

# CAT Coalition Infrastructure-Industry Working Group Meeting

May 27, 2021

1:30-3:00 pm (Eastern)

# Today's Agenda

- Welcome and Introductions
- I-I WG Work Plan Activity Updates: Primer of Terms and AV Scan
- Update from Focus Area WG – IOO/OEM Forum:  
Connected Intersections Consistent Procedures for Operations
- SAE Harmonization of Standards Effort
- Announcements and Closing Remarks
  - CAT Coalition and Partner Announcements or Updates: US DOT, ITS America, ITE, AASHTO
  - Ongoing Commitment to Outreach and Knowledge Transfer

# I-I Working Group: Recap of Activities

- The role of this Working Group is to:
  - Support pre-competitive industry research that will advance infrastructure development and maintenance
  - Connect IOOs with industry
  - Support the natural evolution of infrastructure to accelerate CAVs
  - Clarify terms, definitions and target audiences
- Last meeting recap:
  - I-I WG Work Plan Activity: Primer of Terms
  - KPMG's AV Readiness Index
  - Update on Physical Infrastructure Enhancements to Support AV Deployment
- Link: [https://transportationops.org/CATCoalition/infrastructure\\_industry\\_WG](https://transportationops.org/CATCoalition/infrastructure_industry_WG)

# I-I WG Work Plan Activities: Primer of Terms and AV Scan

Jeremy Schroeder, Athey Creek

# Primer of Terms Resource

- Discussed on March I-I WG Webinar and distributed in April for review
- Definitions are not intended as a preferred definition or to be exclusive of variations or interpretations used by other organizations.
  - We do not intend this as an authoritative source, but as a introduction and reference to bridge the gap between IOO and OEM terms that are used
- Definitions are intended to serve as a starting point for practitioners to have a common understanding of terms used either by IOOs, original equipment manufacturers (OEMs), or both
  - We acknowledge similar work that has been conducted by other working groups

# Last Call for Comments on Primer

- Resource distributed to WG members in April for review
  - Are there terms that are missing that should be included?
  - Are there terms that should be removed?
  - Is there a definitive resource that should be used as a reference?
  - ***Definitions are intended as a starting point reference for readers, not intended as authoritative or an endorsement***
- ***Please submit any comments or additions ASAP to Jeremy***
  - Primer will be posted soon on CAT Coalition resources webpage:  
<https://transportationops.org/CATCoalition/resources>

# AV Scan Activity

- Currently developing four sets of questions as a broader follow-up to the 2020 AV Shuttle Survey
  1. Private Sector AV
  2. Public Sector: AV Shuttles
  3. Public Sector: PDDs
  4. Public Sector: Other AVs
- Plan to distribute next month
  - Intent is to distribute to different groups so that the same person is not tasked with completing multiple question sets

# **IOO-OEM Forum Product: Connected Intersections Consistent Procedures for Operations**

Blaine Leonard, Utah DOT



# Connected Intersections Background

- Definition by ITE: an infrastructure system that broadcasts signal, phase and timing (SPaT), mapping information and position correction data to On-Board Units and Mobile Units
- IOO-OEM Forum identified a need: inherent and intended flexibility in standards and system architecture documents used in V2I data exchanges, which may limit or prevent national interoperability
- “Clarifications for Consistent Implementation” resource developed by IOO-OEM Forum, which led to USDOT/ITE Connected Intersections (CI) effort
  - <https://www.ite.org/technical-resources/standards/connected-intersections>

# Need & Purpose of Resource

- Identifies and begins to clarify approaches to operations and disruption scenarios that will regularly or periodically occur with fully operational Connected Intersections (CIs)
  - Short- or long-term maintenance, road work, or closures, power outages, etc.
  - Conflict monitoring is critical to signal operations; an equivalent approach for Connected Intersections is also needed
- Identifies need for ongoing activities as Connected Intersections are deployed and operated
  - Does not identify or prescribe roles
  - Builds on USDOT/ITE Connected Intersections and RSU Standardization efforts
- Identifies situations and considerations for when operational decisions are needed

# Resource Status

- Initial draft developed and reviewed by the IOO/OEM Forum SPaT/RLVW Working Group
- Posted to the CAT Coalition website as a dated draft document
  - Plan is to update and evolve the document
  - We'd appreciate input from this working group (email Blaine or Jeremy)
  - Available at:  
<https://transportationops.org/sites/transportationops/files/CI%20Consistent%20Procedures%20for%20Operations%20v1.2%2004192021.pdf>

