Standards Participation Guidance

ITS Standards Program

www.its.dot.gov/index.htm
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Notice

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16. Abstract

The Intelligent Transportation System Joint Program Office (ITS JPO) focuses on research projects, exploratory studies and deployment support for the intelligent transportation system. The ITS Architecture and Standards Programs are foundational to the other ITS research programs. The Architecture Program provides a framework for the planning and deployment of ITS. ITS standards exist within technologies deployed under the framework of the ITS Architecture and define how system components interconnect and interact. Because ITS standards are based on open, non-proprietary technology, their use can facilitate the deployment of interoperable ITS systems, and make it easier for state and local ITS deployers to develop and deploy regionally integrated transportation systems.

ITS research programs are encouraged to use ITS standards in the development of their projects. During the research process the program may determine gaps in existing ITS standards or require changes to the standards. This paper guides the ITS JPO research leads through a process for identifying the level of ITS standards program interaction required, and provides sample procurement language for standards coordination.

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Table of Contents

List of Tables

List of Figures

Executive Summary

The Intelligent Transportation System Joint Program Office (ITS JPO) focuses on research projects, exploratory studies and deployment support for the intelligent transportation system. The ITS Architecture and Standards Programs are foundational to the other ITS research programs. The Architecture Program provides a framework for the planning and deployment of ITS. ITS standards exist within technologies deployed under the framework of the ITS Architecture and define how system components interconnect and interact. Because ITS standards are based on open, non-proprietary technology, their use can facilitate the deployment of interoperable ITS systems, and make it easier for state and local ITS deployers to develop and deploy regionally integrated transportation systems.

ITS research programs are encouraged to use ITS standards in the development of their projects. During the research process the program may determine gaps in existing ITS standards or require changes to the standards. This paper guides the ITS JPO research leads through a process for identifying the level of ITS standards program interaction required, and provides sample procurement language for standards coordination.

1 Why ITS Standards?

The purpose of ITS standards is to build interoperable systems. Based on an ITS architecture framework the ITS standards provide the requirements and technical design for most components of an ITS system. Standards define interfaces within architectures to enable required interoperability and support efficient deployment.

The ITS JPO is under a legislative directorate to cooperate with stakeholders and standards development organizations (SDOs) on achieving consensus standards. The USDOT does not seek to dictate content of standards, but to participate in the SDO process in reaching consensus on standards' content. ITS standards generally are not mandated by regulation, however the NHTSA proposed rulemaking may do so. Adoption of ITS standards by deployers is far more likely with broad consensus. The ITS Standards Program is tracking ~100 ITS standards developed to date.

ITS JPO supports the development and publication of standards in the following areas:

- ITS connected vehicle (CV): vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), V2x – SAE J2735/2945, IEEE 1609/802.11 Dedicated Short-Range Communications (DSRC)
- ITS center-to-center (C2C), center-to-field (C2F): National Transportation Communications for ITS Protocol (NTCIP), Advanced Transportation Controller (ATC), Traffic Management Data Dictionary (TMDD)

Additionally, the program is exploring standards in automation/connected automation, and following ITS relevant activities (ex. 3GPP, oneM2M, ETSI, CEN, UN WP29, ISO TC22).

There are three general categories of standards. (1) Protocol standards define rules or conventions formulated to control the exchange of data (e.g. IEEE 802, 1609). (2) Application (or information) standards describe messages and their contents, and dialogs to support one or more applications (e.g. SAE J2735, TMDD, NTCIP 1202). The final category (3) is profile standards that define the options specific to a protocol or application (e.g. SAE J2945/1).

ITS standards are developed by one of the standards development organizations (SDO). There are a number of relevant SDOs that develop ITS related standards which include IEEE, SAE International, Institute of Transportation Engineers (ITE), American Association of State Highway and Transportation Officials (AASHTO) and National Electrical Manufacturers Association (NEMA).

It is important to note that USDOT does not hold the intellectual property rights for the standards, the SDOs do. Any materials developed by the SDO and any materials shared with the SDOs is their intellectual property. USDOT is in partnership with the SDOs to get ITS standardized in a way that will support interoperability.

2 Standards Coordination Methodology

The ITS Standards Program encourages the use of ITS Standards as a building blocks in ITS research projects. The methodology for this use and coordination is described here. Future sections provide examples of research projects and their use of this methodology to coordinate with the ITS Standards Program and implement ITS Standards.

