics - Automatic vehicle and equipment identification - Reference architecture and terminology (ISO 14814:2006)	Published
EN ISO 14815:2005 (WI=00278172) Road transport and traffic telematics - Automatic vehicle and equipment identification - System specifications (ISO 14815:2005)	Published
EN ISO 14816:2005 (WI=00278173) Road transport and traffic telematics - Automatic vehicle and equipment identification - Numbering and data structure (ISO 14816:2005)	Published
EN ISO 14816:2005/prA1 (WI=00278384) Road transport and traffic telematics - Automatic vehicle and equipment identification - Numbering and data structure - Amendment 1 (ISO 14816:2005/DAmd 1:2017)	Under Approval
EN ISO 17261:2012 (WI=00278263) Intelligent transport systems - Automatic vehicle and equipment identification - Intermodal goods transport architecture and terminology (ISO 17261:2012)	Published
EN ISO 17262:2012 (WI=00278264) Intelligent transport systems - Automatic vehicle and equipment identification - Numbering and data structures (ISO 17262:2012)	Published
EN ISO 17262:2012/AC:2013 (WI=00278C09) Intelligent transport systems - Automatic vehicle and equipment identification - Numbering and data structures - Technical Corrigendum 1 (ISO 17262:2012/Cor 1:2013)	Published
EN ISO 17262:2012/prA1 (WI=00278385) Intelligent transport systems - Automatic vehicle and equipment identification - Numbering and data structures - Amendment 1 (ISO 17262:2012/DAmd 1:2017)	Under Approval

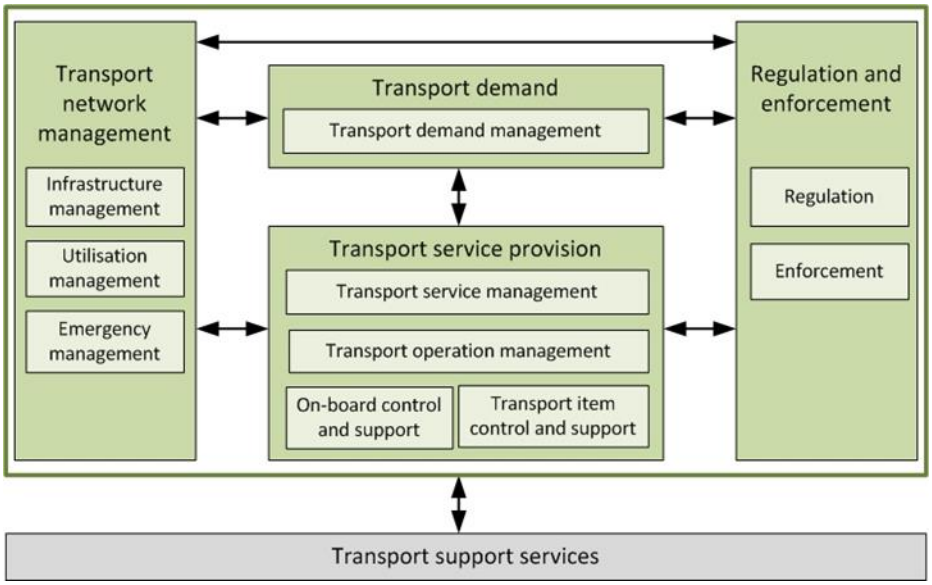
Standard title	Status
WG12 AVI/AEI	
EN ISO 17263:2012 (WI=00278265) Intelligent transport systems - Automatic vehicle and equipment identification - System parameters (ISO 17263:2012)	Published
EN ISO 17263:2012/AC:2013 (WI=00278C10) Intelligent transport systems - Automatic vehicle and equipment identification - System parameters - Technical Corrigendum 1 (ISO 17263:2012/Cor 1:2013)	Published
EN ISO 17264:2009 (WI=00278228) Intelligent transport systems - Automatic vehicle and equipment identification - Interfaces (ISO 17264:2009)	Published
EN ISO 17264:2009/prA1 (WI=00278386) Intelligent transport systems - Automatic vehicle and equipment identification - Interfaces - Amendment 1 (ISO 17264:2009/DAmd 1:2017)	Under Approval
EN ISO 24534-1:2010 (WI=00278229) Automatic vehicle and equipment identification - Electronic Registration Identification (ERI) for vehicles - Part 1: Architecture (ISO 24534-1:2010)	Published
EN ISO 24534-2:2010 (WI=00278230) Automatic vehicle and equipment identification - Electronic Registration Identification (ERI) for vehicles - Part 2: Operational requirements (ISO 24534-2:2010)	Published
EN ISO 24534-3:2016 (WI=00278302) Intelligent transport systems - Automatic vehicle and equipment identification - Electronic registration identification (ERI) for vehicles - Part 3: Vehicle data (ISO 24534-3:2016)	Published
EN ISO 24534-4:2010 (WI=00278232) Automatic vehicle and equipment identification - Electronic Registration Identification (ERI) for vehicles - Part 4: Secure communications using asymmetrical techniques (ISO 24534-4:2010)	Published
EN ISO 24534-4:2010/prA1 (WI=00278395) Automatic vehicle and equipment identification - Electronic registration	Under Approval

Standard title	Status
WG12 AVI/AEI	
identification (ERI) for vehicles - Part 4: Secure communications using asymmetrical techniques - Amendment 1 (ISO 24534-4:2010/DAmd 1:2017)	

4.15 CEN/TC 278 WG13 Architecture

CEN TC278 WG 13 is dormant.

WG13 was not part of the original work programme. Originally TC278 intended to handle architecture, terminology and several other such tasks directly at the TC level. After ISO TC204 started, it set up Architecture as WG1 because of its essential nature. It then became clear that architecture is so central that a reciprocal European WG had to be created, and the TC 278 level work was transferred to the newly created WG 13. According to the Vienna Agreement, most of the work was done in ISO, so there was less activity in WG 13 which was the main reason for making WG 13 dormant.



ARKTRANS ITS architecture

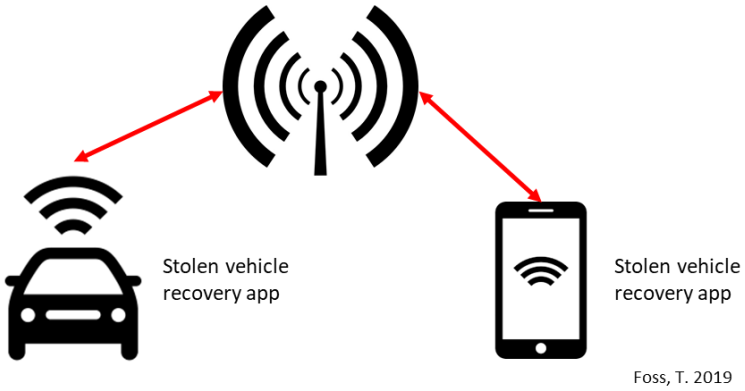
One specific European issue is the Privacy regulations, and this one is not under the joint work with ISO. The work done on privacy has been documented in the only standard published by WG 13.

WG13 Architecture and terminology	
CEN/TR 16742:2014 (WI=00278314) Intelligent transport systems - Privacy aspects in ITS standards and systems in Europe	Published

4.16 CEN/TC 278 WG 14 Recovery of stolen vehicles

WG 14 is dormant.

It was started as cooperation between police and insurance companies. The idea was originally to use ITS to track and recover stolen vehicles, in particular on border crossings. These standards are available but were never deployed widely because of better anti-theft technology in new cars.



Foss, T. 2019

This working group developed a suite of Technical Specifications (TS) for the location, tracking and recovery of stolen vehicles. The TS are not technology specific as they are designed to allow both short-range and long-range systems to detect and identify the stolen vehicle. Systems may therefore be GPS, GSM, direct bearing or electronic tagging based, or a combination of these. Therefore, this service may reside on a C-ITS platform.

The critical features are the testing of systems, accuracy of identification and location, the confirmation of report of crime and the timely and accurate passing of data between the stolen vehicle, infrastructure, monitoring agencies and law enforcement agencies at national or international level. All of which should lead to the lawful recovery of the vehicle and arrest of offenders.

An interesting investigation of new work was the viability of systems to remotely slow down and/or stop the engine of a known stolen vehicle or a vehicle that poses a significant risk to people. In the first instance this was seen to be relevant for heavy vehicles/special vehicles that could be used for terrorism and serious crime. This work has not progressed the last years, however it could be restarted on short notice depending on political requirements.

Table 9 below shows the status of the WG 14 Recovery of stolen vehicles standards (January 2019).

Table 9: WG 14 Recovery of stolen vehicles standards per January 2019

Standard title	**Status**
WG14 Recovery of stolen vehicles	
EN 15213-1:2013 (WI=00278333) Intelligent transport systems - After-theft systems for the recovery of stolen vehicles - Part 1: Reference architecture and terminology	Published
EN 15213-2:2013 (WI=00278335) Intelligent transport systems - After-theft systems for the recovery of stolen vehicles - Part 2: Common status message elements	Published

Standard title	Status
WG14 Recovery of stolen vehicles	
EN 15213-3:2013 (WI=00278336) Intelligent transport systems - After-theft systems for the recovery of stolen vehicles - Part 3: Interface and system requirements in terms of short-range communication system	Published
EN 15213-4:2013 (WI=00278334) Intelligent transport systems - After-theft systems for the recovery of stolen vehicles - Part 4: Interface and system requirements in terms of long-range communication system	Published
EN 15213-5:2013 (WI=00278337) Intelligent transport systems - After-theft systems for the recovery of stolen vehicles - Part 5: Messaging interface	Published
CEN/TS 15213-6:2011 (WI=00278214) Road transport and traffic telematics - After-theft services for the recovery of stolen vehicles - Part 6: Test procedures	Published

4.17 CEN/TC 278 WG 15 eSafety (eCall)

For the benefit of road users and society in general, eSafety is working for a quicker development and increased use of smart road safety (and eco-driving) technologies. They are called 'smart' because they are based on the powers of computers and telecoms.

Source: European Commission

Road traffic accidents in the Member States of the European Union claim about 25.600 lives and leave more than 1,4 million people injured in 2016

'eSafety technologies' help reduce these negative effects of road transport. They bring down the death toll and cut road traffic's energy consumption and CO2 exhausts.

This WG was created specifically to produce system level standards for the eCall directive which is the main eSafety system being standardised. Radio standards for eCall have been produced by ETSI 3GPP.

There are two different “types” of eCall:

- Pan-European eCall is the “normal” standard way to achieve this task
- Third-party eCall is based on already installed equipment in cars (e.g. Volvo On-call, BMW Assist Advanced eCall, Renault Odysline, Ford/Opel OnStar, Daimler TeleAid, etc) and is also allowed under the European Regulations

There are two different regulatory mechanisms involved:

- The majority of European vehicles are mandated to implement this function as part of Directive 2007/46/EC (often called the European Vehicle Type Approval Directive). New vehicle classes are still being added to the list of standards below.
- The infrastructure to receive emergency calls is called Public Service Answering Point (PSAP) and all EC/EEA countries are mandated to operate such a service according to the standards listed below.

Table 10 below shows the status of the WG 15 eSafety standards (January 2019).

Table 10: WG 15 eSafety standards per January 2019

Standard title	**Status**
WG15 e-safety	
CEN/TR 17249-1:2018 (WI=00278466) Intelligent transport systems - eSafety - Part 1: Extending eCall to other categories of vehicle	Published
CEN/TS 17249-2:2018 (WI=00278467) Intelligent transport systems - eSafety - Part 2 : eCall for HGVs and other commercial vehicles	Published
CEN/TS 17249-3:2018 (WI=00278468) Intelligent transport systems - eSafety - Part 3: eCall for Coaches and buses	Published
CEN/TS 17249-4:2019 (WI=00278469) Intelligent transport systems - eSafety - Part 4: eCall for UNECE Category T, R, S agricultural/forestry vehicles	Approved

Standard title	Status
WG15 e-safety	
FprCEN/TS 17249-5 (WI=00278470) Intelligent transport systems - eSafety - Part 5: eCall for UNECE Category L1 and L3 powered two-wheeled vehicles	Under Approval
FprCEN/TS 17249-6 (WI=00278471) Intelligent transport systems - eSafety - Part 6: eCall for UNECE Category L2, L4, L5, L6 and L7 tricycles and quadricycles	Under Approval
(WI=00278511) Intelligent transport systems - eSafety – eCall TPSP-PSAP data sharing exchange mechanism	Under Drafting
(WI=00278519) Intelligent transport systems - eSafety - eCall end to end conformance tests for P2WV, quadricycles and tricycles	Under Drafting
(WI=00278512) Intelligent transport systems - eSafety – eCall TPSP-PSAP CAP data format	Under Drafting
(WI=00278517) Intelligent transport systems - eSafety - eCall interface between PSAPS and dangerous goods or transport databases	Under Drafting
CEN/TS 16405:2017 (WI=00278350) Intelligent transport systems - Ecall - Additional data concept specification for heavy goods vehicles	Published
CEN/TS 17148:2018 (WI=00278400) Intelligent Transport Systems - eSafety - ProForma eCall Agreement between TPSP and PARES	Published
CEN/TS 17182:2018 (WI=00278453) Intelligent transport systems - eSafety - eCall via an ITS-station	Published

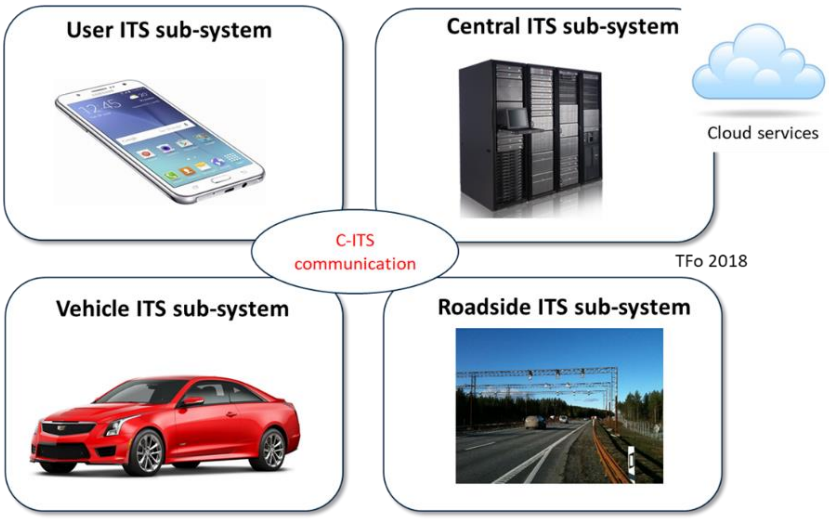
Standard title	Status
WG15 e-safety	
CEN/TS 17184:2018 (WI=00278452) Intelligent transport systems - eSafety - eCall High level application Protocols (HLAP) using IMS packet switched networks	Published
CEN/TS 17234:2018 (WI=00278463) Intelligent transport systems - eSafety - eCall: Tests to enable PSAPs to demonstrate conformance and performance	Published
CEN/TS 17240:2018 (WI=00278460) Intelligent transport systems - ESafety - ECall end to end conformance testing for IMS packet switched based systems	Published
EN 15722:2015 (WI=00278376) Intelligent transport systems - ESafety - ECall minimum set of data	Published
EN 16062:2015 (WI=00278378) Intelligent transport systems - ESafety - eCall high level application requirements (HLAP) using GSM/UMTS circuit switched networks	Published
EN 16072:2015 (WI=00278375) Intelligent transport systems - ESafety - Pan-European eCall operating requirements	Published
EN 16102:2011 (WI=00278244) Intelligent transport systems - eCall - Operating requirements for third party support	Published
EN 16454:2015 (WI=00278349) Intelligent transport systems - ESafety - ECall end to end conformance testing	Published
FprCEN/TS 17312 (WI=00278476) Intelligent transport systems - eSafety - eCall via satellite	Under Approval
FprCEN/TS 17313 (WI=00278401) Intelligent transport systems - ESafety - Interoperability and user choice in eCall aftermarket and third party eCall services	Under Approval

Standard title	Status
WG15 e-safety	
FprCEN/TS 17363 (WI=00278431) Intelligent transport systems - eCall optional additional data - Linked mobile phone number data concept	Published
prCEN/TS (WI=00278518) Intelligent transport systems - eSafety - eCall for automated and autonomous vehicles	Under Drafting
prEN 15722 (WI=00278493) Intelligent transport systems - ESafety - ECall minimum set of data	Under Approval
prEN 17358 (WI=00278494) Intelligent transport systems - ESafety - eCall OAD for multiple Optional Additional Datasets	Under Approval
EN ISO 24978:2009 (WI=00278206) Intelligent transport systems - ITS Safety and emergency messages using any available wireless media - Data registry procedures (ISO 24978:2009)	Published

4.18 CEN/TC 278 WG16 Co-operative systems

Cooperative systems are ITS systems based on vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I, I2V) and infrastructure-to-infrastructure (I2I) communications for the exchange of information, where data are shared between different applications. In principle, the personal end users are also involved via smartphones and similar devices, but so far there are few standardised services aimed at the end users.

As the name indicates the goal is to construct systems that can cooperate and communicate efficiently in a safe and secure manner. Cooperative ITS (C-ITS) have the potential to increase the benefits of ITS services and applications.



ITS sub-systems

WG 16 is an initiative coming out of Europe to answer the European ITS Roadmap and ITS Directive, and in particular linked to the C-ITS Delegated Act. This WG is fully joint with ISO TC 204 WG 18.

Much of the original work load was completed during 2014-2018, but some new work items are being worked on. There are more than 80 experts registered from 17 countries around the world; more than half of the experts coming from Europe. The work inside WG16 has been a mix of architecture and management, applications/services related cyber security, and internal functions related to efficient coordination and communication.

The overall goal is to achieve interoperability in data formats and transfer capabilities, so the systems can "talk together" and exchange understandable and sufficient information. This work is of great importance to achieve the goals of data sharing, not only local within vehicles systems and between the vehicle and the national traffic data bases, but also across borders and international systems.

SAE and ETSI have been working in close collaboration with WG16 in order to harmonize the content of their message sets used in SAE J2735, SAE J2945 and ETSI CAM&DENM.

The Table 11 below shows the status of the WG 16 Co-operative systems standards (January 2019).

Please also refer to ISO TC204 WG18 Co-operative systems since ISO often is ahead of CEN WGs.