## **Connected Intersections – Consistent Procedures for Operations (CPO)**

Cooperative Automated Transportation Coalition  
IOO/OEM SPaT/RLVW Working Group

DRAFT Version 1.0

April 2021

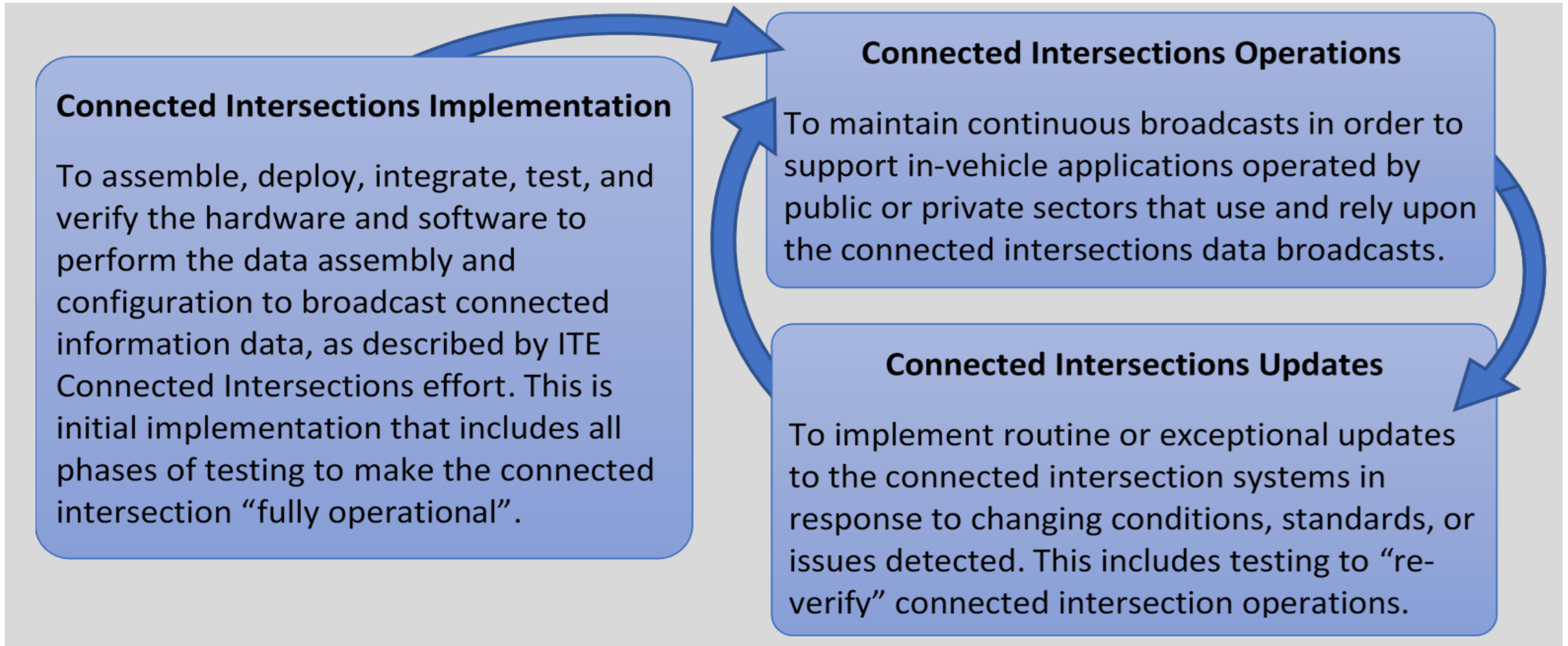
# Resource Content

- Current structure of the resource
- We will highlight several sections today

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# Connected Intersections: Role of Operations



# Four Principles for Connected Intersection Operations

- **Principle #1: No Broadcasts of Incorrect Messages.** Incorrect information risks doing greater harm than if no message were broadcast at all. Any broadcast message should always contain correct information.
- **Principle #2: Restore Correct Broadcasts Progressively as Soon as Practical.** Functionality of CIs should be restored in a progressive, gradual, reliable approach that results in messages containing correct information being broadcast as soon as is practical.
- **Principle #3: Anomalies Must Self-Report to Ensure Accurate Messages.** Anomalies (i.e., CI broadcast does not match the current signal controller mast head displays or the MAP and/or RTCM message is incorrect) should be self-reported by individuals causing the outage (e.g., a utility closing an approach lane to the intersection) when possible. Self-reporting anomalies by automated processes or system detection is also a preferred option.
- **Principle #4: Clearly Identify Fully Operational Connected Intersections.** CIs should be considered “in deployment” until fully tested, verified, and secured; upon which they should be considered “fully operational”.