The methodology is described in the following graphic (Figure 1 Research Program Standards Coordination) and described in detail below.
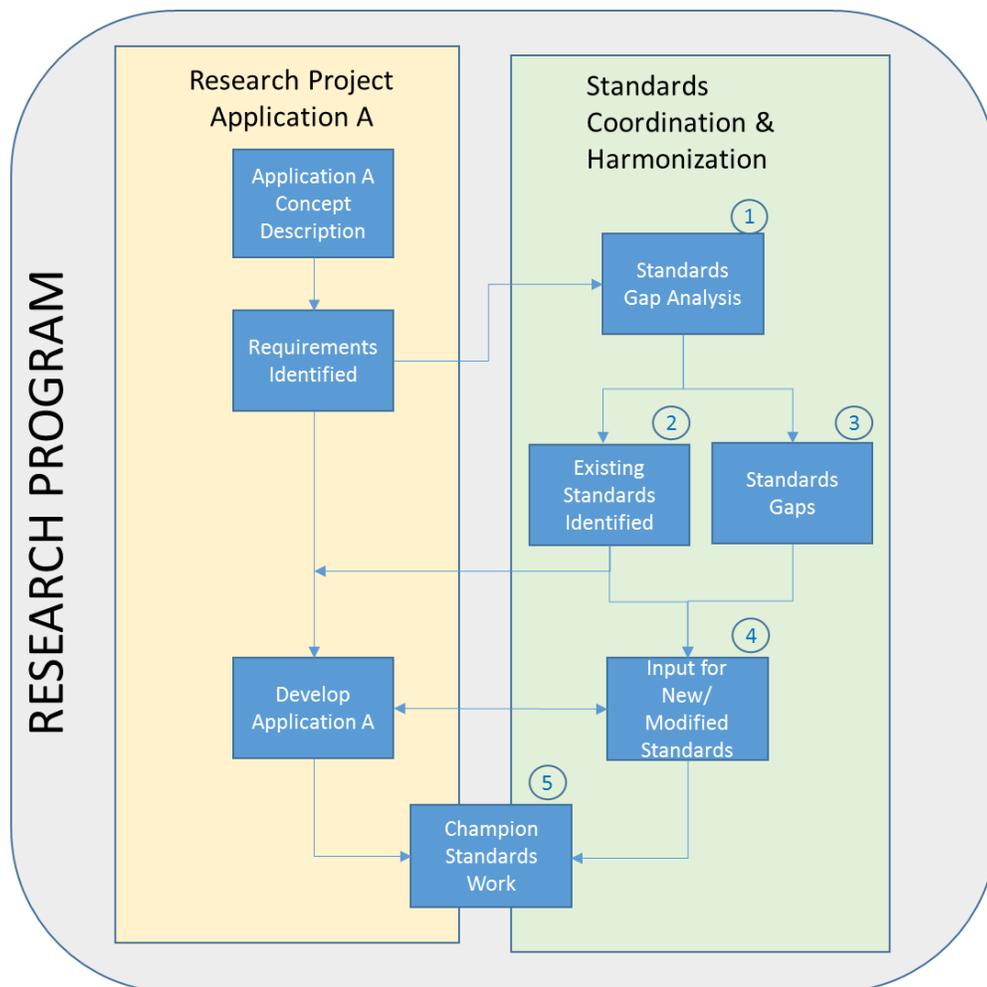

Figure 1 Research Program Standards Coordination

Source: Noblis

2.1 Standards Gap Analysis

Initiate a Standards Gap Analysis task. Using baseline requirements from the Research Project Application(s), determine the standards used, possible standards not considered, and data not standardized.

The gap analysis needs to be done by a <u>software engineer or similarly qualified expert</u> who understands interface development at a minimum. To expedite the process, it would be beneficial to have them involved in the application development & understand standards.

2.2 Existing Standards Identified

The research project should identify the existing standards that could meet their needs. There are a large library of existing Information Technology (IT), ITS and CV standards that meet a wide range of user needs. A good starting point for ITS and CV standards is the list of published standards found at the following USDOT ITS Standards website:
https://www.standards.its.dot.gov/DevelopmentActivities/PublishedStandards.

2.3 Standards Gaps

Once the research program has identified standards that might fit their needs they should do a more detailed analysis and identify the user/applications needs that can't be met by any existing standards. Any gaps found should be identified as either:

- Input for an existing standard – In this case a modification to an existing standard would be able to fill the standards gap. The proposed input should logically fit within the scope of the existing standard.
- Input for a new standard – In this case, there is no standard that logically meets the needs of the research program, and a new standards development effort would be necessary.