Table 11: WG 16 Co-operative systems Standards per January 2019

Standard title	Status
WG16 Co-operative systems	
CEN ISO/TS 17425:2016 (WI=00278287) Intelligent transport systems - Cooperative systems - Data exchange specification for in-vehicle presentation of external road and traffic related data (ISO/TS 17425:2016)	Published

Standard title	Status
WG16 Co-operative systems	
CEN ISO/TS 17426:2016 (WI=00278289) Intelligent transport systems - Cooperative systems - Contextual speeds (ISO/TS 17426:2016)	Published
CEN ISO/TS 17429:2017 (WI=00278288) Intelligent transport systems - Cooperative ITS - ITS station facilities for the transfer of information between ITS stations (ISO/TS 17429:2017)	Published
CEN ISO/TS 19091:2017 (WI=00278396) Intelligent transport systems - Cooperative ITS - Using V2I and I2V communications for applications related to signalized intersections (ISO/TS 19091:2017)	Published
CEN ISO/TS 19321:2015 (WI=00278360) Intelligent transport systems - Cooperative ITS - Dictionary of in-vehicle information (IVI) data structure (ISO/TS 19321:2015)	Published
EN ISO 17419:2018 (WI=00278419) Intelligent transport systems - Cooperative systems - Globally unique identification (ISO 17419:2018)	Published
EN ISO 17423:2018 (WI=00278459) Intelligent transport systems - Cooperative systems - Application requirements and objectives (ISO 17423:2018)	Published
EN ISO 17427-1:2018 (WI=00278393) Intelligent transport systems - Cooperative ITS - Part 1: Roles and responsibilities in the context of co-operative ITS architecture(s) (ISO 17427-1:2018)	Published
EN ISO 18750:2018 (WI=00278403) Intelligent transport systems - Co-operative ITS - Local dynamic map (ISO 18750:2018)	Published
FprCEN ISO/TS 21189 (WI=00278496) Intelligent transport systems - Cooperative ITS - Test requirements and Protocol	Under Approval

Standard title	Status
WG16 Co-operative systems	
Implementation Conformance Statement (PICS) pro forma for CEN ISO/TS 17426 (ISO/PRF TS 21189:2018)	
prCEN ISO/TR 21186 (WI=00278436) Intelligent transport systems - Cooperative ITS - Guidelines on the use of C-ITS standards for hybrid communications	Under Drafting
prCEN ISO/TS 19091 rev (WI=00278461) Intelligent transport systems - Cooperative ITS - Using V2I and I2V communications for applications related to signalized intersections	Under Approval
prCEN ISO/TS 19321 rev (WI=00278509) Intelligent transport systems - Cooperative ITS - Dictionary of in-vehicle information (IVI) data structures	Under Drafting
prCEN ISO/TS 21176 (WI=00278437) Intelligent transport systems - Cooperative ITS - Position, velocity and time functionality in the ITS station	Under Drafting
prEN ISO 17429 (WI=00278462) Intelligent transport systems - Cooperative ITS - ITS station facilities for the transfer of information between ITS stations	Under Drafting

4.19 CEN/TC 278 WG 17 Urban ITS

Urban ITS is the most recent working group of CEN. It was created in 2017 as an initiative from the European Commission, answering a need expressed by city authorities around Europe. EC studies started in the early 2000 showed a need to develop coherent standards for the urban environment.

The work has been run under a EC Mandate (M/546 Urban ITS) that defined the initial targets and critical standardisation areas. The first document was a large study on actual needs based on interviews with more than 100 urban authorities around Europe. The common areas turned out to be focused on three main pillars; namely Multimodal Information Systems for how public transport and new transport modes (car sharing, bike rental, electric push-bikes, etc) can be seamlessly integrated in an end-to-end information system. The second pillar was Traffic Management including intersection control, where Europe has some national standards, but many countries rely on proprietary products with all challenges following from vendor lock-in etc. The third pillar was Urban Logistics for parking and loading/unloading bays in city centres.

This field has developed rapidly, mainly due to the EC providing Project Team funding for many critical standards under M/546. The first set of standards covering the multimodal and traffic management are now complete and ready for (pilot) deployment. Parking has been a bit slower, but the parking industry has recently started working together to produce standards.

Recently, the focus has moved to future needs. The public attention on vehicle automation is setting new requirements for the authority side, particularly in urban but also in suburban and interurban context. Therefore, a new set of standardisation initiatives have been proposed dealing with electronic traffic regulations and how automated vehicles will relate to the infrastructure. This work is now decided to be executed jointly with ISO TC204/WG19 Mobility Integration, and the details can be found in 5.16 ISO/TC 204 WG 19 Mobility Integration.

Photo: Standard Norge

Table 12 below shows the status of the WG 17 Urban ITS standards (January 2019).

CEN Management Centre has prepared a brochure that can be downloaded here.

Table 12: WG 17 Urban ITS standards per January 2019

Standard title	Status
WG17 Urban ITS	
(WI=00278491) Intelligent transport systems - Urban ITS - Models and definitions for new modes	Under Drafting
(WI=00278522) Intelligent transport systems - Urban ITS - Mixed vendor environments, methodologies & translators	Under Drafting
(WI=00278428) Intelligent transport systems - Urban ITS - Air quality management in urban areas	Under Drafting
CEN/TR 17143:2017 (WI=00278454) Intelligent transport systems - Standards and actions necessary to enable urban infrastructure coordination to support Urban-ITS	Published
FprCEN/TS 17241 (WI=00278478) Intelligent transport systems - Traffic management systems - Status, fault and quality requirements	Under Approval
(WI=00278523) Intelligent transport systems - Traffic management systems – TM interfaces and information	Under Drafting
FprCEN/TR 17297-1 (WI=00278474) Intelligent transport systems - Location referencing harmonization for Urban ITS - Part 1: State of the art and guidelines	Under Approval
FprCEN/TS 17297-2 (WI=00278473) Intelligent transport systems - Location referencing harmonization for Urban ITS - Part 2: Transformation methods	Under Approval
(WI=00278521) Intelligent transport systems - DATEX II data exchange specifications for	Under Drafting

Standard title	Status
traffic management and information - Part 8: Traffic management publications and extensions dedicated to the urban environment	
(WI=00278520) Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 9: Traffic signal management publications dedicated to the urban environment	Under Drafting
prEN (WI=00278501) Intelligent transport systems - Urban-ITS - 'Controlled Zone' management using C-ITS	Under Approval

5 ISO/TC 204 Intelligent transport systems

5.1 Introduction

ISO TC204 is the International ITS committee. It was originally called Transport Information Control Systems (TICS) but changed its name to Intelligent Transport Systems some years ago. This was the second ITS standardisation body to start after CEN TC278.

TC204 was patterned on TC278, and the cooperation is regulated by the Vienna Agreement (VA) between ISO and CEN, which means that many working groups have joint meetings and joint voting procedures to ensure alignment.

All Work Items, both drafts and finished standards, can be searched via this search engine in this ISO search page. ISO has also implemented an online browsing tool that enables reading the first chapters of the standards.

5.2 ITS Application areas

ISO/TC 204 has several Working Groups (WG), each responsible for a specific ITS area as shown in. Figure 2: ISO/TC 204 working groups in 2019

Figure 2: ISO/TC 204 working groups in 2019

The following working groups are dormant (2019):

- WG 2 Quality and reliability requirements
- WG 4 Automatic Vehicle and Equipment Identification
- WG 6 General fleet management
- WG 11 Route guidance and navigation systems
- WG 12 Parking management/Off-road commercial
- WG 13 Man – Machine interface (Off-vehicle)
- WG 15 Dedicated Short-Range Communication and for TICS Applications (deleted, work transferred to WG 16 Communications)

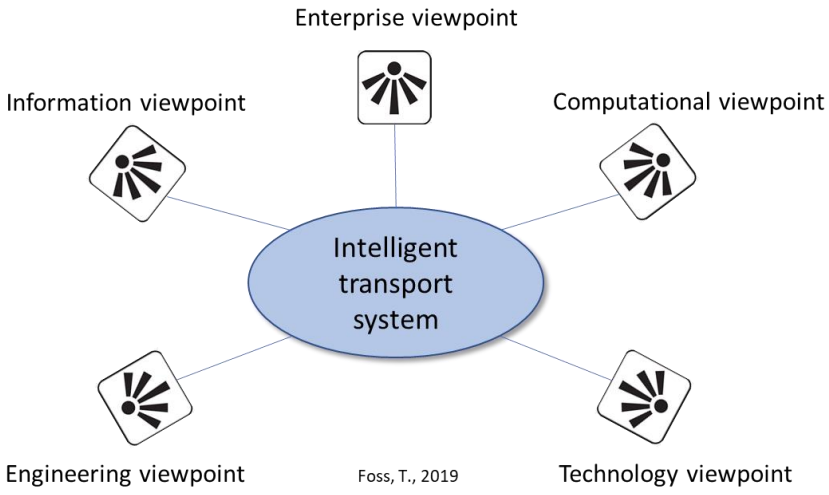
The following table shows the joint working groups in CEN TC278 and ISO TC204.

Table 13: Joint working groups in ISO/TC 204 and CEN/TC 278

ISO/TC 204 Working Groups	CEN/TC 278 Working groups
WG 1 Architecture	WG 13 Architecture (dormant)
WG 5 Fee and toll collection	WG1 Electronic Fee Collection
WG 8 Public transport/emergency	WG 3 Public Transport
WG 9 Integrated transport information, management and control	WG 8 Road Traffic data
WG 10 Traveller information systems	WG 4 Traffic and Traveller information (dormant)
WG 18 Cooperative systems	WG 16 Cooperative ITS
WG 19 Integrated mobility	WG 17 Urban ITS

5.3 ISO/TC 204 WG1 Architecture

WG1 is an active WG producing standards that mainly support ITS specification tasks. The WG is responsible for maintaining terms and dictionaries and has links to basic ITS architectures such as the European FRAME work and the US National ITS Architecture work.



Several of the standards describe how to write other ITS standards, so this can be considered meta-standards. Examples are how to include machine readable data definitions like XML and ASN.1 in the standards, and how to use UML effectively to describe architectures and processes in ITS standards

Recent work is aimed at producing a global registry of all ITS Data elements to avoid proliferation and confusion over nearly-similar data being defined in each standard. Such a registry is believed to be essential for the deployment of C-ITS.

Another active work area is the need for global registration of essential identifers. There is currently ongoing work to establish regional registrars based on standards from WG16 and WG1.

This Working Group continues to support and work with CEN TC278 WG16, ISO TC204 WG19 and other WG's to assist in the creation of some of the standards relevant for horizontal coordination.

The standards published by WG 1 Architecture is shown in Table 14 below. The source is https://sd.iso.org/projects/my-projects and the Stage codes are shown below.

00. Preliminary stage	30. Committee stage	60. Publication stage
10. Proposal stage	40. Enquiry stage	90. Review stage
20. Preparatory stage	50. Approval stage	95. Withdrawal stage

Table 14: WG 1 Architecture standards per January 2019

Standard ref.	Standard title	Stage
	WG1 Architecture	
ISO/TR 26999:2012	Intelligent transport systems -- Systems architecture -- Use of process-oriented methodology in ITS International Standards and other deliverables	60.60
ISO/TR 25104:2008	Intelligent transport systems -- System architecture, taxonomy, terminology and data modelling -- Training requirements for ITS architecture	60.60
ISO/TR 25102:2008	Intelligent transport systems -- System architecture -- 'Use Case' pro-forma template	60.60
ISO/TR 25100:2012	Intelligent transport systems -- Systems architecture -- Harmonization of ITS data concepts	60.60
ISO/TR 24532:2006	Intelligent transport systems -- Systems architecture, taxonomy and terminology -- Using CORBA (Common Object Request Broker Architecture) in ITS standards, data registries and data dictionaries	60.60
ISO 24531:2013	Intelligent transport systems -- System architecture, taxonomy and terminology -- Using XML in ITS standards, data registries and data dictionaries	90.92
ISO/NP 24531-2	Intelligent transport systems -- System architecture, taxonomy and terminology -- Part 2: Using ASN.1 in ITS standards, data registries and data dictionaries	10.00
ISO/TR 24529:2008	Intelligent transport systems -- Systems architecture -- Use of unified modelling language (UML) in ITS International Standards and deliverables	60.60

Standard ref.	Standard title	Stage
	WG1 Architecture	
ISO/NP TR 24098	Intelligent transport systems -- System architecture, taxonomy and terminology -- Procedures for developing ITS deployment plans utilizing ITS system architecture	10.99
ISO/TR 24098:2007	Intelligent transport systems -- System architecture, taxonomy and terminology -- Procedures for developing ITS deployment plans utilizing ITS system architecture	90.92
ISO 24097-1:2017	Intelligent transport systems -- Using web services (machine-machine delivery) for ITS service delivery -- Part 1: Realization of interoperable web services	60.60
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	60.60
ISO/TR 24097-3	Intelligent transport systems -- Using web services (machine-machine delivery) for ITS service delivery -- Part 3: Quality of service	60.00
ISO/PWI TS 23728-1	Intelligent transport systems -- Use of UML in ITS standards -- Part 1: Content of ITS data models	00.00
ISO/PWI TS 23728-2	Intelligent transport systems -- Use of UML in ITS standards -- Part 2: Version control procedures	00.00
ISO/PWI 23507	Intelligent transport systems -- Management of electronic privacy regulations (MEPR)	00.00
ISO/AWI TR 23255	Intelligent transport systems -- Architecture -- Applicability of data distribution technologies within ITS	20.00
ISO/AWI TR 23254	Intelligent transport systems -- Architecture -- Use cases and high-level reference architecture for connected, automated vehicles	20.00
ISO/TR 17465-1:2014	Intelligent transport systems -- Cooperative ITS -- Part 1: Terms and definitions	60.60
ISO/TR 17465-2:2015	Intelligent transport systems -- Cooperative ITS -- Part 2: Guidelines for standards documents	60.60
ISO/TR 17465-3:2015	Intelligent transport systems -- Cooperative ITS -- Part 3: Release procedures for standards documents	60.60
ISO/TR 17452:2007	Intelligent transport systems -- Using UML for defining and documenting ITS/TICS interfaces	60.60
ISO/CD 17419-2	Intelligent transport systems -- Identifiers -- Part 2: Management and operation of registries	30.60

Standard ref.	Standard title	Stage
	WG1 Architecture	
ISO 14817-1:2015	Intelligent transport systems -- ITS central data dictionaries -- Part 1: Requirements for ITS data definitions	60.60
ISO 14817-2:2015	Intelligent transport systems -- ITS central data dictionaries -- Part 2: Governance of the Central ITS Data Concept Registry	60.60
ISO 14817-3:2017	Intelligent transport systems -- ITS data dictionaries -- Part 3: Object identifier assignments for ITS data concepts	60.60
ISO 14813-1:2015	Intelligent transport systems -- Reference model architecture(s) for the ITS sector -- Part 1: ITS service domains, service groups and services	90.93
ISO/DIS 14813-5	Intelligent transport systems -- Reference model architecture(s) for the ITS sector -- Part 5: Requirements for architecture description in ITS standards	40.60
ISO 14813-5:2010	Intelligent transport systems -- Reference model architecture(s) for the ITS sector -- Part 5: Requirements for architecture description in ITS standards	90.92
ISO 14813-6:2017	Intelligent transport systems -- Reference model architecture(s) for the ITS sector -- Part 6: Use of ASN.1	60.60
ISO/NP TR 14812	Intelligent transport systems - Terminology	10.99
ISO/AWI TR 12859	Intelligent transport systems -- System architecture -- Privacy aspects in ITS standards and systems	20.00
ISO/TR 12859:2009	Intelligent transport systems -- System architecture -- Privacy aspects in ITS standards and systems	90.92

5.4 ISO/TC 204 WG2 Quality and reliability requirements

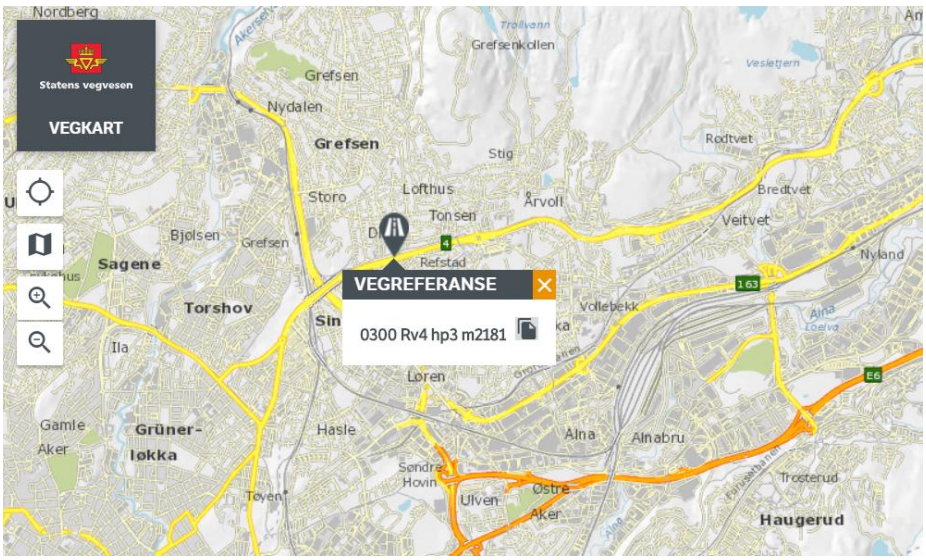
This was a proposed WG from USA, but it never got the necessary support to start real work. This WG is dormant.

5.5 ISO/TC 204 WG3 Database technology

WG 3 is focusing on electronic maps relevant for the ITS area. As such, it maintains the European-based Geographical Data Files (GDF) standard series.

GDF is an international standard that is used to model, describe and transfer road networks and other geographic data.

Apart from that, this WG has mainly concentrated on map databases and common interfaces for navigation systems.



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The standards published by WG 3 Database technology is shown in Table 15 below. The source is https://sd.iso.org/projects/my-projects and the Stage codes are shown below.

00. Preliminary stage	30. Committee stage	60. Publication stage
10. Proposal stage	40. Enquiry stage	90. Review stage
20. Preparatory stage	50. Approval stage	95. Withdrawal stage

Table 15: WG 3 Database technology standards per January 2019

Standard ref.	Standard title	Stage
	WG3 ITS Database Technology	
ISO/DIS 19297-1	Intelligent transport systems -- Shareable geospatial databases for ITS applications -- Part 1: Framework	40.60

Standard ref.	Standard title	Stage
	WG3 ITS Database Technology	
ISO/CD 20524-2	Intelligent transport systems -- Geographic Data Files (GDF) GDF5.1 -- Part 2: Map data used in automated driving systems, Cooperative ITS, and multi-modal transport	30.60
ISO/CD 17572-4	Intelligent transport systems -- Location referencing for geographic databases -- Part 4: Lane-level location referencing	30.60
ISO 24099:2011	Navigation data delivery structures and protocols	90.93
ISO/AWI TS 22726-1	Intelligent transport systems -- Dynamic data and map database specification for connected and automated driving system applications -- Part 1: Architecture and data model for harmonization of static map data	20.00
ISO/PWI TS 22726-2	Intelligent transport systems -- Dynamic data and map database specification for connected and automated driving system applications -- Part 2: Data model of static transitory and dynamic transitory data	00.00
ISO/TR 21718	Intelligent transport systems -- Spatio-temporal data dictionary for cooperative ITS and automated driving systems 2.0	60.00
ISO/TR 21718:2017	Intelligent transport systems -- Spatio-temporal data dictionary for cooperative ITS and automated driving systems	90.92
ISO/DIS 20524-1	Intelligent transport systems -- Geographic Data Files (GDF) -- GDF5.1 -- Part 1: Application independent map data shared between multiple sources	40.60
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	90.93
ISO/NP 19297-4	Intelligent transport systems -- Shareable geospatial databases for ITS applications -- Part 4: Common data structure	10.20
ISO 17572-1:2015	Intelligent transport systems (ITS) -- Location referencing for geographic databases -- Part 1: General requirements and conceptual model	60.60
ISO 17572-2:2018	Intelligent transport systems (ITS) -- Location referencing for geographic databases -- Part 2: Pre-coded location references (pre-coded profile)	60.60
ISO 17572-3:2015	Intelligent transport systems (ITS) -- Location referencing for geographic databases -- Part 3: Dynamic location references (dynamic profile)	60.60

Standard ref.	Standard title	Stage
	WG3 ITS Database Technology	
ISO 17267:2009	Intelligent transport systems -- Navigation systems -- Application programming interface (API)	90.93
ISO 14825:2011	Intelligent transport systems -- Geographic Data Files (GDF) -- GDF5.0	90.93
ISO 14296:2016	Intelligent transport systems -- Extension of map database specifications for applications of cooperative ITS	60.60

5.6 ISO/TC 204 WG4 Automatic Vehicle and Equipment Identification (AVI/AEI)

This WG was fully joint with CEN/TC 278 WG 12 and is now dormant.

