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Provisional agenda item 3

GLOBAL GROUND VEHICLE STANDARDS

SAE Standards Activities to Advance ITS V2X Communications Technology

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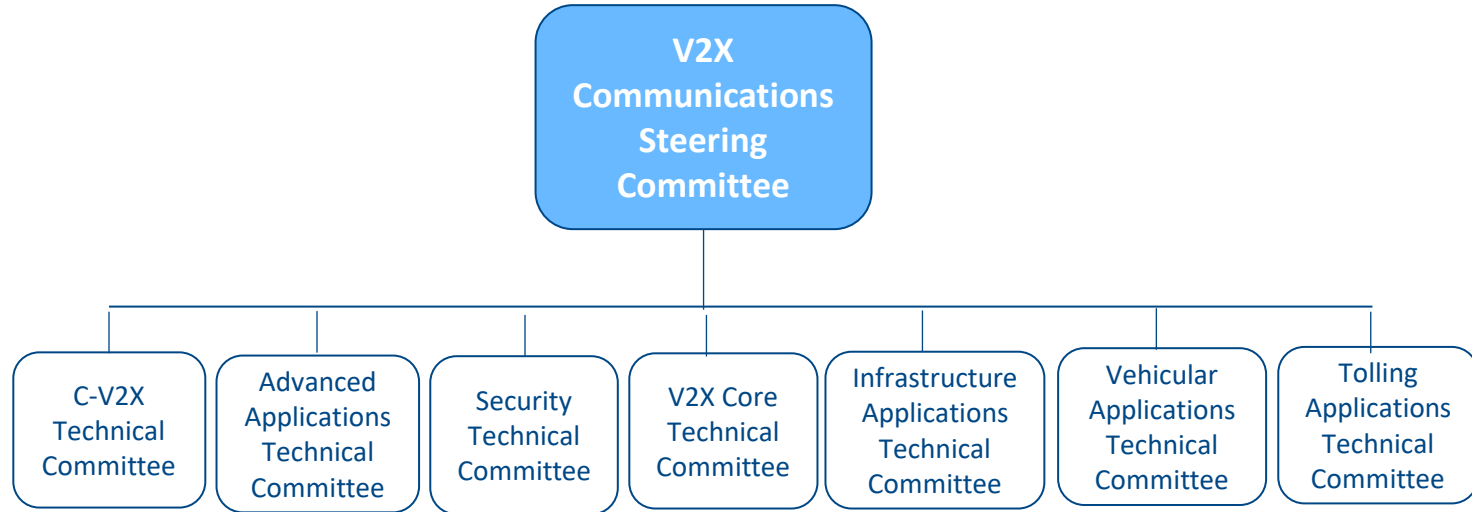


SAE Standards Activities to Advance ITS V2X Communications Technology

CONNECTED



V2X Communications Standards Activities



SAE Standards to Support Connected Vehicle Technologies

Focus Areas for Standards

- Mobile Devices
- Roadside Equipment
- Traffic Information Management
- Systems and Data Back Haul
- Service Providers
- Message Security
- Road Weather
- Curve Warning
- Traveler Information
- Work Zone Warning
- Maps
- Adaptive Signal Control
- Platooning
- Disabled/Vulnerable Road Users



Examples of Driver Alerts

- Forward Collision Warning
- Emergency Electronic Brake Light
- Intersection Movement Assist
- Blind Spot Warning
- Weather Warnings
- Lane Change Warning
- Do Not Pass Warning
- Right Turn in Front
- Signal Phase and Timing
- Curve Speed Warning
- Vulnerable Road Users

Use Cases: V2V V2IV V2 Other Vehicle Automation Center to Center Center to Field

V2X Communications Standards – Foundational Documents

J2735 Message Set Dictionary

* Document Update in Process

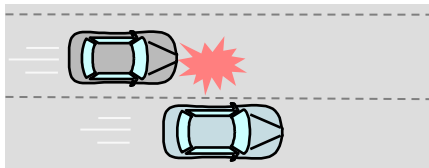
- Defines Standardized Message Sets
- Supports Interoperability
- Defines Formats
- Defines Basic Safety Message (BSM)
- Defines MapData (Map) Message
- Defines Signal Phase and Timing Messages
- Defines Personal Safety Messages for VRUs
- Defines Traveler Information Messages (TIM)

J2945 SEP Guidance for J2945/X Documents

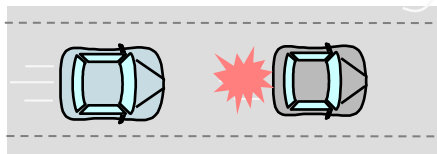
* Document Update in Process

- Provides System Engineering Guidance & Example
- Defines Communication Protocol
- Specifies Communication Performance Requirements
- Defines Message Transmission Rate
- Defines Channel usage
- Optional Data Usage
- Message Application Priorities