# Evolving Tactics for Operating Connected Intersections:

## Normal Operations

- ***SPaT Operations.*** Operating and maintaining the connection between the signal controller and the RSU to ensure content is continuously generated for broadcast to connected vehicles.
- ***MAP Updates.*** Creating and implementing an approach that any time the intersection geometry is altered or the assignment of signal groups changes, the MAP message is updated, tested, verified, secured, and uploaded to be broadcast by the RSU.
- ***Position Correction Operations.*** Operating the selected approach to generate and secure location position correction messages (e.g., RTCM messages) continuously without interruption.
- ***Malfunction Monitoring.*** Operating malfunction monitors to detect situations when the signal controller data does not match SPaT broadcasts. Emerging approaches are expected to be developed and tested in the coming years, which may include:
  - Expansions of existing malfunction monitoring equipment and systems that monitor traffic signals today.
  - New approaches, like comparisons of basic safety message (BSM) data received from connected vehicles in an around the intersection against current signals.
- ***Security Operations.*** Operating security credentialing business practices to ensure credentials are being created on a continuous basis, as needed.

# Evolving Tactics

In 2021, not practical for IOOs to immediately respond to all types of outages that may impact the quality of CI broadcasts.

The number of vehicles operating in-vehicle applications does not justify prioritization of resources to such a response.

Over the coming 10-20 years:

- More intersections are likely to become connected, with increasing numbers of products to support easier more efficient management of the broadcasts;
- More vehicles are likely to be equipped with in-vehicle applications;
- The role of in-vehicle applications is likely to change, possibly beyond supplemental warning systems to supporting partial or automated driving functions, increasing the reliance on the data broadcast by the infrastructure; and
- The operations that IOOs perform will evolve with potentially an increased emphasis on maintaining the operational status of infrastructure broadcast.



# Evolving Tactics for Operating Connected Intersections: During Outages and Disruptions

Possible tactical approaches that may be chosen by an agency for various types of disruptions, include:

- **Take no action.** Wait for the temporary disruption to end. In situations where a lane is closed temporarily, the lane may reopen shortly after and no action may have been performed in response to the outage.
- **Pause Broadcasts.** Implement a temporary stop/pause in broadcasting the messages. In situations where a physical activity impacts the intersection, the RSU broadcast may be paused while either the MAP or SPaT messages are not valid.
- **Supplemental warning.** It may be more efficient to continue to broadcast SPaT/MAP messages while adding an indication in either the SAE J2735 message or the security WSA message to indicate the messages are not valid;
- **Broadcast Road Safety Messages (RSMs).** RSMs describing the maintenance or construction work zone event could be broadcast to help indicate to passing vehicles that the intersection operations may be disrupted.
- **On-site Responder Broadcasts.** Alerts could be broadcasts by vehicles (e.g., law enforcement or first responder vehicles) at the intersection (e.g., stationary location, flashing beacons activated) that would help indicate to passing vehicles that intersection operations may be disrupted.

# Evolving Tactics for Operating Connected Intersections: Preliminary Tracking Approach

Industry and broader community of stakeholders need general understanding of number and location of “fully operational” connected intersections.

1. **Self-reporting process coupled with a web-enabled platform** to support reporting and viewing is needed for tracking deployments of “fully operational” CIs.
  - a. Tracking is **not intended to be a real-time depiction** (fully functioning vs. those with a temporary malfunction), but a **representation of the number of sites “fully operational” CIs.**
2. **High-level count of Connected Intersections by state and/or metro area,** at a minimum
3. **Tracking may also consider number of CIs operating at different thresholds of standards or capabilities.**
  - a. CIs using the latest standards vs. earlier standards;
  - b. CIs with additional capabilities like queue length detection and green window reporting (for applications);
  - c. CIs “in deployment” that require additional testing to be “fully operational”.

# Four Use Cases Describing Possible Disruptions

- Complete unplanned malfunction such as a loss of power (e.g., to everything versus specific elements like RSU and/or controller);
- Partial malfunction where the RSU is operational but data is not guaranteed;
- Maintenance, construction, incident, or planned special event; and
- A geometry change at the intersection

## 5.4 Geometry Change at the Intersection

### Activity:

- An additional turn lane is added to the intersection. Signal timing (and [signal groups](#)) are adjusted to reflect the change.
- There is a construction period and a period where the MAP message is updated.

### Signal Controller Status:

- Signal may continue to operate as timed during construction, with flaggers directing traffic when needed.
- Signal timing changes will be implemented just prior to the opening of the new lane.