Please refer to Chapter 4.14 CEN/TC 278 WG 12 Automatic Vehicle Identification (AVI) and Automatic Equipment Identification (AEI)on page 45.

5.7 ISO/TC 204 WG5 Electronic Fee Collection (EFC)

This is a fully joint WG with CEN/TC 278 WG1.

Please refer to chapter 4.3 CEN/TC 278 WG 1 Electronic Fee Collection (EFC) on page 17.

5.8 ISO/TC 204 WG7 Commercial Fleet Management

WG7 is focusing on heavy vehicle and goods management across the world.

The scope of WG7 is intermodal in its nature, and there has been a close relationship with WG4 (AVI/AEI) resulting in standards with cross references. The main adopted standard relates to hazardous materials electronic marking, and this may be relevant for controlling and monitoring access of dangerous goods to sensitive areas (city centres, tunnels etc).

Another area of WG7 is the TARV series of standards for heavy commercial vehicles. This work has mainly been led from Australia and Japan who have large scale programs implementing these standards. interchanges.

Photo: Tore Medgard / Statens vegvesen

This WG is central to "green (and safe) goods transport". Efforts to decrease fuel consumption, better usage of multimodal transport, good overview of trailers to minimize empty carriage transport etc. will all be part of a green transport effort and is linked to the EC directives and actions.

The standards published by WG 7 General fleet management and commercial/freight is shown in Table 16 below. The source is https://sd.iso.org/projects/my-projects and the Stage codes are shown below.

00. Preliminary stage	30. Committee stage	60. Publication stage
10. Proposal stage	40. Enquiry stage	90. Review stage
20. Preparatory stage	50. Approval stage	95. Withdrawal stage

Table 16: WG 7 General fleet management and commercial/Freight standards per January 2019

Standard ref.	**Standard title**	**Stage**
	WG7 General fleet management and commercial/freight	
ISO/CD 15638-4	Intelligent transport systems -- Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) -- Part 4: System security requirements	30.99
ISO/DIS 15638-9	Intelligent transport systems -- Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) -- Part 9: Remote electronic tachograph monitoring (RTM)	40.60

Standard ref.	Standard title	Stage
	WG7 General fleet management and commercial/freight	
ISO 26683-1:2013	Intelligent transport systems -- Freight land conveyance content identification and communication -- Part 1: Context, architecture and referenced standards	90.93
ISO 26683-2:2013	Intelligent transport systems -- Freight land conveyance content identification and communication -- Part 2: Application interface profiles	90.93
ISO/DIS 26683-3	Intelligent transport systems -- Freight land conveyance content identification and communication -- Part 3: Monitoring cargo condition information during transport	40.60
ISO/DTS 24533	Intelligent transport systems -- Electronic information exchange to facilitate the movement of freight and its intermodal transfer -- Road transport information exchange methodology	30.99
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	90.92
ISO 18495-1:2016	Intelligent transport systems -- Commercial freight -- Automotive visibility in the distribution supply chain -- Part 1: Architecture and data definitions	60.60
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	90.93
ISO/DTS 17187	Intelligent transport systems -- Electronic information exchange to facilitate the movement of freight and its intermodal transfer -- Governance rules to sustain electronic information exchange methods	30.99
ISO/TS 17187:2013	Intelligent transport systems -- Electronic information exchange to facilitate the movement of freight and its intermodal transfer -- Governance rules to sustain electronic information exchange methods	90.92
ISO 15638-1:2012	Intelligent transport systems -- Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) -- Part 1: Framework and architecture	90.60
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	90.60
ISO 15638-3:2013	Intelligent transport systems -- Framework for collaborative telematics applications for regulated commercial freight vehicles	90.60

Standard ref.	Standard title	Stage
	WG7 General fleet management and commercial/freight	
	(TARV) -- Part 3: Operating requirements, 'Approval Authority' procedures, and enforcement provisions for the providers of regulated services	
ISO 15638-5:2013	Intelligent transport systems -- Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) -- Part 5: Generic vehicle information	90.60
ISO 15638-6:2014	Intelligent transport systems -- Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) -- Part 6: Regulated applications	60.60
ISO 15638-7:2013	Intelligent transport systems -- Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) -- Part 7: Other applications	90.60
ISO 15638-8:2014	Intelligent transport systems -- Framework for cooperative telematics applications for regulated vehicles (TARV) -- Part 8: Vehicle access management	60.60
ISO/TS 15638-9:2013	Intelligent transport systems -- Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) -- Part 9: Remote electronic tachograph monitoring (RTM)	90.92
ISO 15638-10:2017	Intelligent transport systems -- Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) -- Part 10: Emergency messaging system/eCall	60.60
ISO 15638-11:2014	Intelligent transport systems -- Framework for cooperative telematics applications for regulated vehicles (TARV) -- Part 11: Driver work records	60.60
ISO 15638-12:2014	Intelligent transport systems -- Framework for cooperative telematics applications for regulated vehicles (TARV) -- Part 12: Vehicle mass monitoring	60.60
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	90.20
ISO 15638-14:2014	Intelligent transport systems -- Framework for cooperative telematics applications for regulated vehicles (TARV) -- Part 14: Vehicle access control	60.60
ISO 15638-15:2014	Intelligent transport systems -- Framework for cooperative telematics applications for regulated vehicles (TARV) -- Part 15: Vehicle location monitoring	60.60

Standard ref.	Standard title	Stage
	WG7 General fleet management and commercial/freight	
ISO 15638-16:2014	Intelligent transport systems -- Framework for cooperative telematics applications for regulated vehicles (TARV) -- Part 16: Vehicle speed monitoring	60.60
ISO 15638-17:2014	Intelligent transport systems -- Framework for cooperative telematics applications for regulated vehicles (TARV) -- Part 17: Consignment and location monitoring	60.60
ISO 15638-18:2017	Intelligent transport systems -- Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) -- Part 18: ADR (Dangerous Goods)	60.60
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)	90.93
ISO/DIS 15638-20	Intelligent transport systems -- Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) -- Part 20: Weigh-in-motion monitoring	40.00
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	60.60
ISO/FDIS 15638-22	Intelligent transport systems -- Framework for collaborative telematics applications for regulated commercial freight vehicles (TARV) -- Part 22: Freight vehicle stability monitoring	50.00
ISO/PWI 15638-23	Intelligent transport systems -- Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) -- Part 23: Tyre monitoring	00.00

5.9 ISO/TC 204 WG8 Public transport/emergency

WG8 were not very active initially, but work has increased the last years. It has a split scope since it covers both public transport and emergency services, but most work has concentrated on public transport and relatively little on emergency services. WG8 has recently been moving closer to the more active CEN TC278/WG3 as far as public transport is concerned. There is some exchange of documents and experts in the domain for ticketing system standards between the groups and there is a joint work on the Interoperable Fare Management System architecture standard (ISO 24014-1).

Photo: AtB AS

Reaching good cooperation between different transports systems is an important area for effective transport of people and goods, in addition to effective emergency handling.

The standards published by WG 8 Public transport/emergency is shown in Table 17 below. The source is https://sd.iso.org/projects/my-projects and the Stage codes are shown below.

00. Preliminary stage	30. Committee stage	60. Publication stage
10. Proposal stage	40. Enquiry stage	90. Review stage
20. Preparatory stage	50. Approval stage	95. Withdrawal stage

Table 17: WG 8 Public transport/emergency standards per January 2019

Standard ref.	Standard title	Stage
	WG8 Public transport/emergency	
ISO/PWI 21733	Intelligent transport systems -- Public transport -- Synchronization of terminology and role models	00.00
ISO/PWI 21345	Intelligent transport systems -- Public transport -- Electric vehicle charging infrastructure for bus rapid transit (BRT)	00.00
ISO/PWI 21344	Intelligent transport systems - Public transport - Emergency services E-Call device for emergency on connected vehicles using ITS station	00.00
ISO/NP 24014-1	Public transport -- Interoperable fare management system -- Part 1: Architecture	10.99

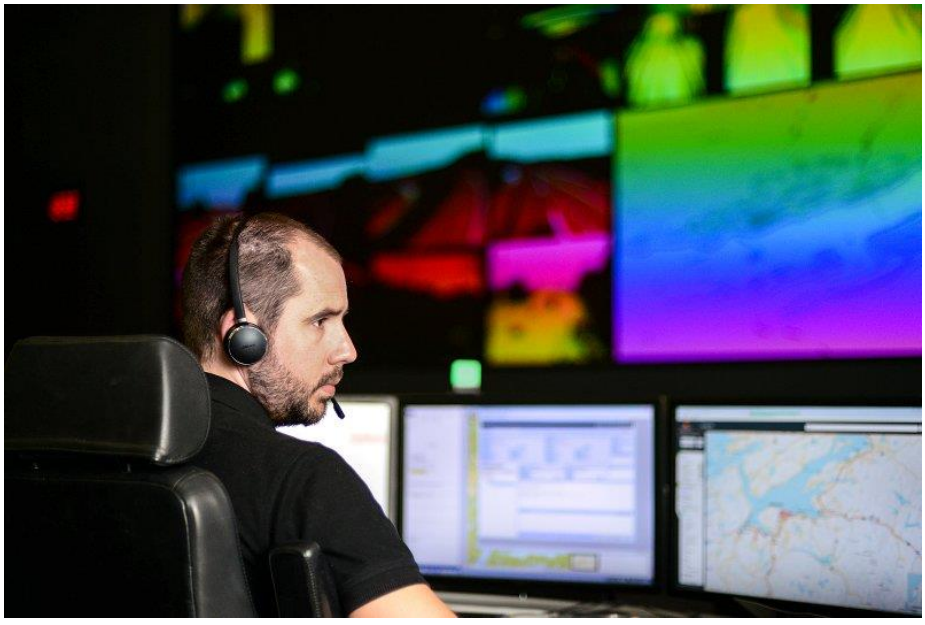
Standard ref.	Standard title	Stage
	WG8 Public transport/emergency	
ISO 24014-1:2015	Public transport -- Interoperable fare management system -- Part 1: Architecture	90.92
ISO/TR 24014-2:2013	Public transport -- Interoperable fare management system -- Part 2: Business practices	60.60
ISO/TR 24014-3:2013	Public transport -- Interoperable fare management system -- Part 3: Complementary concepts to Part 1 for multi-application media	60.60
ISO 22951:2009	Data dictionary and message sets for pre-emption and prioritization signal systems for emergency and public transport vehicles (PRESTO)	90.93
ISO/AWI 21734	Intelligent transport systems -- Public transport -- Performance testing for connectivity and safety functions of automated driving bus	20.00
ISO/DTR 21724-1	Intelligent transport systems -- Common transport service account systems -- Part 1: Framework and use cases	30.99
ISO/AWI TR 20527	Intelligent transport systems -- Interoperability between IFM systems and NFC mobile devices	20.00
ISO/TR 20526:2017	Account-based ticketing state of the art report	60.60
ISO/TR 19083-1:2016	Intelligent transport systems -- Emergency evacuation and disaster response and recovery -- Part 1: Framework and concept of operation	60.60
ISO/NP 19083-3	Intelligent transport systems -- Public transport -- Emergency evacuation and disaster response and recovery -- Part 3: Use cases	10.00
ISO 17185-1:2014	Intelligent transport systems -- Public transport user information -- Part 1: Standards framework for public information systems	60.60
ISO/TR 17185-2:2015	Intelligent transport systems -- Public transport user information -- Part 2: Public transport data and interface standards catalogue and cross references	60.60
ISO/TR 17185-3:2015	Intelligent transport systems -- Public transport user information -- Part 3: Use cases for journey planning systems and their interoperation	60.60
ISO/NP 17185-4	Intelligent transport systems -- Public transport user information -- Part 4: Use cases for mobility journey planning systems and their inter-operation	10.00
ISO/NP 17185-5	Intelligent transport systems -- Part 5: Governance of mandatory public transport standards	10.00

Standard ref.	Standard title	Stage
	WG8 Public transport/emergency	
ISO/NP 17185-6	Intelligent transport systems -- Part 6: Modelling stops and network topology	10.00
ISO/NP 17185-7	Intelligent transport systems -- Part 7: Conformance test of interoperable fare management system (ISO 24014-1)	10.00
ISO/NP 17185-8	Intelligent transport systems -- Part 8: Framework message architecture	10.00
ISO/TR 14806:2013	Intelligent transport systems -- Public transport requirements for the use of payment applications for fare media	60.60

5.10 ISO/TC 204 WG9 Integrated transport information, management and control

This is a very active working group centred on the needs from Road Authorities for information interoperability and sharing. The WG consists of a mix of suppliers and authorities, but with relatively little participation from the European side who have focused on CEN TC278 WG8.

WG9 spans a relatively wide area of ITS by looking at data centres including Centre-to-Centre and Centre-to-Roadside communications. The scope includes relevant interface protocols, data definitions/data dictionary, simulation models and quality of data. WG9 is trying to standardise roadside controller interfaces as well as central to central interfaces, but there has been some resistance and challenges to this undertaking, mainly due to regional differences on approaches and existing deployment.



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WG9 is also in relatively close contact with CEN TC278 WG8 but these WGs are not joint. WG9 is the home of DATEX-ASN in ISO which is very different from the DATEX-II models used in Europe. Also, NTCIP which is the US infrastructure protocol is standardised here for the non-US market.

The standards published by WG 9 Public transport/emergency is shown in Table 18 below. The source is https://sd.iso.org/projects/my-projects and the Stage codes are shown below.

00. Preliminary stage	30. Committee stage	60. Publication stage
10. Proposal stage	40. Enquiry stage	90. Review stage
20. Preparatory stage	50. Approval stage	95. Withdrawal stage

Table 18: WG 9 Integrated transport information, management and control standards per January 2019

Standard ref.	Standard title	Stage
	WG9 Integrated transport information, management and control	
ISO/AWI 20684-10	Intelligent transport systems -- Roadside modules SNMP data interface -- Part 10: Variable message signs	20.00
ISO 15784-2:2015/CD Amd 1	Intelligent transport systems (ITS) -- Data exchange involving roadside modules communication -- Part 2: Centre to field device communications using SNMP -- Amendment 1	30.99
ISO/AWI 22741-1	Intelligent transport systems -- Roadside modules AP-DATEX data interface -- Part 1: Overview	20.00
ISO/PWI 22741-2	Intelligent transport systems -- Roadside modules AP-DATEX data interface -- Part 2: Generalized field devices - basic management	00.00
ISO/PWI 22741-3	Intelligent transport systems -- Roadside modules AP-DATEX data interface -- Part 3: Generalised field device scheduler	00.00
ISO/PWI 22741-4	Intelligent transport systems -- Roadside modules AP-DATEX data interface -- Part 4: Generalised field device exceptions	00.00
ISO/PWI 22741-10	Intelligent transport systems -- Roadside modules AP-DATEX data interface -- Part 10: Variable message signs	00.00
ISO/TR 21707:2008	Intelligent transport systems -- Integrated transport information, management and control -- Data quality in ITS systems	60.60
ISO/CD 20684-1	Intelligent transport systems -- Roadside modules SNMP data interface -- Part 1: Overview	30.60
ISO/CD 20684-2	Intelligent transport systems -- Roadside modules SNMP data interface -- Part 2: Generalized field devices -- Basic management	30.60

Standard ref.	Standard title	Stage
	WG9 Integrated transport information, management and control	
ISO/AWI 20684-3	Intelligent transport systems -- Roadside modules SNMP data interface -- Part 3: Generalized field device -- Scheduler	20.00
ISO/AWI 20684-4	Intelligent transport systems -- Roadside modules SNMP data interface -- Part 4: Generalized field device -- Exceptions	20.00
ISO/DTS 19468	Intelligent transport systems -- Data interfaces between centres for transport information and control systems -- Platform independent model specifications for data exchange protocols for transport information and control systems	30.99
ISO/DIS 19082	Intelligent transport systems -- Definition of data elements and data frames between roadside modules and signal controllers for cooperative signal control	40.20
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	60.60
ISO 15784-1:2008	Intelligent transport systems (ITS) -- Data exchange involving roadside modules communication -- Part 1: General principles and documentation framework of application profiles	90.93
ISO 15784-2:2015	Intelligent transport systems (ITS) -- Data exchange involving roadside modules communication -- Part 2: Centre to field device communications using SNMP	60.60
ISO 15784-3:2008	Intelligent transport systems (ITS) -- Data exchange involving roadside modules communication -- Part 3: Application profile-data exchange (AP-DATEX)	90.93
ISO 14827-1:2005	Transport information and control systems -- Data interfaces between centres for transport information and control systems -- Part 1: Message definition requirements	90.93
ISO 14827-2:2005	Transport information and control systems -- Data interfaces between centres for transport information and control systems -- Part 2: DATEX-ASN	90.93
ISO 14827-3	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)	60.00
ISO 10711:2012	Intelligent Transport Systems -- Interface Protocol and Message Set Definition between Traffic Signal Controllers and Detectors	90.93

5.11 ISO/TC 204 WG10 Traveller Information Systems

This WG were parallel to CEN/TC278 WG 4 until it became dormant. WG 10 has therefore taken over the main contact to Travel Information Services Association (TISA) who are developing the TMC and TPEG standards, and the European standards responsibility has therefore been moved from CEN/TC 278 WG 4 to here. There is no technical work in the working group – all the drafting is done by TISA (www.tisa.org).

TISA is a market-driven membership association with worldwide scope, established as a non-profit company focussed on proactive implementation of traffic and travel information services and products based on existing standards, including primarily RDS-TMC and TPEG ™ technologies.

The standards published by WG 10 Traveller Information Systems is shown in Table 19 below. The source is https://sd.iso.org/projects/my-projects and the Stage codes are shown below.

