

CAT Coalition – AV Infrastructure-Industry Working Group September 25, 2018 Meeting Notes

Attendees:

James Zizelman (WG Co-Chair)	Roger Berg Barry Einsig	Paul Carlson Ken Moshi
Jody Martinson	Katy Salamati	Venkat Nallamothu
Richie Beyer	Dan Veoni	Jeremy Schroeder
Ray Derr	Bill Gouse	
Audrey Copeland	John Hibbard	

Action Items:

- Venkat: share the presentations and meeting summary with the group.
- Venkat will solicit volunteers from the working group following this call to have a small group develop a strawman plan or outline prior to the November meeting.

Introductions and Opening Remarks

- Venkat and the WG co-chair James Zizelman welcomed attendees and provided opening remarks related to the working group.
- James noted that today's meeting is intended to provide input this group needs to complete the deliverables. This group can do anything, but we cannot do everything – and the hope is to get an idea of infrastructure needs to come to a subset that we can agree on.

Presentation: SAE J3016 – Taxonomy & Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles

Bill Gouse of SAE presented on a variety of SAE activities relevant to the working group, including those related to DSRC, C-V2X, and others. Specifically, he referenced the 3016 standard and 3018 guidelines., describing the contents of each and updates that have been made.

- SAE membership votes on whether it is a guideline or standard. 3016 is more well known than 3018. NTSB may instruct SAE to make 3018 a standard, add content, or clarify some information.
- Jim noted that the nature of the AV space is a lot of open-ended, sometimes duplicate efforts. Bill noted that SAE is not an outreach organization, so the products are not always well known.
- Venkat asked if any state regulations had used or referenced the 3018 guidelines. Bill believes Pennsylvania used them, but is not entirely sure about anything else.

Presentation: Infrastructure Needs related to Automated Driving: Proposed Working Group of the On-Road Automated Driving

Paul Carlson, Road Infrastructure Investment Holdings, Inc. described ongoing discussions within the On-Road Automated Driving Committee about whether there is a need to develop a task force that would identify and document characteristics and guidelines for infrastructure as it relates to automated driving technologies. Paul announced that the task force had been approved by SAE to form and begin conducting these activities. His presentation described the needs for this group, and a strawman scope of work defining the objective, considerations, and outputs of the task force.

- Paul noted that the task force will be announced today, and the task force leadership will begin putting together timelines for recruiting membership and objectives. He noted SAE participation generally requires a one-page form that is evaluated by leadership for approval to be on the committees. For anyone interested, contact Paul and he will share the information.
- Ken Moshi noted a program in Transport Canada to develop an infrastructure-focused roadmap for CV-AV that would be beneficial to link with the SAE task force effort.
- Jim asked what the anticipated outcome of the task force might be. Paul noted there are a lot of qualitative recommendations, and one outcome might be to quantify those more. Current infrastructure has been designed around a human driver, so how will design needs change for vehicle sensors? The task force findings could help drive standards and specifications.
- Jim noted it would be helpful to develop a partnership between this working group and the task force to help bring everyone together to a joint goal simultaneously.
- Ray Derr noted a related effort NCHRP 20-102(15) that is closely aligned and he will work with Paul to coordinate these efforts.
- Venkat noted that the presentations will be shared with the meeting minutes.

Roundtable facilitated discussion – Work Group Deliverables

Jim kicked off the roundtable discussion by noting that the working group needs to identify boundaries for an area of focus to drive infrastructure in the right direction.

- Barry Einsig noted the need for a communication plan. OEMs are trying to innovate, some faster than others. Feedback comes from different OEMs at different times because they are at different points of development. Document the objective and the owner for the feedback to have something that the OEMs can develop against. This reflects a need to create some early, fundamental elements of baseline infrastructure. Jim said this would reflect a slight augmentation of Activity #1.
- Ken suggested scoping the boundaries of this working group in the context of what other activities are being conducted by other groups. By mapping out other activities, it may identify other areas that are a gap. Jim noted that this group has a bigger reach and may not have to do a lot of original work, but can provide a great benefit by partnering, providing input, and sharing outputs.
- Paul noted that there are about 15 pages of definitions in SAE 3016 that may be beneficial for the work plan activity, as well as Ray Derr's work.

- Jody Martinson noted how critical it is to capture what is being done. MnDOT is working on a governor's order that needs to be completed by December 1 involving a number of stakeholder groups and gathering information on work that has been done in this area, including cybersecurity, data privacy, and transportation infrastructure. MnDOT is providing recommendations for statute rules.
- Given all the input and comments from today, Venkat and Jim proposed having the small group develop a strawman plan or outline. Venkat will solicit volunteers from the working group following this call.

The next WG meeting is November 27, 2018.

The meeting invite will be updated with an agenda and webinar details closer to the date. The developed strawman will be discussed in this meeting.