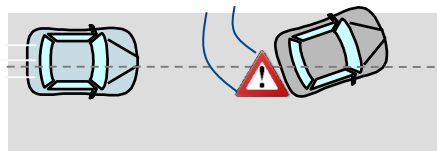
J2945/1 & J3161/1 On-Board System Requirements for V2V Safety Communications



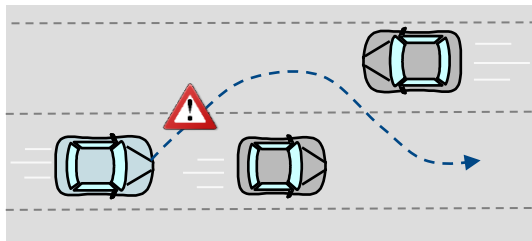
Blind Spot Warning



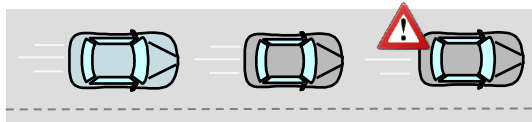
Forward Collision Warning



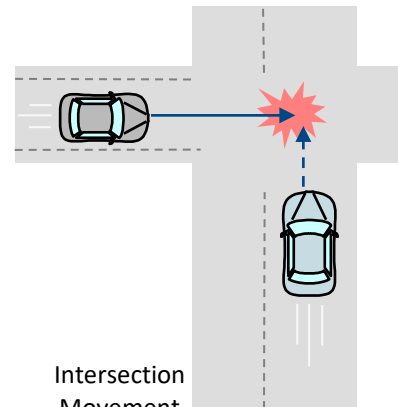
Control Loss Warning



Do Not Pass Warning



Electronic Emergency Brake Lights



Intersection
Movement
Assist

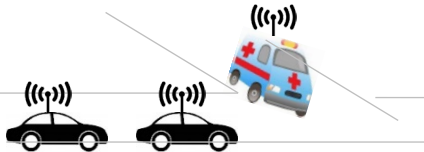
- J3161: C-V2X Deployment Profiles and Radio Parameters
- J3161/1: On-Board System Requirements for LTE-V2X V2V Safety Communications
- J2945/1A & J3161/1A: Vehicle Level Validation Test Procedures for V2V Safety communications

SAE J2945/2 Performance Requirements for V2V Safety Awareness

Defines the performance requirements for V2V Safety Awareness Performance

- Covers four applications: Emergency Vehicle Alert, Roadside Alert, Safety Awareness Alerts for Objects, Adverse Road Conditions
- Includes needs and requirements, design, message and data messages

Emergency Vehicle Alert



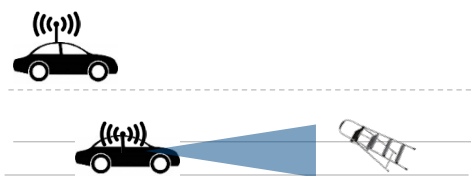
Safety Alert

Slow moving specialty veh.



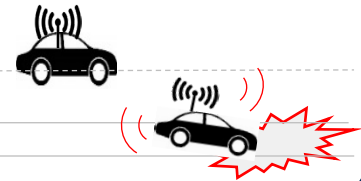
Road Alert

Object on road



Safety Awareness

Black ice



Adverse Road Condition

SAE V2X Communications Documents:

J2945/3

Requirements for V2I Weather Applications

- Collect weather-related data from vehicles & Infrastructure
- Distribute weather-sensitive information for safety and mobility. For example:
 - Enhanced maintenance decision support
 - Weather advisory and warnings
 - Routing support for emergency responders
 - Weather-sensitive variable speed, ramp metering



J2945/5

Service Specific Permissions and Security Guidance for Connected Vehicle Applications

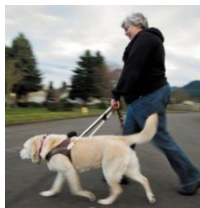
- Establishes a security systems engineering process
- Describes which fields and activities should be subject to SSP constraints
- Specifies syntax and semantics for the SSPs
- Addresses the development of SSPs for scenarios

J2945/9 VRU (V2P) Safety Message Minimum Performance Requirements

* Update in Process

Defines the safety message minimum performance requirements from pedestrian device (e.g., smartphone) to vehicles

Protects vulnerable road users (including people with disabilities/special needs), cyclists, public safety workers



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Traveler Information System Related Standards

J2540 Messages for Handling Strings and Look-up Tables in Advanced Traveler Information System (ATIS) Standard

- *Defines methods and messages to translate sequences of text and other types of data for effective transmission.*