### SPaT Message:

SPaT Message is still derived from the controller data. When the new timing plan is implemented, [SPaT](#) data will immediately be output.

### MAP Message:

MAP message (initial geometry) will exist and may be broadcast and valid during the construction period. A new MAP message will be needed to reflect the additional lane and connections.

### Considerations and Possible Solutions:

- This represents a combination of several use cases above:
  - There will likely be times when intersection work is active, that the original MAP message is [inaccurate](#) and the broadcast should be paused.
  - There will likely be times when intersection work is inactive and all lanes are open (e.g., evenings) when the broadcast of SPaT/MAP is appropriate.
- There will be a need to test the newly configured intersection to verify the SPaT/MAP are properly represented upon reopening the intersection.

# Feedback Requested

- Any initial thoughts or reactions?
- Available at:  
<https://transportationops.org/sites/transops/files/CI%20Consistent%20Procedures%20for%20Operations%20v1.2%2004192021.pdf>
- Email comments and feedback to Blaine or Jeremy

## **Connected Intersections – Consistent Procedures for Operations (CPO)**

Cooperative Automated Transportation Coalition  
IOO/OEM SPaT/RLVW Working Group

DRAFT Version 1.0

April 2021

# SAE Harmonization of Standards Effort

Tim Weisenberger, SAE



# SAE ADS Standards Roadmapping Initiative

*Roadway Automation Readiness Roundtable*

May 24, 2021

Tim Weisenberger

SAE International Ground Vehicle Standards

# Automation with Cooperation

Automation



Cooperation

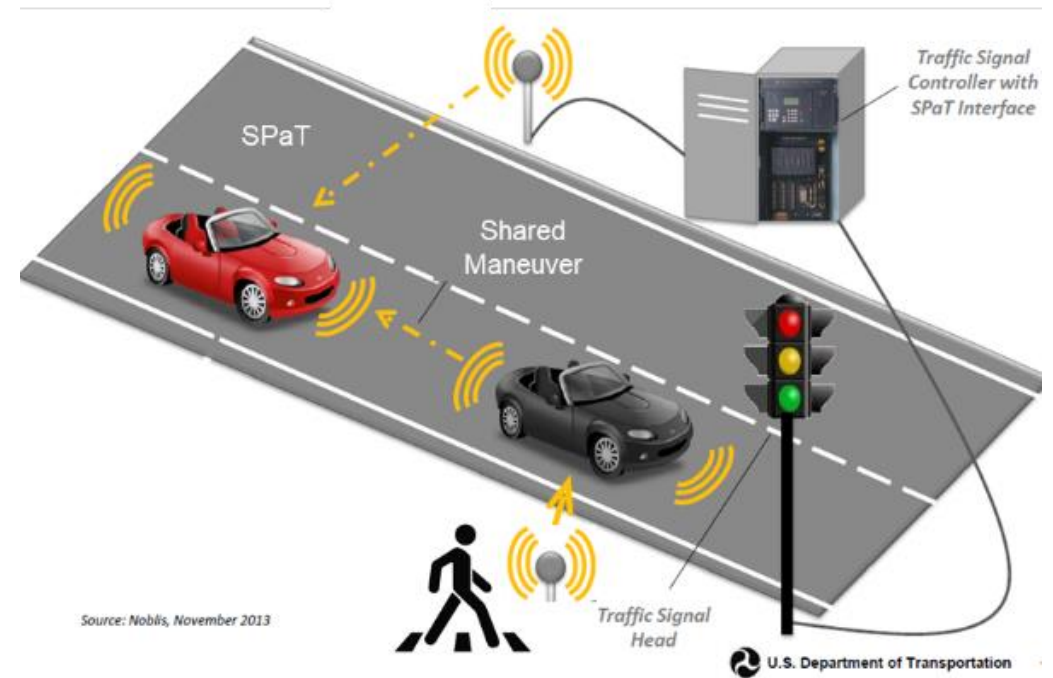


## SAE J3016™ LEVELS OF DRIVING AUTOMATION

	SAE LEVEL 0	SAE LEVEL 1	SAE LEVEL 2	SAE LEVEL 3	SAE LEVEL 4	SAE LEVEL 5
What does the human in the driver's seat have to do?	You <u>are</u> driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			You <u>are not</u> driving when these automated driving features are engaged – even if you are seated in “the driver’s seat”		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
	These are driver support features			These are automated driving features		
What do these features do?	These features are limited to providing warnings and momentary assistance	These features provide steering OR brake/acceleration support to the driver	These features provide steering AND brake/acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met	This feature can drive the vehicle under all conditions	
Example Features	<ul style="list-style-type: none"> <li>• automatic emergency braking</li> <li>• blind spot warning</li> <li>• lane departure warning</li> </ul>	<ul style="list-style-type: none"> <li>• lane centering OR</li> <li>• adaptive cruise control</li> </ul>	<ul style="list-style-type: none"> <li>• lane centering AND</li> <li>• adaptive cruise control at the same time</li> </ul>	<ul style="list-style-type: none"> <li>• traffic jam chauffeur</li> </ul>	<ul style="list-style-type: none"> <li>• local driverless taxi</li> <li>• pedals/steering wheel may or may not be installed</li> </ul>	<ul style="list-style-type: none"> <li>• same as level 4, but feature can drive everywhere in all conditions</li> </ul>

For a more complete description, please download a free copy of SAE J3016: [https://www.sae.org/standards/content/J3016\\_201806/](https://www.sae.org/standards/content/J3016_201806/)