2.4 Input for Existing or New Standards

Inputs for an existing standard should focus on what the user need is that is driving the modification, what the proposed modification would be and the evidence from the research program that supports the modification. The CV Pilot Programs recently identified the need for additional Provider Service Identifiers (PSIDs) to support Signal Phase and Timing (SPaT), MapData message (MAP), Signal Status Message (SSM) and Signal Request Message (SRM) J2735 messages. The CV Pilot Programs have developed a plan for what new PSIDs they will use, the channels that will broadcast these PSIDS, and will be collecting data from the on-board units (OBU) and road-side units (RSU). Their plans, as well as the analysis of the data collected, will be presented to the appropriate SAE standard working group. This is an example of a research program that will be proposing inputs to an existing standard.

As with the input for an existing standard, there should be a focus on the user needs driving the new standard, the proposed scope of the new standard and the evidence that supports the creation of a new standard. A real-world example comes from the CV Pilot programs. The CV Pilot Programs identified the need for an interoperable way to control data collection and other features of a Road Side Unit (RSU) from the Traffic Management Center (TMC). There is no logical existing standard

that could support this user need, so a standards development task has been started to create a new infrastructure standard that can meet this need.

2.5 Champion Standards Work

For either input to existing standards or input for a new standard, participating in the standards development process and championing inputs are critical activities to seeing these inputs implemented. The types of activities that would be included in participating in the standards development process include:

- Participating in standards working group meetings via teleconference to champion modifications and/or new standards ideas or adjudicate comments on draft standards.
  - o Standards working groups don't usually meet more than once per month on average, however working group meetings can occur multiple times per week when adjudicating comments or reviewing/conducting walkthroughs of draft standards.
- Participating in face-to-face working group meetings to champion modifications and/or new standards ideas or adjudicate comments on draft standards.
  - o Face-to-face working group meetings usually occur on a quarterly basis and last 2-3 days.
  - o Travel may be required to attend the face-to-face meetings. Joining face-to-face meetings in-person (rather than by phone) is highly recommended if there is any goal beyond monitoring the proceedings.
- Reviewing drafts and providing comments on draft user needs, requirements and designs.

Standards working group meetings can get into technical topics and benefit greatly from the participation of subject matter experts. It is important that those personnel participating in standards working groups have the experience, knowledge and ability to effectively communicate the necessity of the changes/additions to the standards for which they are advocating. It is especially impactful if a logical case with empirical evidence can be made to support those changes/additions.

3 Project Type Examples

Research and pilot deployment projects vary in their level of maturity. Level I Exploratory Research Projects are researching theoretical solutions. Level II Proof of Concept Projects incorporate the use of standards if applicable standards exist. Level III Pilot Projects are larger deployment efforts that have an operational focus and are using standards as part of the implementation.

For each level of research projects there is an associated level of effort required to interface with the ITS standards depending on the maturity of the individual standards.

- Level I: determine if standards exist that could be applicable to the project. Document the potential standards.

- Level II: determine if standards exist, try them out in the project, document findings and feed back to the standards development organizations (SDOs).

- Level III: determine if standards exist, try them out in the project. Make suggestions to the SDO if changes are needed and champion the change. If no standard exists and one is needed, work with USDOT and SDOs to champion a new standard's effort.

3.1 Level I: Exploratory Research Project

Exploratory Research Projects are researching theoretical solutions. It is recommended the research team execute a gap analysis to determine if standards could be used now or in the future. A report to USDOT describing the analysis and potential standards is suggested. If the execution of the Exploratory Research Project shows deficiencies in a standard or ways to improve a standard, then that research and analysis should be provided to the appropriate standards working group. See Section 4 for draft statement of work language.

3.2 Level II: Proof of Concept Projects

Proof of Concept Projects incorporate the use of standards if applicable standards exist. Proof of Concept Projects usually focus on deploying a specific functionality or capability. An example of this type of project would be the CV Safety Pilot, which focused primarily on V2V safety applications. Proof of Concept Projects would usually only employ a small number of CV or ITS standards. The research team will execute the steps in Figure 1. Step #1 will execute the gap analysis. Based on this analysis the research team can categorize the results into three categories: published standards exist that can support the research, standards exist that are in development by an SDO, or standards do not exist. Actions to be taken are described below for these cases.

