



# CV271

# Using the ISO TS 19091 Standard to Implement V2I Intersection Applications Introduction

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## 1. Module Description

This module is an introduction to the *ISO Technical Specification (TS) 19091, Intelligent transport systems—Cooperative ITS—Using V2I and V2V communications for applications related to signalized intersections*, a standard to assist the deployment of applications related to signalized intersections in a connected vehicle environment. I101, Using ITS Standards – An Overview, and I261: Vehicle-to-Infrastructure (V2I) ITS Standards for Project Managers, are recommended prerequisites for participants.

## 2. Introduction/Purpose

The connected vehicle (CV) environment, also known as the Cooperative Intelligent Transportation System (C-ITS) environment, has the potential to significantly reduce vehicular crashes, provide operators of surface transportation systems with more timely and accurate system performance data to better manage their systems, and provide travelers with access to specific traveler information. In order to achieve these benefits, it is essential that agencies use standards in deploying connected vehicle technologies to maximize the benefits from the connected vehicle environment. Proper deployment of standards will support interoperability, minimize future integration costs, make procurements easier, and facilitate regional and national integration.

The purpose of this module is to introduce ISO TS 19091 specification and its relationship with other connected vehicle standards. This module will provide participants with an introduction to the ISO Technical Specification (TS) 19091, Intelligent transport systems—Cooperative ITS—Using V2I and V2V communications for applications related to signalized intersections. The module describes the structure of the specification, presents the use cases addressed by the specification, and then introduces how to use the standard to deploy a standards-based application for signalized intersections. This module helps the participant understand the scope of the ISO TS 19091 specification and describes how implementers can use this specification to implement standards-based connected vehicle applications specific to signalized intersections.

## 3. Reference to Other Standards

### U.S. Department of Transportation Resources

USDOT ITS Standards Program, <http://www.standards.its.dot.gov/>

#### ISO

- ISO/AWI TS 19091 – Intelligent transport systems – Cooperative ITS – Using V2I and I2V communications for applications related to signalized intersections.  
[http://www.iso.org/iso/home/store/catalogue\\_tc/catalogue\\_detail.htm?csnumber=69897](http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=69897)
- USDOT ITS Standards Program, <https://standards.its.dot.gov/Standard/534>

#### SAE

- Dedicated Short Range Communications (DSRC) Technical Committee Page, SAE, <http://www.sae.org/servlets/works/committeeHome.do?comtID=TEVDSRC>
- SAE J2735\_201603 – Dedicated Short Range Communications (DSRC) Message Set Dictionary, SAE, [http://standards.sae.org/j2735\\_201603/](http://standards.sae.org/j2735_201603/)



- SAE J3067 – Candidate Improvements to Dedicated Short Range Communications (DSRC) Message Set Dictionary [SAE J2735] Using Systems Engineering Methods, SAE, [http://standards.sae.org/j3067\\_201408/](http://standards.sae.org/j3067_201408/)

## 4. Glossary

To include additional **descriptions/acronyms** used primarily in the module.

BSM	Basic Safety Message
C-ITS	Cooperative Intelligent Transportation System
DSRC	Dedicated Short Range Communications
DTS	Draft Technical Specification
FHWA	Federal Highway Administration
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
I2V	Infrastructure-to-Vehicle
IEEE	Formerly Institute of Electrical and Electronics Engineers
ISO	International Standards Organization
ITS	Intelligent Transportation Systems
JPO	Joint Program Office
MS	Mobility/sustainability (use cases)
NMEA	National Marine Electronics Association Message
OBE	On-Board Equipment
PR	Priority/preemption (use cases)
PSOBE	Public Safety On-Board Equipment
RSE	Roadside Equipment
RTCM	Radio Technical Commission for Maritime Services Message
RTM	Requirements Traceability Matrix
SA	Safety (use cases)
SAE	Formerly Society of Automotive Engineers International
SPaT	Signal Phase and Timing
SRM	Signal Request Message
SSM	Signal Status Message
TS	Technical Specification
TSP	(Public) Transit Signal Priority
UCRM	Use Case to Requirements Matrix
USDOT	United States Department of Transportation
V2I	Vehicle-to-Infrastructure
V2V	Vehicle-to-Vehicle

Term	Definition
Agency Specification	A document that has been prepared by an agency to define requirements for a subject item or process when procured by the agency.
Application	A piece of software that processes inputs for a specific use or purpose.