00. Preliminary stage	30. Committee stage	60. Publication stage
10. Proposal stage	40. Enquiry stage	90. Review stage
20. Preparatory stage	50. Approval stage	95. Withdrawal stage

Table 19: WG 10 Traveller information systems standards per January 2019

Standard ref.	Standard title	Stage
	WG10 Traveller information systems	
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	90.93
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	90.93
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	90.93
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	90.93
ISO/TS 21219-1:2016	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 1: Introduction, numbering and versions (TPEG2-INV)	60.60

Standard ref.	Standard title	Stage
	WG10 Traveller information systems	
ISO/DIS 21219-2	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 2: UML modelling rules (TPEG2-UMR)	40.20
ISO/TS 21219-2:2014	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 2: UML modelling rules	90.92
ISO/DIS 21219-3	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)	40.20
ISO/TS 21219-3:2015	Intelligent transport systems - Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 3: UML to binary conversion rules	90.92
ISO/DIS 21219-4	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 4: UML to XML conversion rules	40.20
ISO/TS 21219-4:2015	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 4: UML to XML conversion rules	90.92
ISO/DIS 21219-5	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 5: Service framework (TPEG2-SFW)	40.20
ISO/TS 21219-5:2015	Intelligent transport systems - Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 5: Service framework (TPEG2-SFW)	90.92
ISO/DIS 21219-6	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 6: Message management container (TPEG2-MMC)	40.20
ISO/TS 21219-6:2015	Intelligent transport systems - Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 6: Message management container (TPEG2-MMC)	90.92
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)	60.60
ISO/TS 21219-9:2016	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 9: Service and network information (TPEG2-SNI)	60.60

Standard ref.	Standard title	Stage
	WG10 Traveller information systems	
ISO/TS 21219-10:2016	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 10: Conditional access information (TPEG2-CAI)	60.60
ISO/TS 21219-14:2016	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 14: Parking information application (TPEG2-PKI)	60.60
ISO/TS 21219-15:2016	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 15: Traffic event compact (TPEG2-TEC)	60.60
ISO/TS 21219-16:2016	Intelligent transport systems -- Traffic and travel information via transport protocol exports group, generation 2 (TPEG2) -- Part 16: Fuel price information and availability (TPEG2-FPI)	60.60
ISO/DIS 21219-18	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)	40.20
ISO/TS 21219-18:2015	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)	90.92
ISO/TS 21219-19:2016	Intelligent transport systems -- Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) -- Part 19: Weather information (TPEG2-WEA)	60.60
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)	60.60
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)	60.60
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)	60.60
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)	60.60
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)	60.60

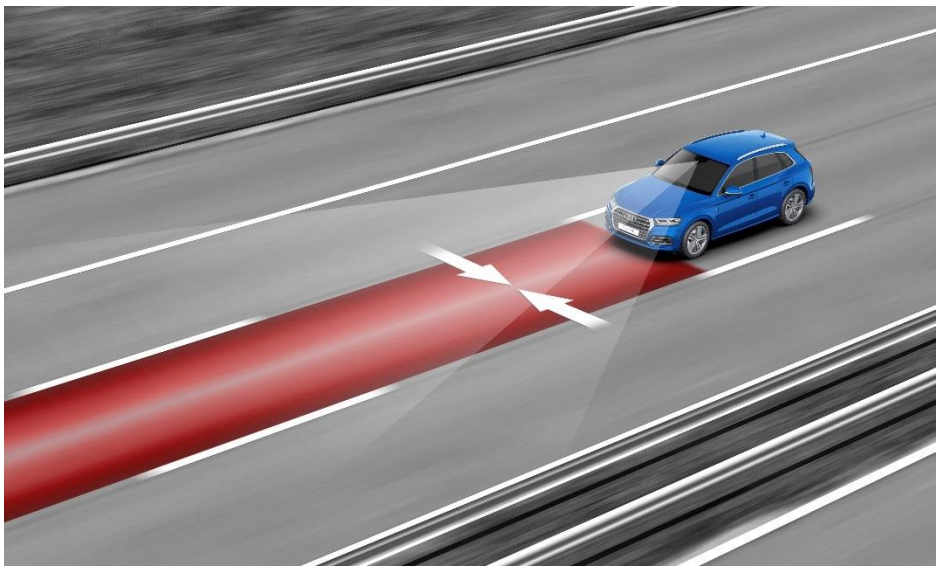
Standard ref.	Standard title	Stage
	WG10 Traveller information systems	
ISO/TS 21219-26:2018	Intelligent transport systems -- Traffic and travel information via transport protocol experts group, generation 2 (TPEG2) -- Part 26: Vigilance location information (TPEG2-VLI)	60.60
ISO/TS 18234-1:2013	Intelligent 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)	90.93
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)	90.93
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)	90.93
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	90.93
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	90.93
ISO/TS 18234-6:2006	Traffic and Travel Information (TTI) - TTI via Transport Protocol Expert Group (TPEG) data-streams -- Part 6: Location referencing applications	90.93
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)	90.93
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)	90.93
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)	90.93
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)	90.93
ISO/TS 18234-11:2013	Intelligent transport systems -- Traffic and Travel Information (TTI) via transport protocol experts group, generation 1 (TPEG1)	90.93

Standard ref.	Standard title	Stage
	WG10 Traveller information systems	
	binary data format -- Part 11: Location Referencing Container (TPEG1-LRC)	
ISO 14823:2017	Intelligent transport systems -- Graphic data dictionary	90.92
ISO/CD 14823-1	Intelligent transport systems -- Graphic data dictionary -- Part 1: Specification	30.99
ISO/DTR 14823-2	Intelligent transport systems -- Graphic data dictionary -- Part 2: Examples	30.60
ISO/CD 14819-1	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	30.99
ISO 14819-1:2013	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	90.92
ISO/CD 14819-2	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	30.99
ISO 14819-2:2013	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	90.92
ISO/CD 14819-3	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	30.99
ISO 14819-3:2013	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	90.92
ISO/CD 14819-6	Traffic and Traveller Information (TTI) -- TTI messages via traffic message coding -- Part 6: Encryption and conditional access for the Radio Data System -- Traffic Message Channel ALERT C coding	30.99
ISO 14819-6:2006	Traffic and Traveller Information (TTI) -- TTI messages via traffic message coding -- Part 6: Encryption and conditional access for the Radio Data System -- Traffic Message Channel ALERT C coding	90.92

Standard ref.	Standard title	Stage
	WG10 Traveller information systems	
ISO 14823-1 rev	Intelligent transport systems - Graphic data dictionary - Part 1: Specification	20.00

5.12 ISO/TC 204 WG14 Vehicle/roadway warning and control systems

This WG is standardizing performance requirements and test procedures for many of the new ITS features in cars, such as automatic parking, intelligent cruise control, backing-up aid, lane departure warning, collision warning and so on. WG14 is also quite active in testing and validation of vehicle automation. Both vehicle manufacturers and authorities are well represented. This is one of the more active and productive WGs; not only in the number of produced standards, but in the consistent deployment of these standards into vehicles on the road today.



Lane keeping assistance. Photo: AUDI AG

New work is under way, and the long-term trend is moving towards a more and more automated driver support systems based on advanced sensors enhanced by cooperative awareness of the surroundings.

Since this WG is closely related to road vehicles, this particular WG is under scrutiny from ISO TC22 who have indicated their interest to take over large parts of the ITS responsibility. This proposal was not accepted by TC204, and an agreement between ISO TC 22 and ISO TC 204 is in place to regulate the overlap between the two committees.

ISO/TC 204 WG14 and ETSI TC ITS WG1 have an understanding how to develop compatible standards which enables the development of interoperable systems with the aim of achieving globally accepted standards.

The standards published by WG 14 Vehicle/roadway warning and control systems is shown in Table 20 below. The source is https://sd.iso.org/projects/my-projects and the Stage codes are shown below.

00. Preliminary stage	30. Committee stage	60. Publication stage
10. Proposal stage	40. Enquiry stage	90. Review stage
20. Preparatory stage	50. Approval stage	95. Withdrawal stage

Table 20: WG 14 Vehicle/roadway warning and control systems standards per January 2019

Standard ref.	Standard title	Stage
	WG14 Vehicle/roadway warning and control systems	
ISO/NP 23374-2	Intelligent transport systems -- Automated valet parking systems (AVPS) -- Part 2: Requirements and test procedures for the vehicle operation	10.60
ISO/NP 22737	Intelligent transport systems -- Low-speed automated driving (LSAD) systems for limited operational design domains -- Performance requirements, system requirements and performance test procedures	10.60
ISO 26684:2015	Intelligent transport systems (ITS) -- Cooperative intersection signal information and violation warning systems (CIWS) -- Performance requirements and test procedures	60.60
ISO/PWI 23793-1	Intelligent transport systems -- Fall-back functions for automated driving systems -- Part 1: Framework	00.00
ISO/PWI 23793-2	Intelligent transport systems – Fall-back functions for automated driving systems -- Part 2: Performance requirements and test procedures for emergency stopping	00.00
ISO/PWI 23792-1	Intelligent transport systems -- Motorway chauffeur systems (MCS) -- Part 1: Framework and general requirements	00.00
ISO/PWI 23792-2	Intelligent transport systems -- Motorway chauffeur systems (MCS) -- Part 2: Requirements and test procedures for in-lane driving	00.00
ISO/PWI 23377-1	Intelligent transport systems -- Functional safety for vehicle-to-vehicle cooperative functions (FSV2V) -- Part 1: Platooning	00.00
ISO/NP 23376	Intelligent transport systems -- Vehicle-to-vehicle intersection collision warning systems (VVICW) -- Performance requirements and test procedures	10.20
ISO/PWI 23375	Intelligent transport systems -- Collision evasive lateral manoeuvre systems (CELM) -- Performance requirements and test procedures	00.00
ISO/PWI 23374-1	Intelligent transport systems -- Automated valet parking systems (AVPS) -- Part 1: System overview and framework	00.00

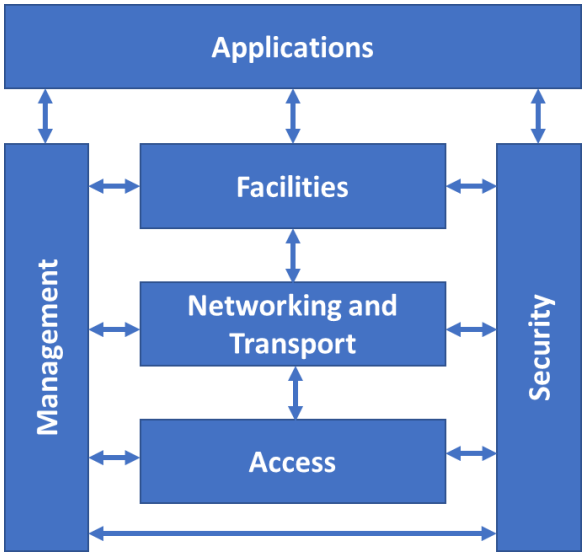
Standard ref.	Standard title	Stage
	WG14 Vehicle/roadway warning and control systems	
ISO/PWI 23374-3	Intelligent transport systems -- Automated valet parking systems (AVPS) -- Part 3: Requirements for the interface to back-office operation	00.00
ISO/PWI 23374-4	Intelligent transport systems -- Automated valet parking systems (AVPS) -- Part 4: Requirements for user interface	00.00
ISO 22840:2010	Intelligent transport systems -- Devices to aid reverse manoeuvres -- Extended-range backing aid systems (ERBA)	90.93
ISO 22839:2013	Intelligent transport systems -- Forward vehicle collision mitigation systems -- Operation, performance, and verification requirements	90.93
ISO/SAE NP PAS 22736	Intelligent transport systems -- Taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles	10.99
ISO 22178:2009	Intelligent transport systems -- Low speed following (LSF) systems -- Performance requirements and test procedures	90.93
ISO/PWI 22084	Intelligent transport systems -- Traffic incident notification systems (TINS) -- System requirements	00.00
ISO/CD 22078	Intelligent transport systems -- Bicyclist detection and collision mitigation systems (BDCMS) -- Performance requirements and test procedures	30.60
ISO 21717:2018	Intelligent transport systems -- Partially Automated In-Lane Driving Systems (PADS) -- Performance requirements and test procedures	60.60
ISO/CD 21202	Intelligent transport systems -- Partially Automated Lane Change Systems (PALS) -- Functional / operational requirements and test procedures	30.60
ISO/DIS 20901	Intelligent transport systems -- Emergency electronic brake light systems (EEBL) -- Performance requirements and test procedures	40.00
ISO/DIS 20900	Intelligent transport systems -- Partially automated parking systems (PAPS) -- Performance requirements and test procedures	40.60
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	60.60
ISO 20035	Intelligent transport systems -- Cooperative adaptive cruise control systems (CACC) -- Performance requirements and test procedures	60.00

Standard ref.	Standard title	Stage
	WG14 Vehicle/roadway warning and control systems	
ISO 19638:2018	Intelligent transport systems -- Road boundary departure prevention systems (RBDPS) -- Performance requirements and test procedures	60.60
ISO 19237:2017	Intelligent transport systems -- Pedestrian detection and collision mitigation systems (PDCMS) -- Performance requirements and test procedures	60.60
ISO 18682:2016	Intelligent transport systems -- External hazard detection and notification systems -- Basic requirements	60.60
ISO 17387:2008	Intelligent transport systems -- Lane change decision aid systems (LCDAS) -- Performance requirements and test procedures	90.93
ISO 17386:2010	Transport information and control systems -- Manoeuvring Aids for Low Speed Operation (MALSO) -- Performance requirements and test procedures	90.93
ISO 17361:2017	Intelligent transport systems -- Lane departure warning systems -- Performance requirements and test procedures	60.60
ISO 16787:2017	Intelligent transport systems -- Assisted parking system (APS) -- Performance requirements and test procedures	60.60
ISO/TS 15624:2001	Transport information and control systems -- Traffic Impediment Warning Systems (TIWS) -- System requirements	90.20
ISO 15623:2013	Intelligent transport systems -- Forward vehicle collision warning systems -- Performance requirements and test procedures	90.60
ISO 15622:2018	Intelligent transport systems -- Adaptive cruise control systems -- Performance requirements and test procedures	60.60
ISO 11270:2014	Intelligent transport systems -- Lane keeping assistance systems (LKAS) -- Performance requirements and test procedures	60.60
ISO 11067:2015	Intelligent transport systems -- Curve speed warning systems (CSWS) -- Performance requirements and test procedures	60.60

5.13 ISO/TC204 WG16 Communications

The initial work of the WG was the CALM series (Communications Access for Land Mobiles) of communications standards. This acronym has been dropped to allow better inter-relations with CEN, ETSI and IEEE standards. This WG is also handling vehicle probe data systems (called floating car data in Europe) and has taken over maintenance of DSRC from ISO/TC 204 WG15. A cooperation agreement with ETSI means that conformance test standards for CALM are developed by ETSI TC ITS WG2. CALM has been tested and validated in several European projects from the stage of CVIS (Cooperative Vehicle-Infrastructure System) and SAFESPOT (European Integrated Project on

cooperative vehicular systems for road safety) and is now used as the baseline in for instance the C-ITS Delegated Act.



The standards published by WG 16 Communications is shown in Table 21 below. The source is https://sd.iso.org/projects/my-projects and the Stage codes are shown below.

00. Preliminary stage	30. Committee stage	60. Publication stage
10. Proposal stage	40. Enquiry stage	90. Review stage
20. Preparatory stage	50. Approval stage	95. Withdrawal stage

Table 21: WG 16 Communications standards per January 2019

Standard ref.	Standard title	Stage
	WG16 Communications	
ISO/AWI 21210	Intelligent transport systems -- Communications access for land mobiles (CALM) -- IPv6 Networking	20.00
ISO/CD 17515-2	Intelligent transport systems -- Communications access for land mobiles (CALM) -- Evolved universal terrestrial radio access network (E-UTRAN) -- Part 2: Device to device communications (D2D)	30.20
ISO/TS 29284:2012	Intelligent transport systems -- Event-based probe vehicle data	90.93
ISO 29283:2011	ITS CALM Mobile Wireless Broadband applications using Communications in accordance with IEEE 802.20	90.93

Standard ref.	Standard title	Stage
	WG16 Communications	
ISO 29282:2011	Intelligent transport systems -- Communications access for land mobiles (CALM) -- Satellite networks	90.93
ISO 29281-1:2018	Intelligent transport systems -- Localized communications -- Part 1: Fast networking & transport layer protocol (FNTP)	60.60
ISO 29281-2	Intelligent transport systems -- Localized communications -- Part 2: Legacy system support	60.00
ISO 29281-2:2013	Intelligent transport systems -- Communication access for land mobiles (CALM) -- Non-IP networking -- Part 2: Legacy system support	90.92
ISO 29281-2:2013/Amd 1:2014	Intelligent transport systems -- Communication access for land mobiles (CALM) -- Non-IP networking -- Part 2: Legacy system support -- Amendment 1	60.60
ISO/NP TS 25114	Intelligent transport systems -- Probe data reporting management (PDRM)	10.00
ISO/TS 25114:2010	Intelligent transport systems -- Probe data reporting management (PDRM)	90.92
ISO 25113:2010	Intelligent transport systems -- Communications access for land mobiles (CALM) -- Mobile wireless broadband using HC-SDMA	90.93
ISO 25112:2010	Intelligent transport systems -- Communications access for land mobiles (CALM) -- Mobile wireless broadband using IEEE 802.16	90.93
ISO 25111:2009	Intelligent transport systems -- Communications access for land mobiles (CALM) -- General requirements for using public networks	90.93
ISO 24978:2009	Intelligent transport systems -- ITS Safety and emergency messages using any available wireless media -- Data registry procedures	90.93
ISO 24103:2009	Intelligent transport systems -- Communications access for land mobiles (CALM) -- Media adapted interface layer (MAIL)	90.93
ISO 24102-1:2018	Intelligent transport systems -- ITS station management -- Part 1: Local management	60.60
ISO 24102-2:2018	Intelligent transport systems -- ITS station management -- Part 2: Remote management of ITS-SCUs	60.60
ISO 24102-3:2018	Intelligent transport systems -- ITS station management -- Part 3: Service access points	60.60

Standard ref.	Standard title	Stage
	WG16 Communications	
ISO 24102-4:2018	Intelligent transport systems -- ITS station management -- Part 4: Station-internal management communications	60.60
ISO 24102-5:2013/Amd 1:2017	Intelligent transport systems -- Communications access for land mobiles (CALM) -- ITS station management -- Part 5: Fast service advertisement protocol (FSAP) -- Amendment 1	60.60
ISO 24102-6:2018	Intelligent transport systems -- Communications access for land mobiles (CALM) -- ITS station management -- Part 6: Path and flow management	60.60
ISO 24101-1:2008	Intelligent transport systems -- Communications access for land mobiles (CALM) -- Application management -- Part 1: General requirements	90.93
ISO 24101-2:2010	Intelligent transport systems -- Communications access for land mobiles (CALM) -- Application management -- Part 2: Conformance test	90.93
ISO/NP 24100	Intelligent transport systems -- Basic principles for personal data protection in probe vehicle information services	10.00
ISO 24100:2010	Intelligent transport systems -- Basic principles for personal data protection in probe vehicle information services	90.92
ISO/NP 22837	Vehicle probe data for wide area communications	10.00
ISO 22837:2009	Vehicle probe data for wide area communications	90.92
ISO/NP 22738	Intelligent transport systems -- Localized communications -- Optical camera communication	10.99
ISO/CD 22418	Intelligent transport systems -- Fast service announcement protocol (FSAP) for general purposes in ITS	30.99
ISO 22418:2018	Intelligent transport systems -- Fast service announcement protocol (FSAP)	90.92
ISO 21218:2018	Intelligent transport systems -- Hybrid communications -- Access technology support	60.60
ISO 21217:2014	Intelligent transport systems -- Communications access for land mobiles (CALM) -- Architecture	60.60
ISO 21216:2012	Intelligent transport systems -- Communication access for land mobiles (CALM) -- Millimetre wave air interface	90.93
ISO 21215:2018	Intelligent transport systems -- Localized communications -- ITS-M5	60.60