3.2.1 Published Standards Exist

When the gap analysis determines ITS standards are available for use in the research project, the research project should provide written feedback to the SDOs on what worked, what didn't work, and why changes were needed to the standards in question. The ITS JPO Standards Program Manager should be included in the distribution of the feedback in order to monitor the progress of any requested changes to the standards.

The research team will need to document any items that didn't work or suggested changes for the standards. In-person participation with the appropriate SDO working group should be planned by the research team to ensure the working group members understand the reasons for any suggested changes. In the case of requesting standards' changes, the research team will need to document the operational scenarios, user needs, requirements and design concepts for the standards working group's consideration. The research team should also plan/budget to support follow-on standards working group teleconferences and face-to-face meetings to champion their recommendations and review the draft standards language that addresses them.

In general, supporting standards that have been published should not require a large level of effort. Most likely this would require attending a 2-3 standards working group meetings to discuss the research findings and review draft standards language. These efforts would normally span 6-12 months.

3.2.2 Standards Are in Development

If the gap analysis identifies applicable standards exist but are in development by the SDO, the research team is encouraged to join the working group and provide input to the standards' development process. The input will be in the form of operational scenarios, user needs, requirements and design concepts. As with the existing standards, the research team should plan/budget to follow-on standards working group teleconferences and face-to-face meetings to champion their recommendations and review the drafts standards language that addresses them.

In general, supporting standards that are in development would require a slightly larger level of effort then a published standard. Most likely this would require attending a 4-6 standards working group meetings to discuss the research findings and 2-3 reviews of draft standards language. It is likely that this type of support would span 1-2 years.

3.2.3 Standards Do Not Exist

If standards do not exist to meet the needs of the research project, the project will need to document the operational scenarios, user needs, requirements and design concepts as they are developed within the project. Involvement with the SDOs includes participating with the SDO in question and sharing with them research documentation to keep the SDOs apprised of emerging standards' needs, as well as the follow-on activities discussed in Sections 3.2.1 and 3.2.2.

Supporting a new standards development effort usually requires a much larger level of effort than published standards or standards already in development. This support would likely require multiple standards working group meetings and draft standard reviews spread out over the course of 2-4 years.

3.3 Level III: Pilot Project(s)

Pilot Projects are larger deployment efforts that have an operational focus and are using standards as part of the implementation. The CV Pilot deployments in New York City, Tampa and Wyoming are a good example of pilot projects. Most pilot projects will utilize multiple CV and ITS related standards.

The research project needs to follow the steps in Figure 1. Step #1 will execute the gap analysis. The results of the analysis will: identify the standards that are published that can be used in the project; identify the standards that are under development that the project would like to use; and/or, determine that standards do not exist that meet the project's needs. The gap analysis document needs to be shared with, and possibly briefed to, the ITS JPO Standards Manager.

3.3.1 Published Standards Exist

When the gap analysis determines ITS standards that are available for use in the research project, the research project should provide written feedback to the SDOs on what worked, what didn't work, and why changes were needed to the standards in question. The ITS JPO Standards Program Manager should be included in the distribution of the feedback in order to monitor the progress of any requested changes to the standards.

The research team will need to document any items that didn't work or suggested changes for the standards. In-person participation with the owning SDO should be planned by the research team to ensure the SDO working group members understand the reasons for any suggested changes. In the case of requesting standards' changes, the research team will need to document the operational scenarios, user needs, requirements and design concepts for the standards working group's consideration. The research team should also plan/budget to support follow-on standards working group teleconferences and face-to-face meetings to champion their recommendations and review the draft standards language that addresses them.

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3.3.3 Standards Do Not Exist

If standards do not exist to meet the needs of the research project, the project will need to document the operational scenarios, user needs, requirements and design concepts as they are developed within the project. Involvement with the SDOs includes participating with the SDO in question and sharing with them research documentation to keep the SDOs apprised of emerging standards' needs, as well as the follow-on activities discussed in Sections 3.2.1 and 3.2.2.

Supporting a new standards development effort usually requires a much larger level of effort than published standards or standards already in development. This support would likely require multiple standards working group meetings and draft standard reviews spread out over the course of 2-4 years.

4 Standards Coordination Tasking

This section presents the Performance Work Statement (PWS) / Statement of Work (SOW) language to be used by Research Program leads. The parts of the language to be used depend on the Section 3 descriptions. When preparing PWS / SOW language for contracts/grants, the following language is provided for the procurement document.