Term	Definition
Basic Safety Message (BSM)	The core data set transmitted by the connected vehicle (vehicle size, position, speed, heading acceleration, brake system status) and transmitted approximately 10x per second. A secondary set is available depending upon events (e.g., ABS activated) and contains a variable set of data elements drawn from many optional data elements (availability by vehicle model varies). This would be transmitted less frequently. The BSM is tailored for low latency, localized broadcast required by V2V safety applications but can be used with many other types of applications. See SAE J2735.
Compliance	A condition that exists when an item meets all of the requirements of an agency specification.
Conformance	A condition that exists when an item meets all of the mandatory requirements as defined by a standard. It can be measured on the standard as a whole, which means that it meets all mandatory (and applicable conditional) requirements of the standard or on a feature level (i.e., it conforms to feature X as defined in section X.X.X), which means that it meets all mandatory (and applicable conditional) requirements of the feature.
Cooperative ITS	ITS in which vehicles communicate with each other and/or with the infrastructure. <sup>1</sup>
Data Elements	Smallest named item of data that conveys meaningful information and has a defined set of attributes.
Data Frames	Collections of data elements.
Dedicated Short Range Communications (DSRC)	<p>The use of non-voice radio techniques to transfer data over short distances between roadside and mobile radio units, between mobile units, and between portable and mobile units to perform operations related to the improvement of traffic flow, traffic safety and other intelligent transportation service applications in a variety of public and commercial environments. [FCC, Dedicated Short Range Communications of Intelligent Transportation Services – Final Rule, FR Doc No: 99-30591].</p> <p>A technology for the transmission of information between multiple vehicles (V2V) and between vehicles and the transportation infrastructure (V2I) using wireless technologies.</p>
Intelligent Transportation Systems (ITS)	Systems that apply data processing and data communications to surface transportation, to increase safety and efficiency. ITS systems will often integrate components and users from many domains, both public and private.
Interoperability	The ability of two or more systems or components to exchange information and to use the information that has been exchanged. The dependence of the CV Environment on successful exchange of data between independent components results in a requirement that all V2I deployments.

<sup>1</sup> <http://www.etsi.org/index.php/technologies-clusters/technologies/intelligent-transport/cooperative-its>



Term	Definition
MAP	A message containing roadway geometric information. See SAE J2735.
Message	A structured string of data elements used to convey information.
On-Board Equipment (OBE)	This term refers to the complement of equipment located in the vehicle for the purpose of supporting the vehicle side of the applications. It is likely to include the DSRC radios, other radio equipment, message processing, driver interface, and other applications to support the use cases described herein. It is also referred to as the Vehicle ITS Station. When referring to the DSRC radio alone, the correct term is OBU (see below).
Signal Phase and Timing (SPaT)	A message type that describes the current state of a signal system and its phases and relates this to the specific lanes (and therefore to maneuvers and approaches) in the intersection. See SAE J2735.
Use case	Identifies the interactions between a user (actor) and a system (in this context, an application) to enable the user to achieve a goal.
V2I	Vehicle-to-Infrastructure communications: a system designed to wirelessly exchange information between a vehicle and the infrastructure.
V2V	Vehicle-to-Vehicle communications: a system designed to transmit basic safety information between vehicles to facilitate warnings to drivers concerning impending crashes.