SAE INTERNATIONAL

**SAE OVERVIEW OF CONNECTED, ADAS,
AND ADS VEHICLE STANDARDS
REVIEW OF SAE J3016™ REVISIONS,
J3018™ OVERVIEW**

**CAT AV-INFRASTRUCTURE WORKING
GROUP**

William Gouse
Global Ground Vehicle Standards

September 25, 2018



Standards Uses: Process and Examples

**National Technology Transfer and Advancement Act &
Office of Management and Budget Circular A119:
*Incorporation by Reference***

US Congress: House of Representatives -HR.3388 SELF DRIVE ACT; Senate - S.1885 AV START ACT

State Legislation: Uniform Laws Commission

Several States & Commonwealths

American Association Of Motor Vehicle Administrators Policy Guidance

UN ECE WP.29 Terms of Reference for AutoVeh and SG.1 & .2

Singapore Land Transport Authority Autonomous Vehicle Technical Reference / Provisional Standards

SAE Standards: Advanced Driver Assistance Systems (ADAS)

ADAS Related Documents – Work In-Process & Published

- J3087™** : (WIP) Automatic Emergency Braking Performance Assessment Test Methods
- J3122™** : (WIP) Active Safety Test Target Correlation
- J3157™** : (WIP) Active Safety Bicyclist Test Targets Task Force
- J3168™** : (WIP) Recommended Practice for Reliability of Physics Analysis of Electronic Equipment, Modules and Components
- J3088™** : Active Safety Systems Sensors
- J3063™** : Active Safety Systems Terms and Definitions

Safety and Human Factors Standards Related to ADAS

- J3045™** : Truck & Bus Lane Departure Warning Systems Test Procedure
- J3048™** : Driver-Vehicle Interface Considerations for Lane Keeping Assistance Systems
- J2988™** : Guidelines for Speech Input & Audible Output in Driver Vehicle Interface
- J2400™** : Human Factors in Forward Collision Warning Systems Operating Characteristics & User Interface
- J2831™** : Development of Design & Engineering Recommendations for In-Vehicle Alphanumeric Messages
- J2972™** : Definition of Hands-Free Operation of a Person to Person Wireless Communication System or Device
- J2399™** : Adaptive Cruise Control Operating Characteristics & User Interface
- J2808™** : Road/Lane Departure Warning Systems: Information for the Human Interface
- J3077™** : Definitions and Data Sources for the Driver Vehicle Interface (DVI)

SAE Standards: Automated Driving Systems & Connected Vehicle

J3016™: Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems

J3131™: Driving Automation Reference Architecture

J3092™: (WIP) Dynamic Test Procedures for Verification and Validation of Automated Driving

J3134™: (WIP) ADS Equipped Vehicle Signal and Marking Lights

J3171™: (WIP) ADS-DV User Issues for Persons with Disabilities

J3114™: Human Factors Definitions for Automated Driving and Related Research Topics

J3018™: Guidelines for Safe On-Road Testing of SAE Level 3, 4, and 5 Prototype Automated Driving Systems

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

J3061™: Cybersecurity Guidebook for Cyber-Physical Systems

J2980™: Considerations for ISO 26262 ASIL Hazard Classification

DSRC Published Standards

DSRC (Dedicated Short Range Communication) Tech Cmte
Committee [Main](#) [WIP](#) [Documents](#) [Committee Work Area](#) [Roster](#) [Ballots](#) [Email](#)

[SAE Members Only](#) [5 Year Review](#) [Standards Status Definitions](#)

Document List		Display: All Documents
Document	Title	Date
J2266_200410	Location Referencing Message Specification (Lrms)	Oct 29, 2004
J2353_199910	Data Dictionary for Advanced Traveler Information Systems (Atis)	Oct 19, 1999
J2354_200402	Message Sets for Advanced Traveler Information System (Atis)	Feb 10, 2004
J2539_200202	Comparison of Gats Messages to SAE Atis Standards	Feb 22, 2002
J2540/1_200207	Rds Phrase Lists	Jul 25, 2002
J2540/2_200911	ITIS Phrase Lists (International Traveler Information Systems)	Nov 19, 2009
J2540/3_200201	National Names Phrase List	Jan 23, 2002
J2540_200207	Messages for Handling Strings and Look-Up Tables in Atis Standards	Jul 25, 2002
J2630_200312	Converting ATIS Message Standards From ASN.1 to XML	Dec 02, 2003
J2735ASN_201603	Dedicated Short Range Communications (DSRC) Message Set Dictionary™ ASN file	Mar 30, 2016
J2735SET_201603	Dedicated Short Range Communications (DSRC) Message Set Dictionary™ Set	Mar 30, 2016
J2735_201603	Dedicated Short Range Communications (DSRC) Message Set Dictionary™	Mar 30, 2016
J2945/1_201603	On-Board System Requirements for V2V Safety Communications	Mar 30, 2016
J2945/9_201703	Vulnerable Road User Safety Message Minimum Performance Requirements	Mar 21, 2017
J2945_201712	Dedicated Short Range Communication (DSRC) Systems Engineering Process Guidance for SAE J2945/X Documents and Common Design Concepts™	Dec 07, 2017
J3067_201408	Candidate Improvements to Dedicated Short Range Communications (DSRC) Message Set Dictionary [SAE J2735] Using Systems Engineering Methods	Aug 26, 2014