4.1 Draft Language for Performing a Standards Gap Analysis

The purpose of this task is to identify existing and under development standards potentially relevant to the research project. Standards provide guidance to ensure products are built with good quality and function properly. This facilitates interoperability across regions. Standardization is essential to trade and helps to reduce costs, encourage innovation, and provides companies access to new markets. Organizations that develop standards can be regional, national, international, or organized around a specific technology or industry. Standards organizations can be treaty-based or voluntary.

Background:
In general, each country has a national standards body (NSB). In the United States, the NSB is the American National Standards Institute (ANSI). The work of ANSI is twofold: first, it oversees the development of voluntary consensus standards for the US; and, second, it represents US interests in standards bodies worldwide.

Occasionally, standards are developed regionally, as in the European Union. In the EU, standards are set by the European Committee for Standardization (CEN), the European Committee for Electrotechnical Standardization (CENELEC) and the European Telecommunications Standards Institution (ETSI). These are the European Standards Organizations (ESOs) recognized by the European Commission and only standards developed by these groups are recognized as European Standards.

In the global economy, international standards serve to remove barriers to trade, advance adoption of new technology, and facilitate innovation. Internationally, ISO (the International Organization for Standardization), IEC (the International Electrotechnical Commission) and ITU-T (the International Telecommunication Union, telecommunication standardization sector) are analogs to the ESOs.

Technology or industry-based standard development organizations (SDOs) that are relevant include, but are not limited to: SAE International; IEEE; ITS America, Standards and Protocol Committee; Institute of Transportation Engineers (ITE); and the American Association of State Highway and Transportation Officials (AASHTO).

The contractor shall interview via questionnaire the SDOs (using the above list as a starting point) to determine the standards in place and in the planning stages that are relevant to the research project. Based on the results of the questionnaire, the contractor shall develop a plan for further interviews/meetings with selected sources and, upon approval execute this. The contractor shall then

develop a white paper documenting the standards relevant to the research project that currently exist or are in development.

4.1.1 Gap Analysis Deliverables

Deliverable	Due Date
Draft questionnaire and list of SDOs to be surveyed	TBD
Final questionnaire and list of surveyed SDOs	TBD
White Paper on Standards Applicable to the Research Project: Currently Existing and Those Being Developed	TBD

Source: Noblis

Table 1 Gap Analysis Deliverables

4.2 Participation in Relevant ITS Standards Development Efforts

Assist the US Department of Transportation (DOT) ITS Joint Program Office (JPO) <Fill in program name> Program in supporting activities of the ITS Standards Program where those activities impact the <Fill in program name> Program. Such support will include attendance at select Standards Development Organization (SDO) working group/committee meetings, providing input to the SDO working group in the form of technical information (e.g., objectives, user needs, data requirements) about the <Fill in program name> Program, and review of relevant standards documentation.

Participation in relevant ITS Standards development efforts may include providing technical input for multiple SDOs and standards-relevant organizations such as the International Organization for Standardization (ISO), European Telecommunications Standards Institute (ETSI), European Committee for Standardization (CEN), IEEE, SAE International (SAE), Institute of Transportation Engineers (ITE), American Association of State Highway and Transportation Officials (AASHTO) and National Electrical Manufacturers Association (NEMA).

4.2.1 Participate in SDO Working Group/Committee Meetings

As the <Fill in program name> Program identifies opportunities for use of ITS Standards, the contractor will coordinate with the ITS JPO and SDOs. The contractor will provide a subject matter expert (SME) to attend SDO working group and/or technical committee meetings. The SME is expected to participate in technical discussions and provide Program needs, use cases, and requirements to the SDO. This tasking includes providing one (1) subject matter expert to attend an estimated six (6) domestic and one (1) international standards meeting annually. The contractor will acquire USDOT travel approval in accordance with their contract.

The USDOT will fund hours associated with attending meetings and reviewing standards documentation for private sector participants. USDOT will reimburse travel expenses at the per diem rate. Reimbursement for membership fees and meeting fees, if required for participation, must be approved by USDOT in writing prior to the meeting. USDOT does not guarantee reimbursement for

every meeting fee or membership fee; these will be evaluated on a case-by-case basis. For each working group/committee meeting attended, the contractor will provide a report to the Contracting Officer Representative (COR) describing the meeting outcomes and any impacts to the <Fill in program name> Program.