## 5. References

### Connected Vehicle Basics

- ITS ePrimer – Module 13: Connected Vehicles. <http://www.pcb.its.dot.gov/eprimer/module13.aspx>
- Research and Innovative Technology Administration, “T3 Webinar: Connected Vehicle Basics.” [http://www.pcb.its.dot.gov/t3/s140424\\_cv\\_basics.asp](http://www.pcb.its.dot.gov/t3/s140424_cv_basics.asp)
- Federal Highway Administration, “Connected Vehicles Environment Fundamentals 101”, [http://stsmo.transportation.org/Documents/ConnectedVehiclesToInfrastructure101\\_PresentationRev7.pdf](http://stsmo.transportation.org/Documents/ConnectedVehiclesToInfrastructure101_PresentationRev7.pdf)
- CITE - Consortium for ITS Training and Education, "Regional Operations Forums: Connected Vehicles and the Future of Transportation", <https://youtu.be/HNS17Iq9QCw>

### Deployment (General)

- Research and Innovative Technology Administration, Connected Vehicle Research, [http://www.its.dot.gov/research\\_areas/connected\\_vehicle.htm](http://www.its.dot.gov/research_areas/connected_vehicle.htm)
- Intelligent Transportation Systems Joint Program Office - Research. <http://www.its.dot.gov/index.htm>
- Research and Innovative Technology Administration, DSRC Fact Sheet, [http://www.its.dot.gov/factsheets/dsrc\\_factsheet.htm](http://www.its.dot.gov/factsheets/dsrc_factsheet.htm)
- ITE Connected Vehicle Support Project, <http://www.ite.org/connectedvehicle/>



- U.S. Government Accountability Office Intelligent Transportation Systems: Vehicle-to-Infrastructure Technologies Expected to Offer Benefits, but Deployment Challenges Exist, GAO-15-775, Published Sept 15, 2015, <http://gao.gov/products/GAO-15-775>

## 6. Study Questions

The quiz/poll questions and answer choices as presented in the PowerPoint slide to allow students to either follow along with the recording or refer to the quiz at a later date in the supplement.

1. Which of the following is NOT a benefit of standardization?
  - a) Supports interoperability
  - b) Reduces risk
  - c) Prohibits proprietary solutions
  - d) Helps with design and procurement
2. Which of the following is NOT an application supported by ISO TS 19091?
  - a) Localized Public Transport Signal Priority
  - b) Signalized Corridor Eco-Driving Speed Guidance
  - c) Red Light Violation Warning
  - d) Forward Collision Warning
3. Which of the following is NOT a category of use cases in ISO TS 19091?
  - a) Safety
  - b) Electronic Payment
  - c) Mobility/Sustainability
  - d) Signal Priority/Preemption
4. How does ISO TS 19091 use SAE J2735 to specify message contents?
  - a) Fulfills requirements based on ISO 19091 use cases
  - b) Fulfills requirements found in the SAE J2735 standard
  - c) Directly satisfy the user needs derived from the ISO 19091 use cases
  - d) Directly satisfy the user needs in the SAE J2735 standard
5. Which matrices allow a system designer to select system requirements based on use cases?
  - a) Needs to Requirements Traceability Matrix
  - b) Requirements Traceability Matrix
  - c) Use Case to Requirements Traceability
  - d) Test Case to Requirements Traceability Matrix

## 7. Icon Guide

The following icons are used throughout the module to visually indicate the corresponding learning concept listed out below, and/or to highlight a specific point in the training material.



- 1) **Background information:** General knowledge that is available elsewhere and is outside the module being presented. This will be used primarily in the beginning of slide set when reviewing information readers are expected to already know.



- 2) **Tools/Applications:** An industry-specific item a person would use to accomplish a specific task, and applying that tool to fit your need.



- 3) **Remember:** Used when referencing something already discussed in the module that is necessary to recount.



- 4) **Refer to Student Supplement:** Items or information that are further explained/detailed in the Student Supplement.



- 5) **Example:** Can be real-world (case study), hypothetical, a sample of a table, etc.



- 6) **Checklist:** Use to indicate a process that is being laid out sequentially.