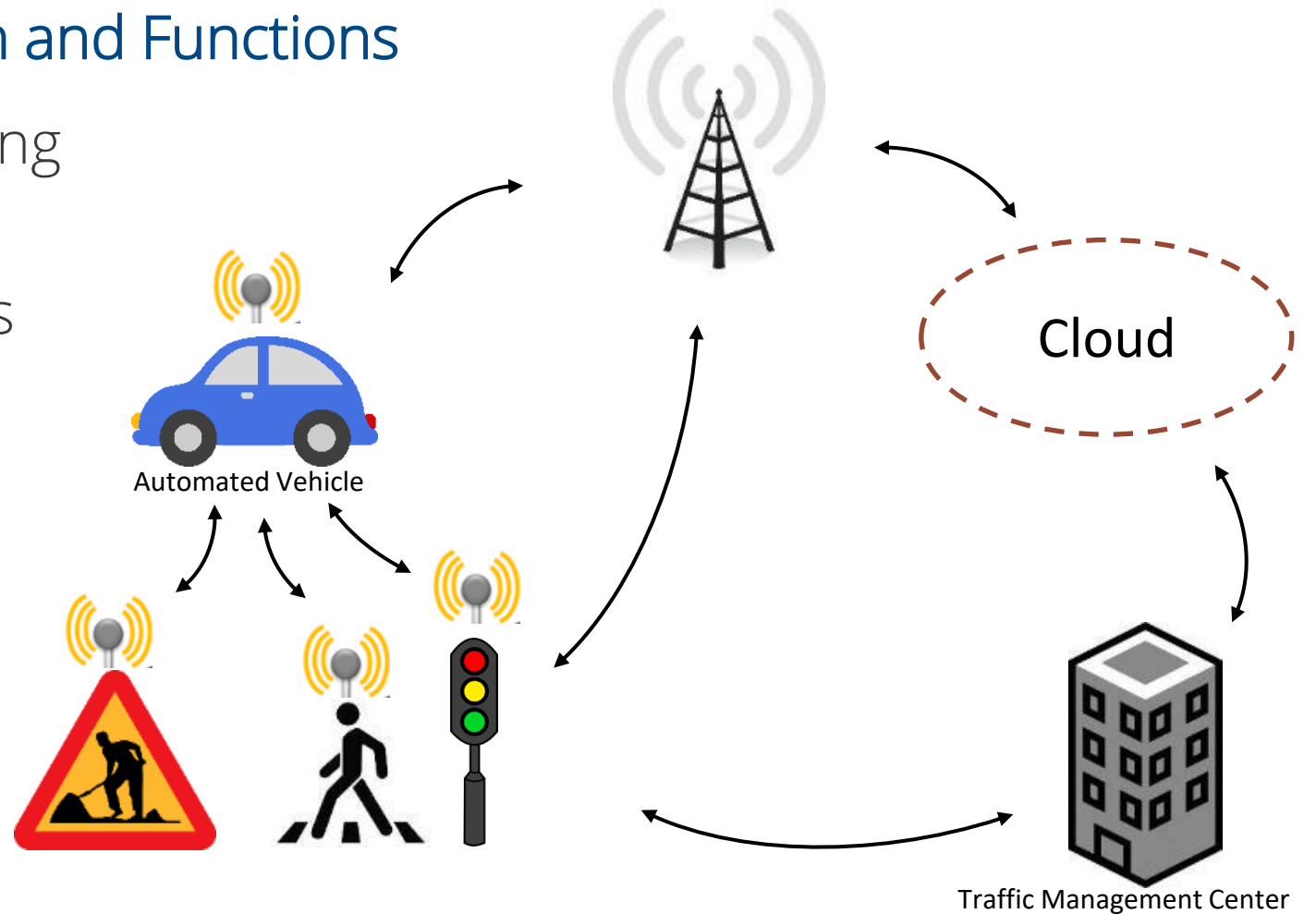
## SAE J3216



# Key Concepts: Traffic Infrastructure Cooperation

## Traffic Infrastructure Information and Functions

- Traffic signal phase and timing
- Dynamic speed limits
- Road conditions, road works
- Dynamic temporary maps
- Lane drops
- Etc.





# SAE International Standards Roadmap



The banner features a futuristic car interior with a steering wheel and a central display. The text "Automated Driving Systems Standards Roadmap" is prominently displayed in the center. Below the text, there is a navigation bar with two options: "Jump to standards