4.2.2 Provide Technical Input

The contractor will also be responsible for reviewing standards documentation as it is created and balloted within the SDO process. If the standard is being developed using a systems engineering process, the contractor will employ a systems engineer (SE) to work with the SME to evaluate the content of the standards under development or revision. The SME and SE are responsible for ensuring the <Fill in program name> Program needs are being addressed.

- As an example, the SME and SE can expect to develop well written user needs using the following criteria:
  - Uniquely Identifiable: Each need must be uniquely identified (i.e., each need shall be assigned a unique number and title).
  - Major Desired Capability (MDC): Each need shall express a major desired capability in the system, regardless of whether the capability exists in the current system or is a gap.
  - Solution Free: Each need shall be solution free, thus giving designers flexibility and latitude to produce the best feasible solution.
  - Capture Rationale: Each need shall capture the rationale or intent as to why the capability is needed in the system.
- Another expected activity is the development of well-formed requirements.
  - Good requirements will generally take the form: [Actor] [Action] [Target] [Constraint] [Localization]. The localization and constraint portions are important, but not all requirements will have both. The constraint identifies how to measure success or failure of the requirement. The localization identifies the circumstances under which the requirement applies. For example: The System [Actor] shall generate [Action] event reports [Target] containing the following information [Constraint] on a scheduled interval [localization]. If a requirement can't be stated in this simple format, one probably needs to define the functionality using multiple requirements.

The USDOT will fund hours and travel expenses associated with SME and SE development of technical content for the standard(s). Public sector travel expenses are also funded by USDOT.

4.2.3 Review Standards Documentation

As the SDO develops or revises the standard(s), the contractor will be responsible for reviewing and commenting on the content pertaining to the <Fill in program name> Program. The SDOs have varying methods for contributing comments. As an example SAE provides a spreadsheet with set columns for providing specific comments. The contractor is responsible for reviewing SDO documents and providing comments in the SDO's preferred format. A copy of the comments will be sent to the <Fill in program name> Program Manager.

The contractor will attend SDO meetings and teleconferences where comments are discussed and resolved. The contractor is responsible for representing the <Fill in program name> Program's best interests during these discussions. Standards content based on a participant's personal views, or views of a participant's employer (affiliation) will not be supported by USDOT and are not funded by this task.

The USDOT will fund hours and travel expenses associated with SME and SE review of SDO documents, and the creation of constructive comments. Public sector travel expenses are also funded by USDOT.

4.2.4 Participation Task Deliverables

Deliverable	Due Date
Trip Reports	15 days after end of travel
Standards Documentation Comments	As requested

Table 2 Participation Task Deliverables

Source: Noblis

APPENDIX A. List of Acronyms

Acronym	Meaning
3GPP	3rd Generation Partnership Project
AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ATC	Advanced Transportation Controller
C2C	Center to Center
C2F	Center to Field
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
COR	Contracting Officer Representative
CV	Connected Vehicle
DSRC	Dedicated Short-Range Communications
ESO	European Standards Organizations
ETSI	European Telecommunications Standards Institute
EU	European Union
FHWA	Federal Highway Administration
IEC	International Electrotechnical Commission
ISO	International Organization of Standardization
IT	Information Technology
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
ITU-T	International Telecommunication Union, telecommunication standardization sector
JPO	Joint Program Office
MAP	MapData message
MDC	Major Desired Capability
NEMA	National Electrical Manufacturers Association
NHTSA	National Highway Traffic Safety Administration
NSB	National Standards Body
NTCIP	National Transportation Communications for ITS Protocol
OBU	On-board Units
oneM2M	One Machine to Machine
PSIDs	Provider Service Identifiers
PWS	Performance Work Statement
RSU	Road-side Units
SAE	SAE International
SDO	Standards Development Organization
SE	Systems Engineer
SME	Subject Matter Expert
SOW	Statement of Work

Acronym	Meaning
SPaT	Signal Phase and Timing
SRM	Signal Request Message
SSM	Signal Status Message
TBD	To Be Determined
TC22	ISO Technical Committee 29
TMC	Traffic Management Center
TMDD	Traffic Management Data Dictionary
UN WP29	United Nations Working Party 29
USDOT	United States Department of Transportation
V2I	Vehicle to Infrastructure
V2V	Vehicle to Vehicle
V2X	Vehicle to Everything

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