J2540/1 Radio Data System Phrase Lists

- *Provides a table of textual messages for expressing "Radio Data Systems"*

J2540/2 International Traveler Information System Phrase Lists

- *Provides a table of textual messages for expressing International Traveler Information Systems phrases*

J2540/3 National Names Phrase Lists

- *Provides a table of textual messages for expressing the names of street and roads*

J2540/3 National Names Phrase Lists

- *Provides a table of textual messages for expressing the names of street and roads*

J2354 Message Sets for Advanced Traveler Information System

- *Describes standardized medium-independent messages needed by information service providers for Advanced Traveler Information Systems*

J2353 Data Dictionary for Advanced Traveler Information Systems

- *Provides a set of core data elements needed by information service providers for Advanced Traveler Information Systems*

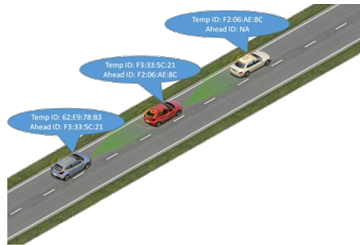
J2266 Location Referencing Message Specification (LRMS)

- *Standardizes location referencing for ITS applications*

SAE V2X Communication Documents: In Process

J2945/6 Cooperative ACC Performance Requirements

- Defines requirements to enhance Adaptive Cruise Control with V2X communications
- Phase 2 to Include platooning



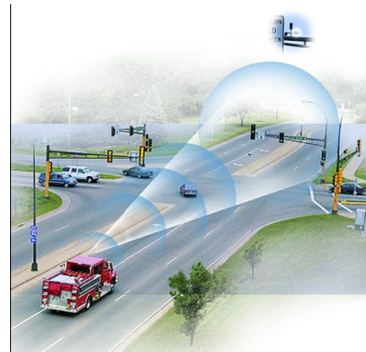
J2945/A Map/SPaT Message Recommended Practice

- Provides guidance on usage & applications
- Intended for developers & users



J2945/B Signal Preemption Recommended Practice

- Provides guidance on usage and applications for signal request & preemption messages



J2945/C Traffic Probe Use and Operation Recommended Practice

- Provides guidance on automated vehicle probe data collection and distribution



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SAE V2X Communication Documents: In Process

J2945/4

Road Safety Applications (WIP)

- Infrastructure → Vehicle safety and mobility-related information
- Candidate applications:
 - Curve speed warning
 - Reduced speed warning
 - Lane & Road changes/closures
 - Interoperability & performance



J2945/7

Positioning Enhancements for V2X Systems (WIP)

- Addressing use cases that require high levels of position accuracy, reliability, and integrity
- Supports integration of high-precision GNSS receivers and other positioning systems



J2945/8

Cooperative Perception Systems (WIP)

- Describes methods for a V2X device to broadcast perception information of other road users/objects nearby
- Defines use cases, performance & security requirements



SAE V2X Communication Documents: In Process

J2945/D

Road User to Road User Courteous Communications (WIP)

- Provides guidance on the requirements of a V2X application to enable drivers (human or machine) to exchange courteous messages to resolve traffic related misunderstandings and conflicts



J3217

Profiles for V2X Based Fee Collection (Published)

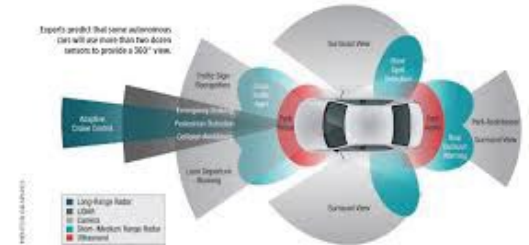
- Provides Concept of Operations to enable V2X toll and other financial transactions.



J3224

V2X Sensor-Sharing for Cooperative & Automated Driving (WIP)

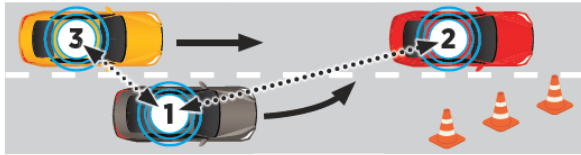
- Provides requirements for a sensor-sharing message suitable for V2X-entities (RSUs, vehicles, VRUs) to describe detected road users, road obstacles and road impairments



SAE V2X Communication Documents: In Process

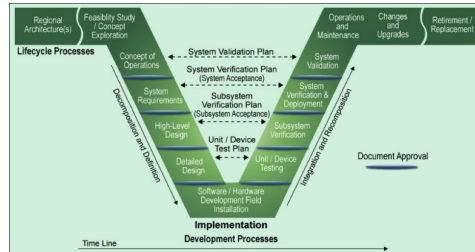
J3186 Application Protocol and Requirements for Maneuver Sharing and Coordinating Service