area" with a downward arrow and "How-to for beta users" with a rightward arrow. The SAE International logo is centered in the background of the navigation bar.

**Automated Driving Systems  
Standards Roadmap**

Jump to standards area ▼

▶ How-to for beta users

**SAE**  
INTERNATIONAL

V0.3 Beta

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Created and Managed By **BQS-2**

# SAE ADS Standards Roadmap Introduction

## Why build an ADS standards roadmap?

Technologies are emerging at varying timescales

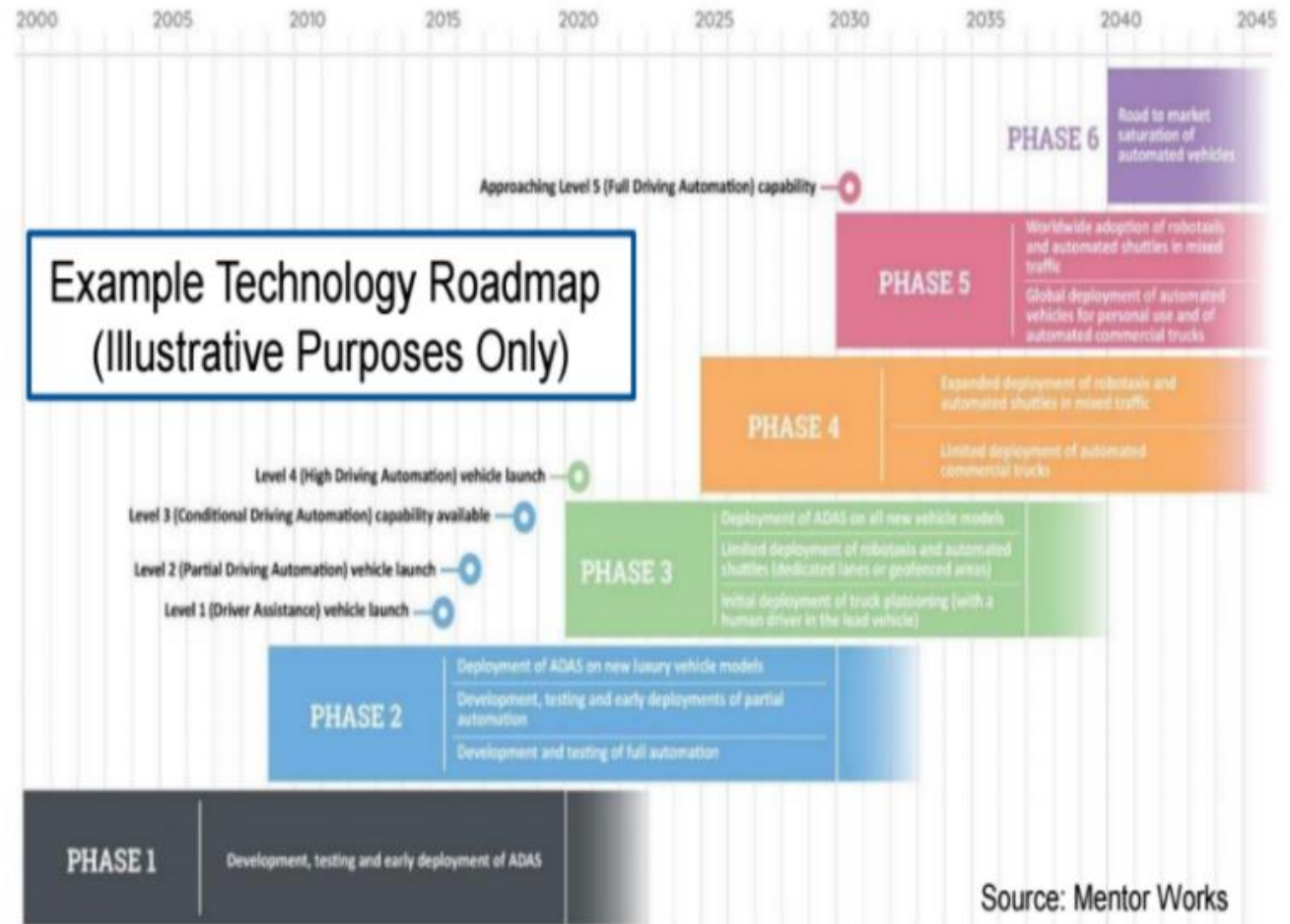
Standards can accelerate safe deployment