Standard ref.	Standard title	Stage
	WG16 Communications	
ISO 21214:2015	Intelligent transport systems -- Communications access for land mobiles (CALM) -- Infra-red systems	60.60
ISO 21213:2008	Intelligent transport systems -- Communications access for land mobiles (CALM) -- 3G Cellular systems	90.93
ISO 21212:2008	Intelligent transport systems -- Communications access for land mobiles (CALM) -- 2G Cellular systems	90.93
ISO 21210:2012	Intelligent transport systems -- Communications access for land mobiles (CALM) -- IPv6 Networking	90.92
ISO 21210:2012/Amd 1:2017	Intelligent transport systems -- Communications access for land mobiles (CALM) -- IPv6 Networking -- Amendment 1	60.60
ISO/DIS 19414	Intelligent transport systems -- Service architecture of probe vehicle systems	40.60
ISO 19080:2016	Intelligent transport systems -- Communications access for land mobiles (CALM) -- CoAP facility	60.60
ISO 19079:2016	Intelligent transport systems -- Communications access for land mobiles (CALM) -- 6LoWPAN networking	60.60
ISO/NP 18380	Intelligent Transport Systems -- Communications access for land mobiles (CALM) - IPv4-IPv6 interoperability	10.00
ISO/NP 18378	Intelligent Transport Systems -- Communications access for land mobiles (CALM) - Multicast	10.00
ISO/NP 18376	Intelligent Transport Systems -- Criteria for Privacy and Integrity protection in Probe Vehicle Information Systems	10.00
ISO/TR 18317:2017	Intelligent transport systems -- Pre-emption of ITS communication networks for disaster and emergency communication -- Use case scenarios	60.60
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	60.60
ISO/DIS 17515-3	Intelligent transport systems -- Evolved-universal terrestrial radio access network -- Part 3: LTE-V2X	40.99
ISO 16461:2018	Intelligent transport systems -- Criteria for privacy and integrity protection in probe vehicle information systems	60.60

Standard ref.	Standard title	Stage
	WG16 Communications	
ISO/TS 16460:2016	Intelligent transport systems -- Communications access for land mobiles (CALM) -- Communication protocol messages for global usage	60.60
ISO 15662:2006	Intelligent transport systems -- Wide area communication -- Protocol management information	90.93
ISO 15628:2013	Intelligent transport systems -- Dedicated short-range communication (DSRC) -- DSRC application layer	90.20
ISO 13183:2012	Intelligent transport systems -- Communications access for land mobiles (CALM) -- Using broadcast communications	90.93
ISO/TR 11769:2010	Intelligent transport systems -- Communications access for land mobiles (CALM) -- Data retention for law enforcement	60.60
ISO/TR 11766:2010	Intelligent transport systems -- Communications access for land mobiles (CALM) -- Security considerations for lawful interception	90.93
ISO 22418:2018	Intelligent transport systems - Fast service announcement protocol (FSAP)	20.00

5.14 ISO/TC 204 WG17 Nomadic Devices in ITS Systems

This group started out looking at integration of smart phones in cars.

The work now includes the use of nomadic and mobile devices to support ITS service and multimedia provision in vehicles. The work relates to vehicle interfaces or gateways for vehicle-internal data access including security, data definitions and protocols.

Part of the work regarding vehicle gateways has met some opposition from car makers, but an agreement with ISO TC22 seems to have clarified most of the challenges. Its convenor is from Korea but experts from Europe are following the work closely.

The standards published by WG 17 Nomadic Devices in ITS Systems is shown in

Table 22 below. The source is https://sd.iso.org/projects/my-projects and the Stage codes are shown below.

00. Preliminary stage	30. Committee stage	60. Publication stage
10. Proposal stage	40. Enquiry stage	90. Review stage
20. Preparatory stage	50. Approval stage	95. Withdrawal stage

Table 22: WG 17 Nomadic Devices in ITS Systems standards per January 2019

Standard ref.	Standard title	Stage
	WG17 Nomadic Devices in ITS Systems	
ISO/NP 18561-1	Intelligent transport systems -- Urban mobility applications via nomadic device for green transport management -- Part 1: General requirements for data exchange between ITS stations	10.60
ISO/NP 13111-2	Intelligent transport systems (ITS) -- The use of personal ITS station to support ITS service provision for travellers -- Part 2: General requirements for data exchange between personal ITS station and other ITS stations	10.60
ISO/DIS 17438-4	Intelligent transport systems -- Indoor navigation for personal and vehicle ITS station -- Part 4: Requirements and specification for interface between personal/vehicle and central ITS stations	40.99
ISO/CD 20530	Intelligent transport systems -- Information for emergency service support via personal ITS station -- General requirements and technical definition	30.60
ISO/CD 20529-2	Intelligent transport systems -- Framework for green ITS (G-ITS) standards -- Part 2: Integrated mobile service application and specification	30.60
ISO/PWI 23795-1	Intelligent transport systems -- Extracting trip data via nomadic device for estimating CO2 emissions -- Part 1: Fuel consumption determination for fleet management	00.00
ISO/PWI 23795-2	Intelligent transport systems -- Extracting trip data via nomadic device for estimating CO2 emissions -- Part 2: Information provision for eco-friendly driving behaviour	00.00
ISO/PWI 22087	Intelligent transport systems -- Exchanging driving experience information collected by nomadic devices	00.00
ISO/PRF TR 22086-1	Intelligent transport systems -- Network based precise positioning infrastructure for land transportation -- Part 1: General information and use cases description	50.00
ISO/PWI 22086-2	Intelligent transport systems -- Network based precise positioning infrastructure for land transportation -- Part 2: Functional requirements and data interface	00.00
ISO/DTR 22085-1	Intelligent transport systems (ITS) -- Nomadic device service platform for micro mobility -- Part 1: General information and use cases definition	30.99
ISO/AWI 22085-2	Intelligent transport systems -- Nomadic device service platform for micro mobility -- Part 2: Functional requirements and data set definitions	20.00

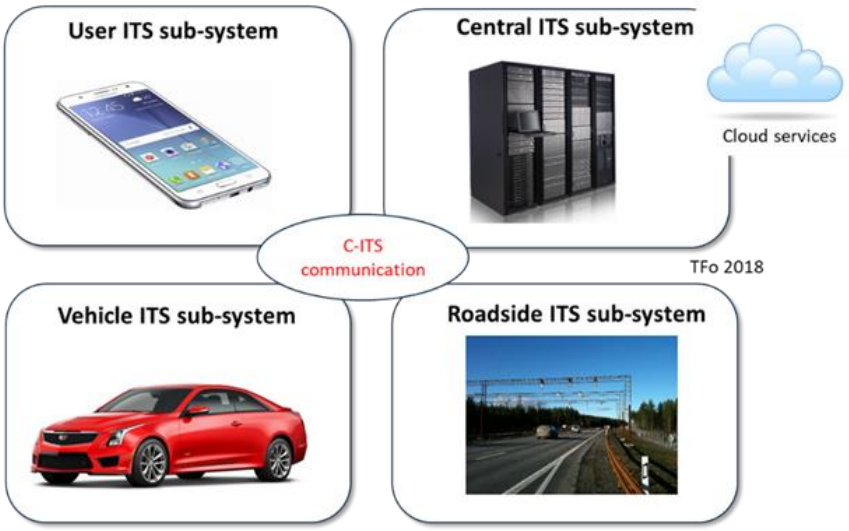
Standard ref.	Standard title	Stage
	WG17 Nomadic Devices in ITS Systems	
ISO/PWI 22085-3	Intelligent transport systems -- Nomadic device service platform for micro mobility -- Part 3: Data structure and data exchange procedures	00.00
ISO/DTR 21735	Intelligent transport systems -- Framework architecture for plug & play (PnP) functionality in vehicles utilizing nomadic devices	30.60
ISO/TR 20529-1:2017	Intelligent transport systems -- Framework for green ITS (G-ITS) standards -- Part 1: General information and use case definitions	60.60
ISO/PWI 18561-2	Intelligent transport systems -- Urban mobility applications via nomadic device for green transport management -- Part 2: Trip and modal choice applications and specification	00.00
ISO 17438-1:2016	Intelligent transport systems -- Indoor navigation for personal and vehicle ITS station -- Part 1: General information and use case definition	60.60
ISO/PWI 17438-2	Intelligent transport systems -- Indoor navigation for personal and vehicle ITS stations -- Part 2: Requirements and specification for indoor maps	00.00
ISO/PWI 17438-3	Intelligent transport systems -- Indoor navigation for personal and vehicle ITS stations -- Part 3: TBD	00.00
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	60.60
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	60.60
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	60.60
ISO/CD 13185-4	Intelligent transport systems -- Vehicle interface for provisioning and support of ITS Services -- Part 4: Unified vehicle interface protocol (UVIP) conformance test specification	30.60
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	60.60
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	60.60

Standard ref.	Standard title	Stage
	WG17 Nomadic Devices in ITS Systems	
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	60.60
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	60.60
ISO/TR 10992:2011	Intelligent transport systems -- Use of nomadic and portable devices to support ITS service and multimedia provision in vehicles	60.60
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	60.60

5.15 ISO/TC 204 WG18 Cooperative systems

This is a full parallel group to CEN/TC 278 WG16. Please refer to chapter 4.18 CEN/TC 278 WG16 Co-operative systems on page 56.

WG18 has similar roles in ISO as in CEN: Firstly, to develop new standards in the field of Cooperative ITS, and secondly to help coordinate and foster new Cooperative ITS thinking in the existing WGs.



Note that a change in the cooperation agreement between ISO and CEN at top level (Vienna Agreement) stipulates that there are no CEN-lead standards anymore; all standards shall be developed as ISO standards. This has created practical challenges when developing standards based on EC Mandates or other regulations.

The standards published by WG 18 Cooperative systems is shown in Table 23 below. The source is https://sd.iso.org/projects/my-projects and the Stage codes are shown below.

00. Preliminary stage	30. Committee stage	60. Publication stage
10. Proposal stage	40. Enquiry stage	90. Review stage
20. Preparatory stage	50. Approval stage	95. Withdrawal stage

Table 23: WG 18 Cooperative systems standards per January 2019

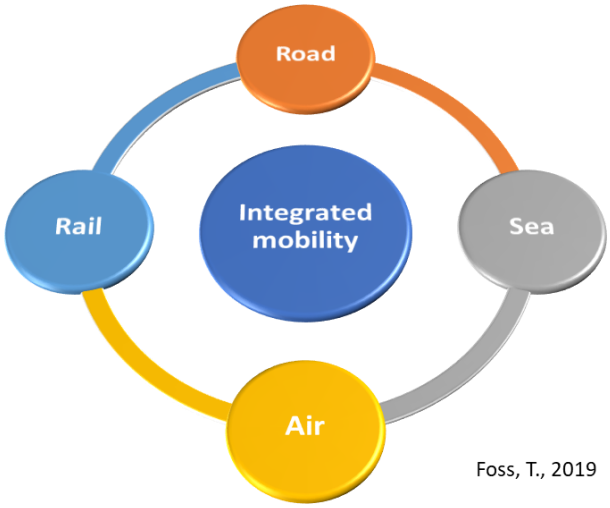
Standard ref.	Standard title	Stage
	WG18 Cooperative systems	
ISO/AWI TS 21176	Intelligent transport systems -- Cooperative ITS -- Position, velocity and time functionality in the ITS station	20.00
ISO/NP 17429	Intelligent transport systems -- Cooperative ITS -- ITS station facilities for the transfer of information between ITS stations	10.99
ISO/PRF TS 21189	Intelligent transport systems -- Cooperative ITS -- Test requirements and protocol implementation conformance statement (PICS) pro forma for ISO/TS 17426	50.20
ISO/AWI TR 21186	Intelligent transport systems -- Cooperative ITS -- Guidelines on the use of C-ITS standards for hybrid communications	20.00
ISO/DTS 21185	Intelligent transport systems -- Communication profiles for secure connections between trusted devices	30.99
ISO/AWI TS 21184	Intelligent transport systems -- Management of messages containing information of sensor and control networks specified in data dictionaries	20.00
ISO/DTS 21177	Intelligent transport systems -- ITS station security services for secure session establishment and authentication between trusted devices	30.99
ISO/TS 20026:2017	Intelligent transport systems -- Cooperative ITS -- Test architecture	60.60
ISO/NP TS 19321	Intelligent transport systems -- Cooperative ITS -- Dictionary of in-vehicle information (IVI) data structures	10.99
ISO/TS 19321:2015	Intelligent transport systems -- Cooperative ITS -- Dictionary of in-vehicle information (IVI) data structures	90.92
ISO/PRF TS 19091	Intelligent transport systems -- Cooperative ITS -- Using V2I and I2V communications for applications related to signalized intersections	50.00

Standard ref.	Standard title	Stage
	WG18 Cooperative systems	
ISO/TS 19091:2017	Intelligent transport systems -- Cooperative ITS -- Using V2I and I2V communications for applications related to signalized intersections	90.92
ISO 18750:2018	Intelligent transport systems -- Co-operative ITS -- Local dynamic map	60.60
ISO/TS 17429:2017	Intelligent transport systems -- Cooperative ITS -- ITS station facilities for the transfer of information between ITS stations	90.92
ISO 17427-1:2018	Intelligent transport systems -- Cooperative ITS -- Part 1: Roles and responsibilities in the context of co-operative ITS architecture(s)	60.60
ISO/TR 17427-2:2015	Intelligent transport systems -- Cooperative ITS -- Part 2: Framework overview	60.60
ISO/TR 17427-3:2015	Intelligent transport systems -- Cooperative ITS -- Part 3: Concept of operations (ConOps) for 'core' systems	60.60
ISO/TR 17427-4:2015	Intelligent transport systems -- Cooperative ITS -- Part 4: Minimum system requirements and behaviour for core systems	60.60
ISO/TR 17427-6:2015	Intelligent transport systems -- Cooperative ITS -- Part 6: 'Core system' risk assessment methodology	60.60
ISO/TR 17427-7:2015	Intelligent transport systems -- Cooperative ITS -- Part 7: Privacy aspects	60.60
ISO/TR 17427-8:2015	Intelligent transport systems -- Cooperative ITS -- Part 8: Liability aspects	60.60
ISO/TR 17427-9:2015	Intelligent transport systems -- Cooperative ITS -- Part 9: Compliance and enforcement aspects	60.60
ISO/TR 17427-10:2015	Intelligent transport systems -- Cooperative ITS -- Part 10: Driver distraction and information display	60.60
ISO/TS 17426:2016	Intelligent transport systems -- Cooperative systems -- Contextual speeds	60.60
ISO/TS 17425:2016	Intelligent transport systems -- Cooperative systems -- Data exchange specification for in-vehicle presentation of external road and traffic related data	60.60
ISO/TR 17424:2015	Intelligent transport systems -- Cooperative systems -- State of the art of Local Dynamic Maps concepts	60.60

Standard ref.	Standard title	Stage
	WG18 Cooperative systems	
ISO 17423:2018	Intelligent transport systems -- Cooperative systems -- Application requirements and objectives	60.60
ISO 17419:2018	Intelligent transport systems -- Cooperative systems -- Globally unique identification	60.60
ISO/TS 21177	Intelligent transport systems - ITS-station security services for secure session establishment and authentication between trusted devices	20.00
ISO/TS 21184	Intelligent transport systems -- Management of messages containing information of sensor and control networks specified in data dictionaries	20.00
ISO/TS 21185	Intelligent transport systems -- Communication profiles for secure connections between trusted devices	20.00

5.16 ISO/TC 204 WG 19 Mobility Integration

ISO WG19 is the most recent standardisation group in ITS. It is founded on the success of CEN TC278/WG17 Urban ITS and the need for a similar horizontal coordination mechanism in ISO. It is therefore joint with WG17, but with a responsibility going beyond the urban areas. This WG is led by Norway and supported by NPRA.



Part of this coordination task stems from the need to combine all the existing silo standards in a full system perspective. This need has become more urgent with the advent of automated vehicles where the machine must combine the various data sources without the benefit of a human in the loop to focus on essentials and filter out (obvious?) errors and mismatches in the incoming data streams.

WG19 has a horizontal coordination role and will not develop many standards on its own, but rather farm them out to other WGs and other TCs where the scope is more correct.

WG19 will only develop documents in two categories:

- To do an analysis of a new area to determine if there is a need, and set out the ground rules to get interoperability and seamless technical standards from the group that will develop the actual technical standard, and
- Develop new technical standards in areas where there is no existing WG

The first set of standards are "inherited" from CEN TC278/WG17, since the Urban ITS needs are relatively global. The work is continuing into the needs for automated vehicles and transport automation in general. The media and car makers use of the term "AUTONOMOUS", whilst the transport science, standards and regulators all agree that this will not work since the full transport system is heavily dependent on communication and sharing information between the actors. The preferred term is "AUTOMATION", and the five levels of automation is well defined in SAE J3016.

WG19 will therefore develop two sets on standards in 2019/2020 that are considered essential for the public sector, since they form the basis for regulatory measures as well as core operational responsibilities from the public sector:

- Architecture for Automation (A4A). This will define the essential interfaces and information streams needed for an efficient transport network where automation on L4/L5 is allowed in high volumes.
- Management for Electronic Traffic Regulations. This set of standards specifies how existing traffic regulations meant for humans, can be encoded, secured and transferred for use by automated systems including advanced driver assistance.

The standards published by WG 19 Mobility integration is shown in Table 24 below. The source is https://sd.iso.org/projects/my-projects and the Stage codes are shown below.

00. Preliminary stage	30. Committee stage	60. Publication stage
10. Proposal stage	40. Enquiry stage	90. Review stage
20. Preparatory stage	50. Approval stage	95. Withdrawal stage

Table 24: WG 19 Mobility integration standards per May 2019

Standard ref.	Standard title	Stage
	WG19 Mobility integration	
ISO/PWI TR 24321	Intelligent transport systems -- Development of data standards for the parking sector	00.00
ISO/PWI 24318	Intelligent transport systems -- Mobility integration -- Architecture for automation	00.00
ISO/PWI 24317	Intelligent transport systems -- Mobility integration -- Mobility integration needs for vulnerable users and light modes of transport	00.00

Standard ref.	Standard title	Stage
ISO/PWI 24315-1	Intelligent transport systems - Management for Electronic Traffic Regulations (METR) -- Part 1: General concept and architecture	00.00
ISO/PWI 24312	Intelligent transport systems -- Urban ITS -- Air quality management in urban areas	00.00
ISO/PWI 24311	Intelligent transport systems -- Urban ITS -- 'Controlled zone' management for UVARs using C-ITS	00.00
ISO/PWI 24310	Intelligent transport systems -- Urban ITS -- Models and definitions for new modes	00.00
ISO/PWI 24309-1	Intelligent transport systems -- Location referencing harmonization for Urban ITS -- Part 1: State of the art and guidelines	00.00
ISO/PWI 24309-2	Intelligent transport systems -- Location referencing harmonization for Urban ITS -- Part 2: Transformation methods	00.00
ISO/PWI TR 23797	Intelligent transport systems -- Mobility integration -- Gap and overlap analysis of ISO/TC 204 work programme for mobility integration	00.00

6 ETSI

6.1 Introduction

The European Telecom Standardisation Institute (ETSI) is a major contributor to global telecom standards such as GSM, LTE and now 5G. ETSI does also have a formal and legal role in Europe since it produces Harmonised European Norms, which is an operative part of the RED directive that allows sale and operation of radio equipment without type approval. ETSI is different from ISO and CEN since it is a private institution with paying members, and where balloting is done by weighted votes according to membership size.