DSRC (Dedicated Short Range Communication) Tech Cmte

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Works in Progress

Project	Title	Sponsor
J2945/10	J2945/10 Recommended Practices for MAP/SPaT Message Development	David C. Kelley
J2945/11	J2945/11 Recommended Practices for Signal Preemption Message Development	Kenneth Larry Head
J2945/12	Traffic Probe Use and Operation	Justin Johnson
J2945/2	DSRC Requirements for V2V Safety Awareness	David C. Kelley
J2945/3	Requirements for V2I Weather Applications	Lee Mixon
J2945/4	DSRC Messages for Traveler Information and Basic Information Delivery	Purser K. Sturgeon II
J2945/5	Service Specific Permissions and Security Guidelines for Connected Vehicle Applications	William Whyte
J2945/6	Performance Requirements for Cooperative Adaptive Cruise Control and Platooning	Ehsan Moradi-Pari
J2945/7	Positioning Enhancements for V2X systems	Jerome Vogedes
J2945/8	Cooperative Perception System	Roger Berg

Cellular V2X Works in Progress

Cellular V2X Technical Committee

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[SAE Members Only](#) [WIPs Older Than 5 Years.](#)

Works in Progress			
Project	Title	Sponsor	Date
J3161	On-Board System Requirements for LTE V2X V2V Safety Communications	Jim Lansford	Nov 06, 2017
J3186	Maneuver Sharing and Coordinating service	Seung Yang	Sep 11, 2018

- This 3rd revision of J3016:

1. Added several new terms and definitions
2. Added further clarification to address frequently misunderstood concepts
3. Corrected errors such as figure numbers and italicized terms

- The following terms were added and defined:
 - 3.4 [DRIVERLESS OPERATION] DISPATCHING ENTITY
 - 3.5 CONVENTIONAL VEHICLE
 - 3.6 DISPATCH [IN DRIVERLESS OPERATION]
 - 3.10 DRIVER SUPPORT [DRIVING AUTOMATION SYSTEM] FEATURE
 - 3.11 DRIVERLESS OPERATION [OF AN ADS-EQUIPPED VEHICLE]
 - 3.12 [ADS-EQUIPPED] DUAL-MODE VEHICLE
 - 3.29.4 DRIVERLESS OPERATION DISPATCHER

Brief summary of changes – clarification of frequently misunderstood concepts

- The following concepts were clarified in section 8:
 - 8.1 J3016 is not a specification and imposes no requirements
 - 8.2 Levels are assigned, rather than measured, and reflect the design intent for the driving automation system feature as defined by its manufacturer
 - 8.3 Level assignments are nominal, rather than ordinal, and are never fractional
 - 8.5 DDT performance, fallback performance, and minimal risk condition achievement are separate functions
 - 8.6 DDT fallback vs failure mitigation strategy
 - 8.7 Level 5 “full driving automation” is the inverse analog of level 0 “no driving automation”
 - 8.8 Practical considerations regarding level 5
 - 8.10 Possible automation of some strategic aspects of driving
 - 8.12 Crash avoidance features found on some conventional vehicles designed for human operation are subsumed by an ADS

Brief summary of changes – corrections

- The following corrections were made:
- Definition of “request to intervene” incorrectly referred to the “driver,” rather than to the “user.”
- Definition of dispatcher corrected to specify dispatch in driverless operation, and to address both personal vehicle dispatching and dispatching entities (i.e., fleet operators).
- The definition of “[dynamic driving task (DDT)] fallback” incorrectly implies that, when performed by an ADS, fallback includes the option of performing the DDT. However, this option is only available to a fallback-ready user at level 3 (provided the vehicle remains drivable, if fallback was triggered by the occurrence of a failure).
- Corrected mis-numbered figures
- Italicized some defined terms that were missed in the last version

SAE J3018 Overview

Authored by the SAE On-Road Automated Driving Committee as part of the Verification and Validation guidelines development.

Provides general safety-relevant guidelines for performing tests of prototype automated driving systems (ADSs) equipped on test vehicles operated in mixed-traffic environments on public roads.