Many standards are underway and it is increasingly difficult to track all of them

SAE has developed a tool to capture standards needs and coordinate on addressing gaps

## Acts as a living roadmap

Intended to incorporate changes over time based on crowdsourced input



# Collecting Input: Organizing Standards Needs into Categories

## Deployment Phase

- Design
- Development
- Demonstration
- Deployment

## Functional Area

- Cooperative-ADS
- Cybersecurity
- Data
- Human Factors
- Infrastructure
- Safety

## Standards Functionality

- Definitions and Architecture
- Data Format
- Design
- Maintenance and Inspection
- Functional / Performance
- Protocol (Communications)
- Security
- Testing / Test Targets
- Training

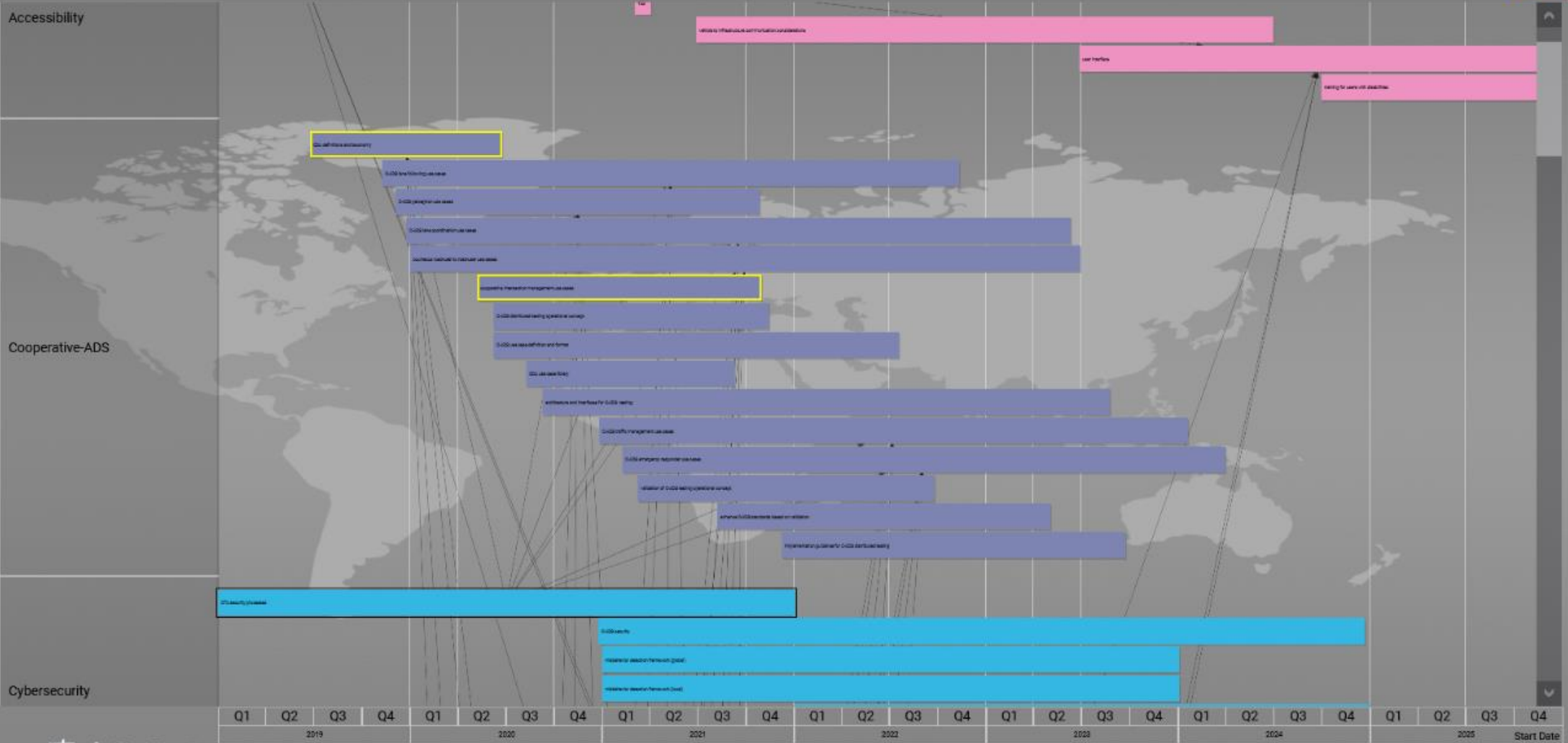
**SAE INTERNATIONAL™**

Key

- Funded
- Not Funded

**Standards Area**

- View All
- Accessibility
- Cooperative-ADS
- Cybersecurity
- Data
- Human Factors
- Infrastructure
- Safety



# Navigating Roadmap -Roadmap Overview

The screenshot displays the SAE International Automated Driving Systems Standards Roadmap V0.3 Beta interface. A central callout box titled "Roadmap Anatomy" lists eight key components of the interface, each numbered and linked to a specific UI element on the page:

- 1. Main Menu Button
- 2. Search Button
- 3. Standards Area Grouping
- 4. Roadmap
- 5. Comments Button
- 6. Standards Area Buttons
- 7. Filter Bar
- 8. Roadmap Timeline

The interface includes a sidebar with the SAE International logo, a search bar, and a "Standards Area" list with buttons for "View All", "Accessibility", "Cooperative-ADS", "Cybersecurity", "Data", "Human Factors", "Infrastructure", and "Safety". The main content area features a world map and a timeline from 2019 to 2025. A filter bar at the bottom allows users to filter by tags such as AVSC, BP, FHSK, Funded, IEEE, ISO, ITU, JAMA, Jisc, PAS, UNECE, US DOT, and Work Zone.

# Navigating Roadmap- Main Menu

Accessibility

Cooperative-ADS

Cybersecurity

Data

Human Factors

Infrastructure

Safety

All Standards Areas

Jump to standards area ▲

Key

Funded

Not Funded

Standards Area

View All

Accessibility

Cooperative-ADS

Cybersecurity

Data

Human Factors

Infrastructure

Safety

Q1 Q2 Q3 Q4 2019 2020 2021 2022 2023 2024 2025 Start Date