Since the members pay for the secretariat, the resulting standards and finished documents can be downloaded for free. This main link to ETSI gives a good overview, and there are further links to search for freely downloadable standards.

ETSI TC ITS has a separate home page. This home page is relatively complete with news updates and links to much other work, but unfortunately not very easy to get an overview of.

The formal work is performed under the ETSI Portal. Much of the overview and status information is available, but drafts and internal documents require password access.

Figure 3: Overview picture illustrating the scope of ETSI standardisation of ITS.

This picture gives an overview of the intended total scope of ETSI, and it is also a good overview of elements for multimodal Cooperative ITS.

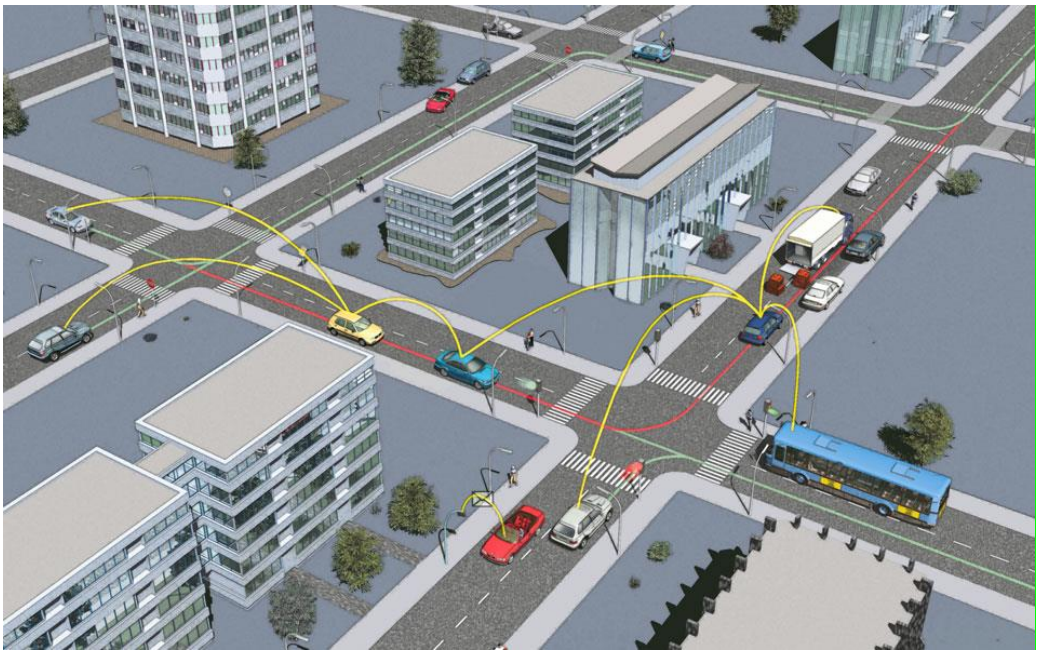


Figure 4: Overview of the communication scenarios

Note that ETSI TC ITS is currently limited to a small subset of this scope. The main focus is

- 5.9 GHz communications called ITS-G5 in ETSI terminology,
- applying a special multi-hopping network function called GeoNet, and
- serving a small number of mainly safety applications for vehicle-to-vehicle and vehicle-to-roadside scenarios. This vehicle-safety-centric scenario is supported by strong security provisions.

The strong focus on vehicle safety is promoted by the Car-to-Car Communications Consortium (C2C-CC) which is led by European car industry.

During the last two years, interest on the use of 5G cellular technology has come in, but the main part of the ETSI ITS standards are still untouched by this effort from the telecoms industry. Also note that the naming (G5 vs 5G) has confused many actors by their similarity, so it is advised to use the full name such as **ITS-G5** or **C-V2X** or **LTE-V2X** to avoid harmful misunderstandings.

ETSI TC ITS has made very good use of EC financial support to pay for standardisation developments. The process is called Specialist Task Force (STF) and consists of groups of 3-5 experts that are paid to draft a standard over a limited period, typically 6-12 months. This is the same as CEN Project Teams (PTs). The financing formally comes from DG GROW but is advised by DG CONNECT and DG MOVE.

6.2 ETSI TC ITS Working Groups

There are five working groups in this committee. The structure of the committee is as follows:

Figure 5: Overview of ETSI WGs

The tables listing the specifications for each working group have been taken from the ETSI Portal. Please note that there can be several versions of the same documents listed (e.g. for TS 102 637-2 there is V1.1.1 and V1.2.1) as the backward compatibility between different versions is not always guaranteed.

6.3 WG1: User and Application requirements

WG1 is developing standards in three different areas:

1. Facilities are protocols in the ITS-S facilities layer. These are core standards (building blocks) that form the basis for applications.
2. Basic set of Applications is a list of around 50 core applications and services for Cooperative ITS. This list contains an overall description of each application plus some parameters that are useful for sorting and characterizing the different applications. This document can be quite useful to understand the scope of Cooperative ITS as seen from ETSI perspective.
3. Data sets defining CAM, DENM and some other services. These messages are broadcast from a vehicle and/or a roadside and are used in several different applications. This work is partly based on data sets from TC278 WG4, TC278 WG8, TC204 WG3, TC204/WG14, TC204 WG16 and SAE J2735, and the results are also partly overlapping.

It should also be mentioned that WG1 has taken an active role in standards for Tyre Pressure and Electric Vehicles, for the use case of communicating charge status and opportunities, and guiding vehicles to charge points.

The Table 25 below shows the standards published by WG1 User and Application requirements

Table 25: WG1 User and Application requirements per January 2019

Standard ref.	Standard title	Stage
	WG1 User and Application requirements	
ETSI TS 103 301 V1.2.1 (2018-08)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Facilities layer protocols and communication requirements for infrastructure services	Published
ETSI TS 103 191-3 V1.2.1 (2017-03)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Facilities layer protocols and communication requirements for infrastructure services; Part 3: Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)	Published
ETSI TS 103 191-2 V1.2.1 (2017-03)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Facilities layer protocols and communication requirements for infrastructure services; Part 2: Test Suite Structure and Test Purposes (TSS & TP)	Published

Standard ref.	Standard title	Stage
	WG1 User and Application requirements	
ETSI TS 103 191-1 V1.2.1 (2017-03)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Facilities layer protocols and communication requirements for infrastructure services; Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) pro forma	Published
ETSI TR 103 061-2 V1.2.1 (2014-04)	Intelligent Transport Systems (ITS); Testing; Part 2: Conformance test specifications for Decentralized Environmental Notification basic service Messages (DENM); DENM validation report	Published
ETSI TR 103 061-1 V1.2.1 (2014-04)	Intelligent Transport Systems (ITS); Testing; Part 1: Conformance test specifications for Co-operative Awareness Messages (CAM); CAM validation report	Published
ETSI EN 302 895 V1.1.1 (2014-09)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Local Dynamic Map (LDM)	Published
ETSI TS 102 894-2 V1.3.1 (2018-08)	Intelligent Transport Systems (ITS); Users and applications requirements; Part 2: Applications and facilities layer common data dictionary	Published
ETSI TS 102 894-1 V1.1.1 (2013-08)	Intelligent Transport Systems (ITS); Users and applications requirements; Part 1: Facility layer structure, functional requirements and specifications	Published
ETSI TS 102 869-3 V1.5.1 (2017-03)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Decentralized Environmental Notification Basic Service (DEN); Part 3: Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)	Published
ETSI TS 102 869-2 V1.5.1 (2017-03)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Decentralized Environmental Notification Basic Service (DEN); Part 2: Test Suite Structure and Test Purposes (TSS & TP)	Published
ETSI TS 102 869-1 V1.5.1 (2017-03)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Decentralized Environmental Notification Basic Service (DEN); Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) pro forma	Published
ETSI TS 102 868-3 V1.4.1 (2017-03)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Cooperative Awareness Basic Service (CA); Part 3: Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)	Published

Standard ref.	Standard title	Stage
	WG1 User and Application requirements	
ETSI TS 102 868-2 V1.4.1 (2017-03)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Cooperative Awareness Basic Service (CA); Part 2: Test Suite Structure and Test Purposes (TSS & TP)	Published
ETSI TS 102 868-1 V1.4.1 (2017-03)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Cooperative Awareness Basic Service (CA); Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) pro forma	Published
ETSI TR 102 863 V1.1.1 (2011-06)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Local Dynamic Map (LDM); Rationale for and guidance on standardization	Published
ETSI TR 102 698 V1.1.2 (2010-07)	Intelligent Transport Systems (ITS); Vehicular Communications; C2C-CC Demonstrator 2008; Use Cases and Technical Specifications	Published
ETSI TR 102 638 V1.1.1 (2009-06)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Definitions	Published
ETSI EN 302 637-3 V1.3.0 (2018-08)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service	On Approval
ETSI TS 102 637-3 V1.1.1 (2010-09)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service	Published
ETSI EN 302 637-2 V1.4.0 (2018-08)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service	On Approval
ETSI TS 102 637-2 V1.2.1 (2011-03)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service	Published
ETSI TS 102 637-1 V1.1.1 (2010-09)	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 1: Functional Requirements	Published
ETSI TS 101 556-3 V1.1.1 (2014-10)	Intelligent Transport Systems (ITS); Infrastructure to Vehicle Communications; Part 3: Communications system for the planning and reservation of EV energy supply using wireless networks	Published

Standard ref.	Standard title	Stage
	WG1 User and Application requirements	
ETSI TS 101 556-2 V1.1.1 (2016-02)	Intelligent Transport Systems (ITS); Infrastructure to Vehicle Communication; Part 2: Communication system specification to support application requirements for Tyre Information System (TIS) and Tyre Pressure Gauge (TPG) interoperability	Published
ETSI TS 101 556-1 V1.1.1 (2012-07)	Intelligent Transport Systems (ITS); Infrastructure to Vehicle Communication; Electric Vehicle Charging Spot Notification Specification	Published
ETSI TS 101 539-3 V1.1.1 (2013-11)	Intelligent Transport Systems (ITS); V2X Applications; Part 3: Longitudinal Collision Risk Warning (LCRW) application requirements specification	Published
ETSI TS 101 539-2 V1.1.1 (2018-06)	Intelligent Transport Systems (ITS); V2X Applications; Part 2: Intersection Collision Risk Warning (ICRW) application requirements specification	Published
ETSI TS 101 539-1 V1.1.1 (2013-08)	Intelligent Transport Systems (ITS); V2X Applications; Part 1: Road Hazard Signalling (RHS) application requirements specification	Published
ETSI TS 103 324	Collective Perception Service	Stable draft
ETSI TR 103 300-1	Vulnerable Road Users (VRU) awareness; Part 1: Use Cases definition	Stable draft
ETSI TS 103 300-2	Vulnerable Road Users (VRU) awareness; Part 2: Functional Architecture and Requirements definition	Start of Work
ETSI TS 103 300-3	Vulnerable Road Users (VRU) awareness; Part 3: Specification of VRU awareness basic service	Start of Work
ETSI TR 103 299	Cooperative Adaptive Cruise Control (C-ACC); Pre-standardization study	Final Draft for approval
ETSI TR 103 298	Platooning; Pre-standardization study	Stable Draft
ETSI TR 103 562	Vehicular Communications; Basic Set of Applications; Analysis of the Collective Perception Service (CPS)	Stable Draft
ETSI TS 103 152	V2X Communications; Multimedia Content Dissemination Basic Service specification	Final Draft for approval
ETSI TS 103 141	Facilities layer; Communication congestion control	Final Draft for approval
ETSI TR 102 638	Use cases; Description R2	Start of Work

Standard ref.	Standard title	Stage
	WG1 User and Application requirements	
ETSI TS 103 301	Vehicular Communications; Basic Set of Applications; Facilities layer protocols and communication requirements for infrastructure services	Early draft
ETSI TR 103 496	Cooperative ITS (C-ITS) support for transport pollution management applications; use cases and standardization study	Stable Draft
ETSI TS 103 561	Vehicular Communications; Basic Set of Applications; Manoeuvre Coordination Service	Early Draft
ETSI EN 302 890-2	Facilities layer function; Part 2: Position and time facility specification	Stable draft
ETSI TR 103 578	Vehicular Communications; Informative report for the Manoeuvre Coordination Service	Stable Draft
ETSI TR 103 579	Pre-Standardization Study on charging applications in ETSI ITS-G5	Stable Draft

6.4 WG2 Architecture and Cross Layer

The first specification of the ITS station and communication architecture, ISO 21217, was published by ISO in 2010. Later the same year, based on ISO 21217, ETSI published EN 302 665, which is almost identical to ISO 21217. With the 2014 version of 21217, ISO aligned with EN 302 665 and added several new examples and clarifications to the terminology.

EN 302 665 / ISO 21217 is part of the published basic set of communication standards for cooperative systems in ITS.

- **NOTE: EN 302 665 has not been updated since 2010. Readers are advised to use ISO 21217 to get the latest terminology and functionality.**

IEEE 1609 has developed a WAVE device architecture standard (IEEE 1609.0) for short-range 5.9GHz (IEEE 802.11/1609 (WAVE)) communications only (V2V / V2I). This WAVE device architecture can be seen as a subset of the ITS station and communication architecture.

WG2 has three main responsibilities:

- **Communications Reference Architecture** was the first full standard to be completed in TC ITS. This is a coordination and an extension of what has been produced in TC204 WG16 as the CALM standards, and is now fully harmonized with ISO and CEN. It embodies the ITS station concept that is included in the definition of Cooperative ITS. Definition of ITS Station and C-ITS is essential for the C-ITS Delegated Act.
- **Cross-layer coordination and management plane standards.** This is mainly the technical kernel of the ITS station and defines how the different components work together to form a system.
- **Legacy DSRC standards**. The EC has funded several STFs in this domain, and the basic set of DSRC test suites in the EN 300 674 series are developed here. Also, the test suites for the CALM set of standards are developed under this umbrella.

The Table 26 below shows the standards published by WG2 Architecture and Cross Layer.

Table 26: WG2 Architecture and Cross Layer standards per January 2019

Standard ref.	Standard title	Stage
	WG2 Architecture and Cross Layer	
ETSI TS 103 175 V1.1.1 (2015-06)	Intelligent Transport Systems (ITS); Cross Layer DCC Management Entity for operation in the ITS G5A and ITS G5B medium	Published
ETSI TR 103 101 V1.1.1 (2014-06)	Intelligent Transport Systems (ITS); Test suite validation; Access technology support ISO 21218	Published
ETSI TS 102 985-3 V1.2.1 (2014-06)	Intelligent Transport Systems (ITS); Communications Access for Land Mobiles (CALM); Test specifications for non-IP networking (ISO 29281); Part 3: Abstract Test Suite (ATS) and partial PIXIT proforma	Published
ETSI TS 102 985-2 V1.2.1 (2014-06)	Intelligent Transport Systems (ITS); Communications Access for Land Mobiles (CALM); Test specifications for non-IP networking (ISO 29281); Part 2: Test Suite Structure and Test Purposes (TSS & TP)	Published
ETSI TS 102 985-1 V1.2.1 (2014-06)	Intelligent Transport Systems (ITS); Communications Access for Land Mobiles (CALM); Test specifications for non-IP networking (ISO 29281); Part 1: Protocol Implementation Conformance Statement (PICS) proforma	Published
ETSI TR 102 965 V1.1.1 (2013-03)	Intelligent Transport Systems (ITS); Application Object Identifier (ITS-AID); Registration list	Published
ETSI TR 102 962 V1.1.1 (2012-02)	Intelligent Transport Systems (ITS); Framework for Public Mobile Networks in Cooperative ITS (C-ITS)	Published
ETSI EN 302 890-1 V1.2.0 (2018-04)	Intelligent Transport Systems (ITS); Facilities layer function; Part 1: Services Announcement (SA) specification	On Approval
ETSI TS 102 890-1 V1.1.1 (2017-05)	Intelligent Transport Systems (ITS); Facilities layer function; Part 1: Services Announcement (SA) specification	Published
ETSI TS 102 860 V1.1.1 (2011-05)	Intelligent Transport Systems (ITS); Classification and management of ITS application objects	Published
ETSI EG 202 798 V1.1.1 (2011-01)	Intelligent Transport Systems (ITS); Testing; Framework for conformance and interoperability testing	Published
ETSI TS 102 797-3 V1.2.1 (2014-06)	Intelligent Transport Systems (ITS); Communications Access for Land Mobiles (CALM); Test specifications for ITS station management (ISO 24102); Part 3: Abstract Test Suite (ATS) and partial PIXIT proforma	Published

Standard ref.	Standard title	Stage
	WG2 Architecture and Cross Layer	
ETSI TS 102 797-2 V1.2.1 (2014-06)	Intelligent Transport Systems (ITS); Communications Access for Land Mobiles (CALM); Test specifications for ITS station management (ISO 24102); Part 2: Test Suite Structure and Test Purposes (TSS & TP)	Published
ETSI TS 102 797-1 V1.2.1 (2014-06)	Intelligent Transport Systems (ITS); Communications Access for Land Mobiles (CALM); Test specifications for ITS station management (ISO 24102); Part 1: Protocol Implementation Conformance Statement (PICS) specification	Published
ETSI TS 102 760-3 V1.1.1 (2014-06)	Intelligent Transport Systems (ITS); Communications Access for Land Mobiles (CALM); Test specifications for Access Technology Support (ISO 21218); Part 3: Abstract Test Suite (ATS) and partial PIXIT proforma	Published
ETSI TS 102 760-2 V1.2.1 (2014-06)	Intelligent Transport Systems (ITS); Communications Access for Land Mobiles (CALM); Test specifications for Access Technology Support (ISO 21218); Part 2: Test Suite Structure and Test Purposes (TSS & TP)	Published
ETSI TS 102 760-1 V1.2.1 (2014-06)	Intelligent Transport Systems (ITS); Communications Access for Land Mobiles (CALM); Test specifications for Access Technology Support (ISO 21218); Part 1: Implementation Conformance Statement (ICS) proforma	Published
ETSI TS 102 723-5 V1.1.1 (2012-11)	Intelligent Transport Systems (ITS); OSI cross-layer topics; Part 5: Interface between management entity and facilities layer	Published
ETSI TS 102 723-4 V1.1.1 (2012-11)	Intelligent Transport Systems (ITS); OSI cross-layer topics; Part 4: Interface between management entity and networking & transport layer	Published
ETSI TS 102 723-3 V1.1.1 (2012-11)	Intelligent Transport Systems (ITS); OSI cross-layer topics; Part 3: Interface between management entity and access layer	Published
ETSI TS 102 723-2 V1.1.1 (2012-11)	Intelligent Transport Systems (ITS); OSI cross-layer topics; Part 2: Management information base	Published
ETSI TS 102 723-1 V1.1.1 (2012-11)	Intelligent Transport Systems (ITS); OSI cross-layer topics; Part 1: Architecture and addressing schemes	Published
ETSI TS 102 708-2-3 V1.5.1 (2018-08)	Intelligent Transport Systems (ITS); RTTT; Test specifications for High Data Rate (HDR) data transmission equipment operating in the 5,8 GHz ISM band; Part 2: Application Layer; Sub-part 3: Abstract Test Suite (ATS) and partial PIXIT pro forma	Published