The levels of automation addressed in this document include conditional (level 3), high (level 4), and full (level 5) as defined by SAE J3016; when activated, these ADSs do not rely on a human driver for monitoring and responding to the vehicle or traffic environment.

SAE J3018: SCOPE

The document provides guidelines for the safe conduct of on-road tests of vehicles equipped with prototype conditional, high, and full (SAE Levels 3-5) automated driving systems (ADS), as defined by SAE J3016.

The scope is limited to testing of automated prototype vehicles on public roads.

SAE J3018: SCOPE

- Purpose
- References / applicable documents
- Definitions
 - From SAE J3016
 - Novice, Trained, Expert Test Driver
- Safety Testing Guidance

Safety Testing Guidance

- Test Driver Training
- Test Driver Workload
- Managing Test Drivers
- Safety Development Process
- Software Development and Modifications
- Selection of Test Routes
- Graduated Road Testing
- Test Data Capture
- Safety Override

These Guidelines Do Not Address:

- Testing of driver assist (Level 1) or partial (Level 2) automation systems, which rely on a human driver to monitor the environment.
- Closed-course testing.
- Component-level testing.

A prototype suitable for testing on public roadways should have already passed laboratory and / or closed-course testing, which are not addressed by this document.

A revision is in committee discussion; content influenced by addition experience and stakeholder recommendations.

National Highway Transportation Safety Administration (NHTSA) Letter of 15 September 2017:

- Standard Data Elements for Crash Reconstruction
- Clear and Concise Definitions of Parameters Regarding Operational Design Domain
- Performance Tests Suitable for Variable Performance ADS Testing

Intelligent Transportation Systems / Federal Highway Administration: SAE ITS Standards Support

- ADS and Infrastructure Standardization Factors
- ADS and Infrastructure Standards Gap Analysis
- ADS and Infrastructure Standardization Roadmap

National Transportation Safety Board (NTSB) Recommendations

UN ECE–WP.29, World Forum for the Harmonization of Vehicle Regulations, AutoVeh Task Force, SG- 2:

On-Road Testing (to be renamed / categorized at GRVA meeting as IWG)

<https://wiki.unece.org/display/trans/SG-2+2nd+session>

US-China Joint High-Level Transportation Summit on Automated Vehicles

Uniform Laws Commission on Automated Vehicle Testing

Joint SAE – ISO Standards Development

THANK YOU



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Global Ground Vehicle Standards

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SAE INTERNATIONAL

INFRASTRUCTURE NEEDS RELATED TO AUTOMATED DRIVING

Proposed Working Group of the
On-Road Automated Driving (ORAD) Cmt.

August 2018



Background

- **Automated driving technologies are being tested, built, and deployed (in pilot projects) at a rapid pace**
- **Physical roadway infrastructure operators/owners (IOO) are trying to determine which infrastructure modifications or enhancements are beneficial toward eliminating barriers, accelerating adoption, and enabling operation of vehicles with automated technologies**
- **Various stakeholders (vehicle manufacturers, associations representing vehicle manufacturers, etc.) have expressed interest in more uniformity and increased maintenance of roadway infrastructure assets such as markings, signs, and other traffic control devices**

Strawman Scope of Work

- **Objective**
 - Identify, prioritize, and define roadway infrastructure characteristics that benefit vehicles with automated driving technologies
 - Liaise with other standards relevant organizations involved in IOO and ADS topics
- **Considerations**
 - For the foreseeable future, a mixed fleet of vehicles will be on the roadways (automated driving systems and human driven vehicles)
 - Uncertainty in infrastructure investment and allocation of limited resources are key concerns for State and local IOOs.
- **Outputs**
 - Develop performance-based SAE information reports, recommended practices, and standards that can be used to cost-effectively evolve roadway infrastructure standards and specifications to support automated technologies while continuing to support human driver needs

Terms of Reference

- **Applicability**
 - Vehicles that include at least one SAEJ3016 level 1 through 5 driving automation system feature
 - This effort is envisioned to focus on automated technologies
- **Physical Infrastructure**
 - Physical assets of the roadway that vehicles having automated technologies interact with
- **To be considered later / Topics that will not be addressed in detail**
 - Connected vehicle efforts are already underway (e.g., SAE 2945, 2735)

Suggested Tasks

Realistic topics that the group can address such as:

Infrastructure Categories

- **Road markings**
- **Traffic signs**
- **Traffic signals**
- **Work zones**
- **Rail crossings**
- **Pedestrian and bicycle facilities**
- **School zones**

Topics of Interest

- **Uniformity of design**
- **Maintenance levels**
- **Consistency of application**
- **Optimization**
- **Environmental conditions**

Interest

- **There has already been a strong interest from a diverse group**
 - Infrastructure owners and operators
 - Infrastructure industry
 - Vehicle manufacturers
 - Automotive suppliers
 - Academia
 - Consulting and engineering firms