- *Provides requirements to support applications for the Maneuver Sharing and Coordinating service beyond broadcast of Basic Safety Messages to improve road safety and traffic efficiency*



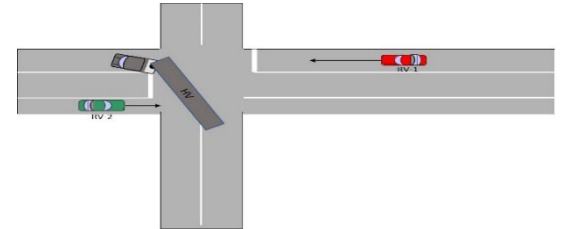
J3242 Systems Engineering Process Guidance and Common Design Concepts for V2X Applications

- *Provides recommendations for the use of Systems Engineering (SE), and cross-cutting material for using V2X security and interfaces.*



J3246 On-Board V2X Safety Systems Requirements for Non-Light Duty Vehicles

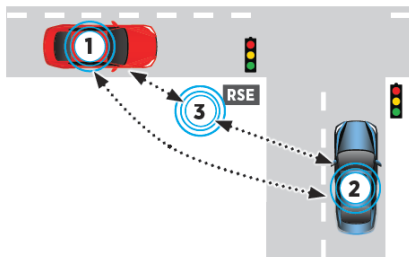
- *Specifies the system requirements for vehicle-to-vehicle (V2V) safety systems for FHWA vehicle classes 1, and 4 through 13 (non-light duty), including functional requirements, and performance requirements.*



SAE V2X Communication Documents: In Process

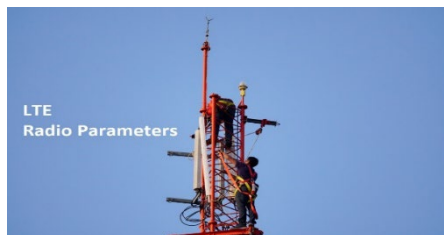
J3238 Infrastructure Applications Testing for Interoperability

- *Provides a generalized test methodology for infrastructure-based application interfaces and corresponding performance levels, using application-specific test methodologies to exchange specific data objects over interface configurations*



J3161/2 LTE Vehicle-to-Everything (LTE-V2X) Deployment Profiles and Radio Parameters for 10 MHz Channel

- *Describes deployment profile and radio parameters for 10 MHz channel based on LTE-V2X PC5 Sidelink (Mode 4) that can be used to support current and future application standards*



J3286

Identity Management Entity within Security Services

- *Provides a generalized approach for identity management entity within security services across V2X applications defined by SAE*



SAE V2X Communication Documents: In Process

J3287 V2X Misbehavior Reporting

- *Provides a generalized approach for identity management entity within security services across V2X applications defined by SAE*



J2945/1B On-Board V2X Safety System Requirements for Non-Light Duty Vehicles

- *Specifies the system requirements for vehicle-to-vehicle (V2V) safety systems for non-light duty vehicle classes 1 & 4 -13*



J3268 Listing of Provider Service Identifiers and Associate Application Technical Report

- *Provides a mapping between provider service identifiers (PSIDs)—allocated to SAE and SAE technical specifications of applications identified by those PSIDs*



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SAE V2X Communication Documents: In Process

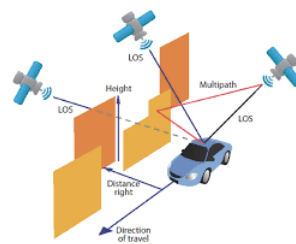
J3269 Vehicular Precise Positioning System Reference Architecture

- *Defines a reference high-level architecture for precise positioning system of passenger vehicles for V2X applications, with the goal of delivering submeter positioning accuracy performance as much as possible*



J3270 Test Procedures for Precise Positioning Systems for Passenger Vehicles

- *Specifies the review, testing, and analysis steps for certifying the performance of precise positioning system of passenger vehicles*



J3217/R

- *Identifies the communications interface between road user and a service provider to support Road User Charging. Also defined are map data structures that enable charging based on geography and vehicle characteristics.*



Safety and Human Factors Standards Related to Connected Vehicles



Driver Interface /
Human Factors

- ✓ J3077™ Definitions and Data Sources for the Driver Vehicle Interface
- ✓ J2395™: ITS In-Vehicle Message Priority
- ✓ J2831™: Development of Design & Engineering Recommendations for In-Vehicle Alphanumeric Messages
- ✓ J2988™: Guidelines for Speech Input & Audible Output in Driver Vehicle Interface
- ✓ J2944™: Operational Definitions of Driving Performance Measures & Statistics

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