Standard ref.	Standard title	Stage
	WG2 Architecture and Cross Layer	
ETSI TS 102 708-2-2 V1.5.1 (2018-08)	Intelligent Transport Systems (ITS); RTTT; Test specifications for High Data Rate (HDR) data transmission equipment operating in the 5,8 GHz ISM band; Part 2: Application Layer; Sub-Part 2: Test Suite Structure and Test Purposes (TSS & TP)	Published
ETSI TS 102 708-2-1 V1.3.1 (2013-03)	Intelligent Transport Systems (ITS); RTTT; Test specifications for High Data Rate (HDR) data transmission equipment operating in the 5,8 GHz ISM band; Part 2: Application Layer; Sub-part 1: Protocol Implementation Conformance Statement (PICS) proforma specification	Published
ETSI TS 102 708-1-3 V1.1.1 (2010-03)	Intelligent Transport Systems (ITS); RTTT; Test specifications for High Data Rate (HDR) data transmission equipment operating in the 5,8 GHz ISM band; Part 1: Data Link Layer; Sub-Part 3: Abstract Test Suite (ATS) and partial PIXIT proforma	Published
ETSI TS 102 708-1-2 V1.1.1 (2010-03)	Intelligent Transport Systems (ITS); RTTT; Test specifications for High Data Rate (HDR) data transmission equipment operating in the 5,8 GHz ISM band; Part 1: Data Link Layer; Sub-Part 2: Test Suite Structure and Test Purposes (TSS&TP)	Published
ETSI TS 102 708-1-1 V1.1.1 (2010-03)	Intelligent Transport Systems (ITS); RTTT; Test specifications for High Data Rate (HDR) data transmission equipment operating in the 5,8 GHz ISM band; Part 1: Data Link Layer; Sub-Part 1: Protocol Implementation Conformance Statement (PICS) proforma specification	Published
ETSI TR 102 707 V1.1.1 (2009-05)	Intelligent Transport Systems (ITS); ETSI object identifier tree; ITS domain	Published
ETSI EN 302 665 V1.1.1 (2010-09)	Intelligent Transport Systems (ITS); Communications Architecture	Published
ETSI TR 101 613 V1.1.1 (2015-09)	Intelligent Transport Systems (ITS); Cross Layer DCC Management Entity for operation in the ITS G5A and ITS G5B medium; Validation set-up and results	Published
ETSI TR 101 612 V1.1.1 (2014-09)	Intelligent Transport Systems (ITS); Cross Layer DCC Management Entity for operation in the ITS G5A and ITS G5B medium; Report on Cross layer DCC algorithms and performance evaluation	Published
ETSI TR 101 611 V1.1.1 (2014-06)	Intelligent Transport Systems (ITS); Testing; Conformance test specification for CALM Fast Services; FNTP/FSAP/IICP validation report	Published

Standard ref.	Standard title	Stage
	WG2 Architecture and Cross Layer	
ETSI ES 200 674-1 V2.4.1 (2013-05)	Intelligent Transport Systems (ITS); Road Transport and Traffic Telematics (RTTT); Dedicated Short Range Communications (DSRC); Part 1: Technical characteristics and test methods for High Data Rate (HDR) data transmission equipment operating in the 5,8 GHz Industrial, Scientific and Medical (ISM) band	Published
ETSI TR 103 439	Multi Channel Operations; Pre-standardization study	Start of Work
ETSI TR 103 576-1	Pre-standardization study on ITS architecture; Part 1: Architecture for communications among ITS stations with multiple access layer technologies;	Final Draft for approval
ETSI TR 103 576-2	Pre-standardization study on ITS architecture; Part 2: Interoperability among heterogeneous ITS systems and backward compatibility	Final Draft for approval
ETSI EN 302 890-1	Facilities layer function; Part 1: Services Announcement (SA) specification	TB Approval
ETSI TR 102 962	Framework for Public Mobile Networks in Cooperative ITS (C-ITS)	Stable Draft

6.5 WG3: Transport and Network

WG3 is focused on the middle communications layers for network and data transport functions. All efforts are concentrated on GeoNetworking/GeoRouting which is a concept that uses GPS positions as an address, and where intermediate stations can be used as relay stations in case there is no direct connection. This work has been described as experimental, unproven and containing IPR from the main promoters. This functionality is currently not used in the C-ITS Delegated Act implementations.

The Table 27 below shows the standards published by WG3 Transport and Network.

Table 27: WG3 Transport and Network standards per January 2019

Standard ref.	Standard title	Stage
	WG3 Transport and Network	
ETSI TS 103 248 V1.2.1 (2018-08)	Intelligent Transport Systems (ITS); GeoNetworking; Port Numbers for the Basic Transport Protocol (BTP)	Published
ETSI TR 103 061-5 V1.1.1 (2012-11)	Intelligent Transport Systems (ITS); Testing; Part 5: IPv6 over GeoNetworking validation report	Published

Standard ref.	Standard title	Stage
	WG3 Transport and Network	
ETSI TR 103 061-4 V1.1.1 (2012-11)	Intelligent Transport Systems (ITS); Testing; Part 4: Conformance test specification for GeoNetworking Basic Transport Protocol (BTP); GeoNetworking BTP validation report	Published
ETSI TR 103 061-3 V1.2.1 (2014-04)	Intelligent Transport Systems (ITS); Testing; Part 3: Conformance test specifications for Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; GeoNetworking validation report	Published
ETSI EN 302 931 V1.1.1 (2011-07)	Intelligent Transport Systems (ITS); Vehicular Communications; Geographical Area Definition	Published
ETSI TS 102 871-3 V1.4.1 (2017-05)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for GeoNetworking ITS-G5; Part 3: Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)	Published
ETSI TS 102 871-2 V1.4.1 (2017-05)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for GeoNetworking ITS-G5; Part 2: Test Suite Structure and Test Purposes (TSS & TP)	Published
ETSI TS 102 871-1 V1.4.1 (2017-05)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for GeoNetworking ITS-G5; Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) pro forma	Published
ETSI TS 102 870-3 V1.1.1 (2011-03)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for GeoNetworking Basic Transport Protocol (BTP); Part 3: Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)	Published
ETSI TS 102 870-2 V1.1.1 (2011-03)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for GeoNetworking Basic Transport Protocol (BTP); Part 2: Test Suite Structure and Test Purposes (TSS&TP)	Published
ETSI TS 102 870-1 V1.1.1 (2011-03)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for GeoNetworking Basic Transport Protocol (BTP); Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) proforma	Published
ETSI TS 102 859-3 V1.2.1 (2014-04)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Transmission of IP packets over GeoNetworking; Part 3: Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)	Published

Standard ref.	Standard title	Stage
	WG3 Transport and Network	
ETSI TS 102 859-2 V1.2.1 (2014-04)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Transmission of IP packets over GeoNetworking; Part 2: Test Suite Structure and Test Purposes (TSS & TP)	Published
ETSI TS 102 859-1 V1.2.1 (2014-04)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for Transmission of IP packets over GeoNetworking; Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) proforma	Published
ETSI TS 102 723-11 V1.1.1 (2013-12)	Intelligent Transport Systems (ITS); OSI cross-layer topics; Part 11: Interface between networking and transport layer and facilities layer	Published
ETSI EN 302 636-6-1 V1.2.1 (2014-05)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 6: Internet Integration; Sub-part 1: Transmission of IPv6 Packets over GeoNetworking Protocols	Published
ETSI TS 102 636-6-1 V1.1.1 (2011-03)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 6: Internet Integration; Sub-part 1: Transmission of IPv6 Packets over GeoNetworking Protocols	Published
ETSI EN 302 636-5-1 V2.1.1 (2017-08)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 5: Transport Protocols; Sub-part 1: Basic Transport Protocol	Published
ETSI EN 302 636-5-1 V1.2.1 (2014-08)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 5: Transport Protocols; Sub-part 1: Basic Transport Protocol	Published
ETSI TS 102 636-5-1 V1.1.1 (2011-02)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 5: Transport Protocols; Sub-part 1: Basic Transport Protocol	Published
ETSI TS 102 636-4-2 V1.1.1 (2013-10)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 2: Media-dependent functionalities for ITS-G5	Published
ETSI EN 302 636-4-1 V1.3.1 (2017-08)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 1: Media-Independent Functionality	Published

Standard ref.	Standard title	Stage
	WG3 Transport and Network	
ETSI TS 102 636-4-1 V1.1.1 (2011-06)	Intelligent Transport System (ITS); Vehicular communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 1: Media-Independent Functionality	Published
ETSI EN 302 636-3 V1.2.1 (2014-12)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 3: Network Architecture	Published
ETSI TS 102 636-3 V1.1.1 (2010-03)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 3: Network architecture	Published
ETSI EN 302 636-2 V1.2.1 (2013-11)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 2: Scenarios	Published
ETSI TS 102 636-2 V1.1.1 (2010-03)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 2: Scenarios	Published
ETSI EN 302 636-1 V1.2.1 (2014-04)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 1: Requirements	Published
ETSI TS 102 636-1 V1.1.1 (2010-03)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 1: Requirements	Published
ETSI TR 103 563	Pre-standardization study for GeoNetworking Release 2	Stable Draft
ETSI TS 102 636-7-1	GeoNetworking; Part 7: Amendments for C-V2X; Sub-part 1: Amendments to EN 303 636-4-1 (Media-Independent Functionality)	WG Approval
ETSI TS 102 636-7-2	GeoNetworking; Part 7: Amendments for C-V2X; Sub-part 2: Amendments to EN 303 636-5-1 (Basic Transport Protocol)	WG Approval

6.6 5.1.4 WG4: Media

WG4 is the media / physical interface group. The work can be split in two parts as follows:

- The work related to 5.9GHz called ITS-G5. Here we have the basic standards deciding legal operation in Europe called Harmonised ENs followed with the relevant test standards, but also technical regulations how to use the channels effectively. One of the standards specifies interference management between the CEN DSRC on 5.8GHz, and the ITS-G5 on 5.9 GHz. This is of special interest for current operators of DSRC systems. A potential new allocation of WiFi (802.11ac) at 5.8/5.9GHz will cause some interference, and there are several studies on-going to determine how much interference this would entail.
- All the other media like 700 MHz digital dividend, LTE, new digital broadcast media and so on are also included in the WG scope but have so far had a much lower priority than ITS-G5. The

last two years has seen a strong focus on two new cellular technologies, namely LTe-V2X and C-V2X (5G tech).

The Table 28 below shows the standards published by WG4 Media.

Table 28: WG4 Media standards per January 2019

Standard ref.	Standard title	Stage
	WG4 Media	
ETSI TS 103 613 V1.1.1 (2018-11)	Intelligent Transport Systems (ITS); Access layer specification for Intelligent Transport Systems using LTE Vehicle to everything communication in the 5,9 GHz frequency band	Published
ETSI TS 103 574 V1.1.1 (2018-11)	Intelligent Transport Systems (ITS); Congestion Control Mechanisms for C-V2X PC5 interface; Access layer part	Published
ETSI TR 103 403 V1.1.1 (2017-06)	Intelligent Transport Systems (ITS); Mitigation techniques to avoid harmful interference between equipment compliant with ES 200 674-1 and ITS operating in the 5 GHz frequency range; Evaluation of mitigation methods and techniques	Published
ETSI TR 102 960 V1.1.1 (2012-11)	Intelligent Transport Systems (ITS); Mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (RTTT DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range; Evaluation of mitigation methods and techniques	Published
ETSI TS 102 917-3 V1.1.1 (2013-01)	Intelligent Transport Systems (ITS); Test specifications for the channel congestion control algorithms operating in the 5,9 GHz range; Part 3: Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT)	Published
ETSI TS 102 917-2 V1.1.1 (2013-01)	Intelligent Transport Systems (ITS); Test specifications for the channel congestion control algorithms operating in the 5,9 GHz range; Part 2: Test Suite Structure and Test Purposes (TSS & TP)	Published
ETSI TS 102 917-1 V1.1.1 (2013-01)	Intelligent Transport Systems (ITS); Test specifications for the channel congestion control algorithms operating in the 5,9 GHz range; Part 1: Protocol Implementation Conformance Statement (PICS)	Published
ETSI TS 102 916-3 V1.1.1 (2012-05)	Intelligent Transport Systems (ITS); Test specifications for the methods to ensure coexistence of Cooperative ITS G5 with RTTT DSRC; Part 3: Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT)	Published

Standard ref.	Standard title	Stage
	WG4 Media	
ETSI TS 102 916-2 V1.1.1 (2012-05)	Intelligent Transport Systems (ITS); Test specifications for the methods to ensure coexistence of Cooperative ITS G5 with RTTT DSRC; Part 2: Test Suite Structure and Test Purposes (TSS&TP)	Published
ETSI TS 102 916-1 V1.1.1 (2012-05)	Intelligent Transport Systems (ITS); Test specifications for the methods to ensure coexistence of Cooperative ITS G5 with RTTT DSRC; Part 1: Protocol Implementation Conformance Statement (PICS)	Published
ETSI TR 102 862 V1.1.1 (2011-12)	Intelligent Transport Systems (ITS); Performance Evaluation of Self-Organizing TDMA as Medium Access Control Method Applied to ITS; Access Layer Part	Published
ETSI TR 102 861 V1.1.1 (2012-01)	Intelligent Transport Systems (ITS); STDMA recommended parameters and settings for cooperative ITS; Access Layer Part	Published
ETSI TS 102 792 V1.2.1 (2015-06)	Intelligent Transport Systems (ITS); Mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (CEN DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range	Published
ETSI TS 102 724 V1.1.1 (2012-10)	Intelligent Transport Systems (ITS); Harmonized Channel Specifications for Intelligent Transport Systems operating in the 5 GHz frequency band	Published
ETSI TS 102 723-10 V1.1.1 (2012-11)	Intelligent Transport Systems (ITS); OSI cross-layer topics; Part 10: Interface between access layer and networking & transport layer	Published
ETSI TS 102 687 V1.2.1 (2018-04)	Intelligent Transport Systems (ITS); Decentralized Congestion Control Mechanisms for Intelligent Transport Systems operating in the 5 GHz range; Access layer part	Published
ETSI EN 302 663 V1.2.1 (2013-07)	Intelligent Transport Systems (ITS); Access layer specification for Intelligent Transport Systems operating in the 5 GHz frequency band	Published
ETSI ES 202 663 V1.1.0 (2010-01)	Intelligent Transport Systems (ITS); European profile standard for the physical and medium access control layer of Intelligent Transport Systems operating in the 5 GHz frequency band	Published
ETSI TS 102 486-2-3 V1.2.1 (2008-10)	Intelligent Transport Systems (ITS); Road Transport and Traffic Telematics (RTTT); Test specifications for Dedicated Short Range Communication (DSRC) transmission	Published

Standard ref.	Standard title	Stage
	WG4 Media	
	equipment; Part 2: DSRC application layer; Sub-Part 3: Abstract Test Suite (ATS) and partial PIXIT proforma	
ETSI TS 102 486-2-2 V1.2.1 (2008-10)	Intelligent Transport Systems (ITS) Road Transport and Traffic Telematics (RTTT); Test specifications for Dedicated Short Range Communication (DSRC) transmission equipment; Part 2: DSRC application layer; Sub-Part 2: Test Suite Structure and Test Purposes (TSS&TP)	Published
ETSI TS 102 486-2-1 V1.2.1 (2008-10)	Intelligent Transport Systems (ITS); Road Transport and Traffic Telematics (RTTT); Test specifications for Dedicated Short Range Communication (DSRC) transmission equipment; Part 2: DSRC application layer; Sub-Part 1: Protocol Implementation Conformance Statement (PICS) proforma specification	Published
ETSI TS 102 486-1-3 V1.2.2 (2009-05)	Intelligent Transport Systems (ITS); Road Transport and Traffic Telematics (RTTT); Test specifications for Dedicated Short Range Communication (DSRC) transmission equipment; Part 1: DSRC data link layer: medium access and logical link control; Sub-Part 3: Abstract Test Suite (ATS) and partial PIXIT proforma	Published
ETSI TS 102 486-1-2 V1.2.1 (2008-10)	Intelligent Transport Systems (ITS); Road Transport and Traffic Telematics (RTTT); Test specifications for Dedicated Short Range Communication (DSRC) transmission equipment; Part 1: DSRC data link layer: medium access and logical link control; Sub-Part 2: Test Suite Structure and Test Purposes (TSS&TP)	Published
TR 103 440	Investigation to improve TTT DSRC	Stable draft
TS 103 257-1	Access Layer; Part 1: Channel Models for the 5.9 GHz frequency band	Final Draft for approval
TS 103 257-2	Access Layer; Part 2: ITS Performance Analysis Framework	Stable draft
TS 102 916-1	Testing; Coexistence of Cooperative ITS G5 with TTT DSRC; Part 1: Protocol Implementation Conformance Statement (PICS)	TB Approval
TS 102 916-2	Testing; Coexistence of Cooperative ITS G5 with TTT DSRC; Part 2: Test Suite Structure and Test Purposes (TSS & TP)	TB Approval
TS 102 916-3	Testing; Coexistence of Cooperative ITS G5 with TTT DSRC; Part 3: Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT)	Early Draft
TR 103 573	Definition of ITS test mode for operational devices in the field	Stable draft

Standard ref.	Standard title	Stage
	WG4 Media	
TS 103 574	Congestion Control Mechanisms for C-V2X PC5 interface; Access layer part	Publication
TS 103 613	Access layer specification for Intelligent Transport Systems using LTE Vehicle to everything communication in the 5.9 GHz frequency band	Publication

6.7 WG5: Security

Security is considered to be one of the most important and most difficult areas in C-ITS. To illustrate the challenge, just imagine a 15-year-old Japanese produced car registered in Norway, and a new American car registered in Italy, meeting somewhere in France. These two cars will have to understand and trust the information the other is sending and prove that the other car is not a fake installation sending spoofed information. But at the same time the identity must be fully protected according to strict privacy laws (GDPR).

WG5 consists of cryptography experts and has several STFs to help. The individual experts are the same as those in IEEE 1609 WG (developing IEEE 1609.2) and in ISO TC204 WG16, so the basic concepts are harmonized in this area. Unfortunately, the resulting standards are still not fully compatible due to different requirements. The standardisation process involves several steps where the first step is to characterize the entire environment using an ETSI concept called TVRA for Threat, Vulnerability and Risk Analysis. WG5 has performed this analysis but limited the scope to ITS-G5 in a V2V/V2I scenario which is driven by the C2C-CC needs.

The core standards have been harmonised with both IEEE P1609 and CEN/ISO, and together with work from the EU-US Task Force, forms the basis for the EU C-ITS Security Policy and Certificate Policy.

The Table 29 below shows the standards published by WG5 Security.

Table 29: WG5 Security standards per January 2019

Standard ref.	Standard title	Stage
	WG5 Security	
ETSI TR 103 415 V1.1.1 (2018-04)	Intelligent Transport Systems (ITS); Security; Pre-standardization study on pseudonym change management	Published
ETSI TS 103 097 V1.3.1 (2017-10)	Intelligent Transport Systems (ITS); Security; Security header and certificate formats	Published
ETSI TS 103 096-3 V1.4.1 (2018-08)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for ITS Security; Part 3: Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)	Published

Standard ref.	Standard title	Stage
	WG5 Security	
ETSI TS 103 096-2 V1.4.1 (2018-08)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for ITS Security; Part 2: Test Suite Structure and Test Purposes (TSS & TP)	Published
ETSI TS 103 096-1 V1.4.1 (2018-08)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for ITS Security; Part 1: Protocol Implementation Conformance Statement (PICS)	Published
ETSI TR 103 061-6 V1.1.1 (2015-09)	Intelligent Transport Systems (ITS); Testing; Conformance test specifications for ITS Security; Part 6: Validation report	Published
ETSI TS 102 943 V1.1.1 (2012-06)	Intelligent Transport Systems (ITS); Security; Confidentiality services	Published
ETSI TS 102 942 V1.1.1 (2012-06)	Intelligent Transport Systems (ITS); Security; Access Control	Published
ETSI TS 102 941 V1.2.1 (2018-05)	Intelligent Transport Systems (ITS); Security; Trust and Privacy Management	Published
ETSI TS 102 940 V1.3.1 (2018-04)	Intelligent Transport Systems (ITS); Security; ITS communications security architecture and security management	Published
ETSI TR 102 893 V1.2.1 (2017-03)	Intelligent Transport Systems (ITS); Security; Threat, Vulnerability and Risk Analysis (TVRA)	Published
ETSI TS 102 731 V1.1.1 (2010-09)	Intelligent Transport Systems (ITS); Security; Security Services and Architecture	Published
ETSI TS 102 723-8 V1.1.1 (2016-04)	Intelligent Transport Systems (ITS); OSI cross-layer topics; Part 8: Interface between security entity and network and transport layer	Published
TR 103 460	Security Pre-standardisation study on malicious behaviour detection	Stable Draft
TS 103 525-1	Conformance test specifications for ITS PKI management; Part 1: Protocol Implementation Conformance Statement (PICS);	Final draft
TS 103 525-2	Conformance test specifications for ITS PKI management; Part 2: Test Suite Structure and Test Purposes (TSS & TP);	Final draft
TS 103 525-3	Conformance test specifications for ITS PKI management; Part 3: Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)	Final draft
TS 103 097	Security; Security header and certificate formats	Stable Draft

Standard ref.	Standard title	Stage
	WG5 Security	
TS 103 630	Security; Pre-standardization Study on ITS Facility Layer Security for C-ITS Communication Using Cellular Uu Interface	WG Approval
TR 102 893	Security; TVRA	Final Draft for approval
TS 103 600	Testing; Interoperability test specifications	Final Draft
TS 103 601	ITS Security; Security management messages communication requirements and distribution protocols	Stable Draft

7 IEEE (Institute of Electrical and Electronic Engineers)

IEEE is a mainly USA based organisation, but it has several work items relevant for global ITS standardisation. Two groups in IEEE need to be mentioned, in particular:

IEEE 802.11p has defined the basic medium-range V2V/V2I (vehicle-to-vehicle and vehicle-to-roadside) communication link dedicated to ITS. This operates on 5.9 GHz and is currently accepted in all of Europe, Northern America, Australia and New Zeeland, some central and South American countries. Some countries in Asia and Africa are considering the use.

The 802.11p Task Group has completed their work and the approved 802.11p amendment was published July 15, 2010.

802.11p has been "rolled up" in the main 802.11 wireless standard and become an operational mode of normal 802.11.

This standard is available for free download, but please be warned that it consists of several thousand pages and the ITS/802.11p relevant part is difficult to find for non-experts!
(Note: It is called OCB mode, for **Outside the Context of a BSS**, where BSS is the "normal" operation connecting to a WiFi access point).

There are some new studies ongoing, related to a push from the traditional WiFi suppliers to get more spectrum in the 5GHz band. The request is to extend this band for the entire 5GHz band, which would impact with the ITS band, and potentially cause problems for the ITS safety applications at 5.9GHz as well as CEN DSRC at 5.8GHz. Studies are still on-going in USA but will likely result in ITS losing some of the 75MHz spectrum they currently enjoy in USA. In Europe the EC and ERO have decided that the 5.9 GHz spectrum is protected until new potential users can show and justify non-interference to the safety-relevant ITS services.

One challenge is the use of DSRC (Dedicated Short-Range Communication) as an acronym for the 5.9GHz technology. Traditionally this acronym has been used for the CEN TC278 WG9 technology, and the use of the same acronym for very different technologies has given rise to significant confusion already.

Note: Please be aware that DSRC in the US context, is different from the traditional 5.8GHz CEN DSRC used in tolling systems (CEN TC278/WG1 EFC).

IEEE P1609 (also referred to as IEEE 1609 WG) adds the higher layers including some applications. P1609 has approved six standards (P1609.0 – 1609.4 + 1609.11).

P1609 is the preferred standardisation body for 5.9GHz operation in the US. Standards can be accessed or bought from this site.

Please note that the dates in the tables below can seem a bit old compared to CEN/ETSI/ISO ITS standards. This is not so. IEEE and SAE have been providing national reference standards for many years, and these standards are used in operational systems for decades. They are still relevant and being maintained, and are often used as a source of inspiration for the newer ITS standards. Many of the standards in the following list are of that nature.

The below links are referring to the list of published standards gathered by the ITS Standards Program of the US DOT RITA (http://www.standards.its.dot.gov/DevelopmentActivities/PublishedStandards):

- IEEE 1512.3-2006 Standard for Hazardous Material Incident Management Message Sets for Use by Emergency Management Centers;

- IEEE 1609.2-2013 Standard for Wireless Access in Vehicular Environments - Security Services for Applications and Management Messages;
- IEEE 1609.3-2010 Standard for Wireless Access in Vehicular Environments (WAVE) - Networking Services;
- IEEE 1570-2002 Standard for the Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection;
- IEEE 1512 -2006 Standard for Common Incident Management Message Sets for use by Emergency Management Centers ;
- IEEE 1512.1-2006 Standard for Traffic Incident Management Message Sets for Use by Emergency Management Centers;
- IEEE 1609.4-2010 Standard for Wireless Access in Vehicular Environments (WAVE) - Multi-Channel Operation;
- IEEE 1609.12-2012 Standard for Wireless Access in Vehicular Environments (WAVE) - Identifier Allocations;
- IEEE 802.11-2012 Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part II: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification;
- IEEE 1609.0-2013 Standard for Wireless Access in Vehicular Environments (WAVE) - Architecture;
- IEEE 1609.11 - 2010 Standard for Wireless Access in Vehicular Environments (WAVE)--Over-the-Air Electronic Payment Data Exchange Protocol for Intelligent Transportation Systems (ITS);

8 SAE (Society of Automotive Engineers)

SAE J2735 is the name of both a group and a standard. J2735 is a collection of data types and messages that are primarily intended for 5.9GHz link, i.e. V2V/V2R communications. This is the US data set definition for ITS, and in the last few years the data sets intended for the 5.9GHz link are coming together on the global level, with cooperation between ETSI, ISO and SAE. The intention is to achieve a fully harmonized set, where there will be regional differences based on the same basic data elements. As an example, the SPaT/MAP set is developed in ISO TC204/WG18 and transposed back to J2735.

SAE J2945-x is another field of activity. This series is related to specific applications and use cases of key interest for the NHTSA notice of proposed rule making.

There are also a number of other data definitions and ITS-relevant standards in the following list.

The below links are referring to the list of published standards gathered by the ITS Standards Program of the US DOT RITA (http://www.standards.its.dot.gov/DevelopmentActivities/PublishedStandards):

- SAE J2630 Converting ATIS Message Standards from ASN.1 to XML;
- SAE J2399 Adaptive Cruise Control (ACC) Operating Characteristics and User Interface;
- SAE J1663 Truth-in-Labeling Standard for Navigation Map Databases;
- SAE J2540/2 ITIS (International Traveler Information Systems) Phrase Lists;
- SAE J2540/3 National Names Phrase List;
- SAE J2540/1 RDS (Radio Data System) Phrase Lists;
- SAE J2735 Dedicated Short Range Communications (DSRC) Message Set Dictionary;
- SAE J2266 Location Referencing Message Specification (LRMS);
- SAE J1757/1 Standard Metrology for Vehicular Displays;
- SAE J2366/1L ITS Data Bus - Low Impedance Stereo Audio;
- SAE J2365 Calculation of the Time to Complete In-Vehicle Navigation and Route Guidance Tasks;
- SAE J3067_201408 Candidate Improvements to Dedicated Short Range Communications (DSRC) Message Set Dictionary [SAE J2735] Using Systems Engineering Methods ;
- SAE J2539 Comparison of GATS Messages to SAE ATIS Standards Information Report;
- SAE J2372 Field Test Analysis Information Report;
- SAE J2400 Human Factors in Forward Collision Warning Systems: Operating Characteristics and User Interface Requirements;
- SAE J1746 ISP-Vehicle Location Referencing Standard ;
- SAE J2355 ITS Data Bus Architecture Reference Model Information Report;
- SAE J1760 ITS Data Bus Data Security Services;
- SAE J2366/7 ITS Data Bus - Application Message Layer;
- SAE J2366/2 ITS Data Bus - Link Layer;

- SAE J2366/1 ITS Data Bus - lDB-C Physical Layer;
- SAE J2366/4 ITS Data Bus - Thin Transport Layer;
- SAE J2395 ITS In-Vehicle Message Priority;
- SAE J2352 Mayday Industry Survey Information Report;
- SAE J2396 Definitions and Experimental Measures Related to the Specification of Driver Visual Behavior Using Video Based Techniques;
- SAE J2354 Message Set for Advanced Traveler Information System (ATIS);
- SAE J2540 Messages for Handling Strings and Look-Up Tables in ATIS Standards;
- SAE J2313 On-Board Land Vehicle Mayday Reporting Interface;
- SAE J1708 Serial Data Communications Between Microcomputer Systems in Heavy-Duty Vehicle Applications;
- SAE J2373 Stakeholders Workshop Information Report;
- SAE J2369 Standard for ATIS Message Sets Delivered Over Reduced Bandwidth Media;

9 IETF (Internet Engineering Task Force)

The Internet Engineering Task Force supplies all the basic Internet standards. “Normal” Internet access is of course already the basis for almost all communications except short range vehicle access. C-ITS is depending on a new level of mobility that current Internet Protocols (IPv4 and IPv6) cannot supply out of the box. Therefore, IETF has had a task force working on a better solution for the new IPv6 that we all are being moved into these days as the addressable range of IPv4 is getting depleted.

The task force relevant for ITS was initially called NEMO for Network Mobility, but is now merged with other (intermodal) use cases to the group MEXT, Mobility EXTensions. The work of MEXT is also completed.

The current implementations in the European pilots, and the work of CALM, are fully based on IPv6 with NEMO/MEXT extensions, and there has been a cooperation to introduce these essential standards for the core Internet operation.

IETF is also studying further needs of ITS and considering starting work on route optimization and fast handover operation.

A formal liaison between IETF and ISO TC204 was set up at the end of 2015.

10 Standard development and standardisation organisation mapping

In this picture global standardisation resides on top, with regional standardisation in the middle, and with national standardisation efforts on the lower end, see Figure 6: Structure of SDOs on various levels.

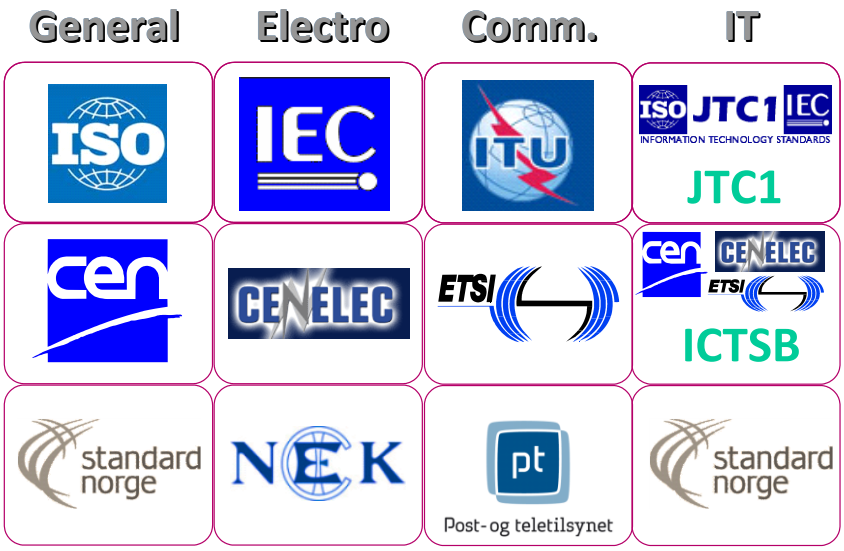


Figure 6: Structure of SDOs on various levels

The idea is that higher layers should take precedence, so that if global standardisation is started, then regional and national standardisation should stop, and all efforts should be focused to the international domain. There are agreements and conventions between the different SDOs to this effect, such as the stand-still agreement between national SDOs and CEN/ISO, and the Vienna Agreement that regulates the cooperation between CEN and ISO. The situation between the other bodies are usually based on bilateral agreement on a case by case basis, or often lack of any agreements at all.

Unfortunately, the world of ITS standardisation has significant overlaps between some SDOs, in particular regarding communication subsystem and some of the new applications such as safety. The main overlaps are currently seen between ETSI TC ITS, ISO TC204/WG16 (CALM), and IEEE P1609 (WAVE/DSRC).

The relevant authorities in Europe (EC DG INFSO) and USA (US DoT RITA/JPO) are following this situation and has signed a policy statement.

Types of standards:

We broadly distinguish between the following main groups or levels of standards.

1. The top level in Europe is called an EN (European Norm). An EN can only be issues by CEN, CENELEC or ETSI. This is the real, permanent standard voted by 27 European national members according to a key decided by population in each country. ENs have some legal implication for public bodies according to the European Public Procurement Directive, but is mainly voluntary for implementation as long as it is not referenced in national or European law (Directives).
   At the same level we have full International Standards (IS). These are also voted by national members, but with one country-one vote. An IS has less binding force than an EN.
2. The second level is usually called a TS for Technical Specification. A TS is decided by the technical committee itself and is a faster process. TS is often used as an intermediate step

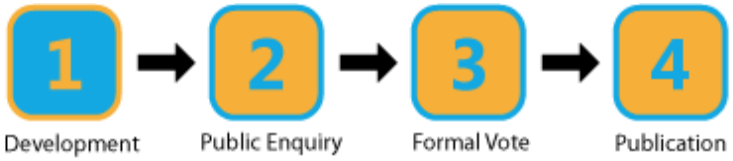
towards a full EN/IS. TS can be referenced in public procurement, but it is more common to require a full EN/IS to assure a better consensus. Older document types that are not used any more are ENVs (preliminary EN standards), and these references can still be found in some specifications.

3. Further levels are called a Technical Report (TR), ETSI Specification (ES), Workshop Agreement (WS) and several other names. These are documents that either are intended as supporting material, or if a specification is needed very fast, or where consensus cannot be achieved but the documents still are registered.

There are also other types of documents issued by SDOs, and their status will usually be described in the introduction of the document itself.

Time to produce standards.

Standardisation is a very time-consuming process. The full standard EN or ISO above involves four steps or stages to go through as indicated in the following drawing:



Each of these process steps may take anywhere from 6 to 18 months, and the typical duration is around three-four years for a full standard. More details can be found in the various bodies development rules, see for example the ETSI Status Codes and the CEN/ISO Stage Codes. The ISO stage codes are shown in Figure 7. ISO stage codes (next page).

The focus is on enabling standards. This means that a typical standard will allow several ways to achieve the goal, as long as the function and external behaviour is the same. Exact product specifications are not the responsibility of SDOs, which often leads to misunderstandings even within the Working Groups.

STAGE	SUBSTAGE						
				90 Decision			
	00 Registration	**20** Start of main action	**60** Completion of main action	**92** Repeat an earlier phase	**93** Repeat current phase	**98** Abandon	**99** Proceed
00 Preliminary stage	**00.00** Proposal for new project received	**00.20** Proposal for new project under review	**00.60** Close of review			**00.98** Proposal for new project abandoned	**00.99** Approval to ballot proposal for new project
10 Proposal stage	**10.00** Proposal for new project registered	**10.20** New project ballot initiated	**10.60** Close of voting	**10.92** Proposal returned to submitter for further definition		**10.98** New project rejected	**10.99** Approval to New project approved
20 Preparatory stage	**20.00** New project registered in TC/SC work programme	**20.20** Working draft (WD) study initiated	**20.60** Close of comment period			**20.98** Project deleted	**20.99** WD approved for registration as CD
30 Committee stage	**30.00** Committee draft (CD) registered	**30.20** CD study/ballot initiated	**30.60** Close of voting/ comment period	**30.92** CD referred back to Working Group		**30.98** Project deleted	**30.99** CD approved for registration as DIS
40 Enquiry stage	**40.00** DIS registered	**40.20** DIS ballot initiated: 12 weeks	**40.60** Close of voting	**40.92** Full report circulated: DIS referred back to TC or SC	**40.93** Full report circulated: decision for new DIS ballot	**40.98** Project deleted	**40.99** Full report circulated: DIS approved for registration as FDIS
50 Approval stage	**50.00** Final text received or FDIS registered for formal approval	**50.20** Proof sent to secretariat or FDIS ballot initiated: 8 weeks	**50.60** Close of voting. Proof returned by secretariat	**50.92** FDIS or proof referred back to TC or SC		**50.98** Project deleted	**50.99** FDIS or proof approved for publication
60 Publication stage	**60.00** International Standard under publication		**60.60** International Standard published				
90 Review stage		**90.20** International Standard under periodical review	**90.60** Close of review	**90.92** International Standard to be revised	**90.93** International Standard confirmed		**90.99** Withdrawal of International Standard proposed by TC or SC
95 Withdrawal stage		**95.20** Withdrawal ballot initiated	**95.60** Close of voting	**95.92** Decision not to withdraw International Standard			**95.99** Withdrawal of International Standard

Figure 7. ISO stage codes

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