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12:54 PM

A list of *standards areas* will pop up. To navigate to a *roadmap* for a particular *standards area*, click on one of the options shown. To view all of the *standards areas* in one *roadmap* click on the *All Standards Areas* option at the bottom of the list.

# Navigating Roadmap -Standards Areas

## Relationships and sub-areas

Automated Driving Systems Standards Roadmap V0.3 Beta

SAE INTERNATIONAL

Key

- Funded
- Not Funded

Standards Area

- View All
- Accessibility
- Cooperative-ADS
- Cybersecurity
- Data
- Human Factors
- Infrastructure
- Safety

To see a *roadmap* containing only *standards needs* within a particular *standards area*, simply click on the corresponding button shown in the group to the left.

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Hide Area Definitions

Definition and Architecture

Testing

Use Cases

Standards needs related to Cooperative ADS can be found below, and are further divided into the three subcategories defined to the right.

Standards for a common definition framework and testing architecture for design and testing of cooperative ADS features.

Standards for the testing of cooperative use cases.

Standards for defining use cases for cooperative ADS features.

Key

- Funded
- Not Funded

Standards Area

- View All
- Accessibility
- Cooperative-ADS
- Cybersecurity
- Data
- Human Factors
- Infrastructure
- Safety

Definition and Architecture

Testing

CDA definitions and taxonomy

C-ADS use case definition and format

architecture and interfaces for C-ADS testing

C-ADS distributed testing operational concept

validation of C-ADS testing operational concept

enhance C-ADS standards based on validation

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Tags: NOT OR AND ASAM AVSC BP FHWA Funded IEEE ISO ITU JAMA NIST PAG SAE UL UNECE US DOT Work Zone

Reset

# Navigating Roadmap -Funding Indication

*Standards needs* which have known funded *standards activities* underway will have the distinctive yellow perimeter as shown to the right.

CDA definitions and taxonomy

C-ADS lane following use cases

*Standards needs* that do not have known funded *standards activities* underway lack the distinctive yellow perimeter as shown to the left.

C-ADS distributed testing operational concept

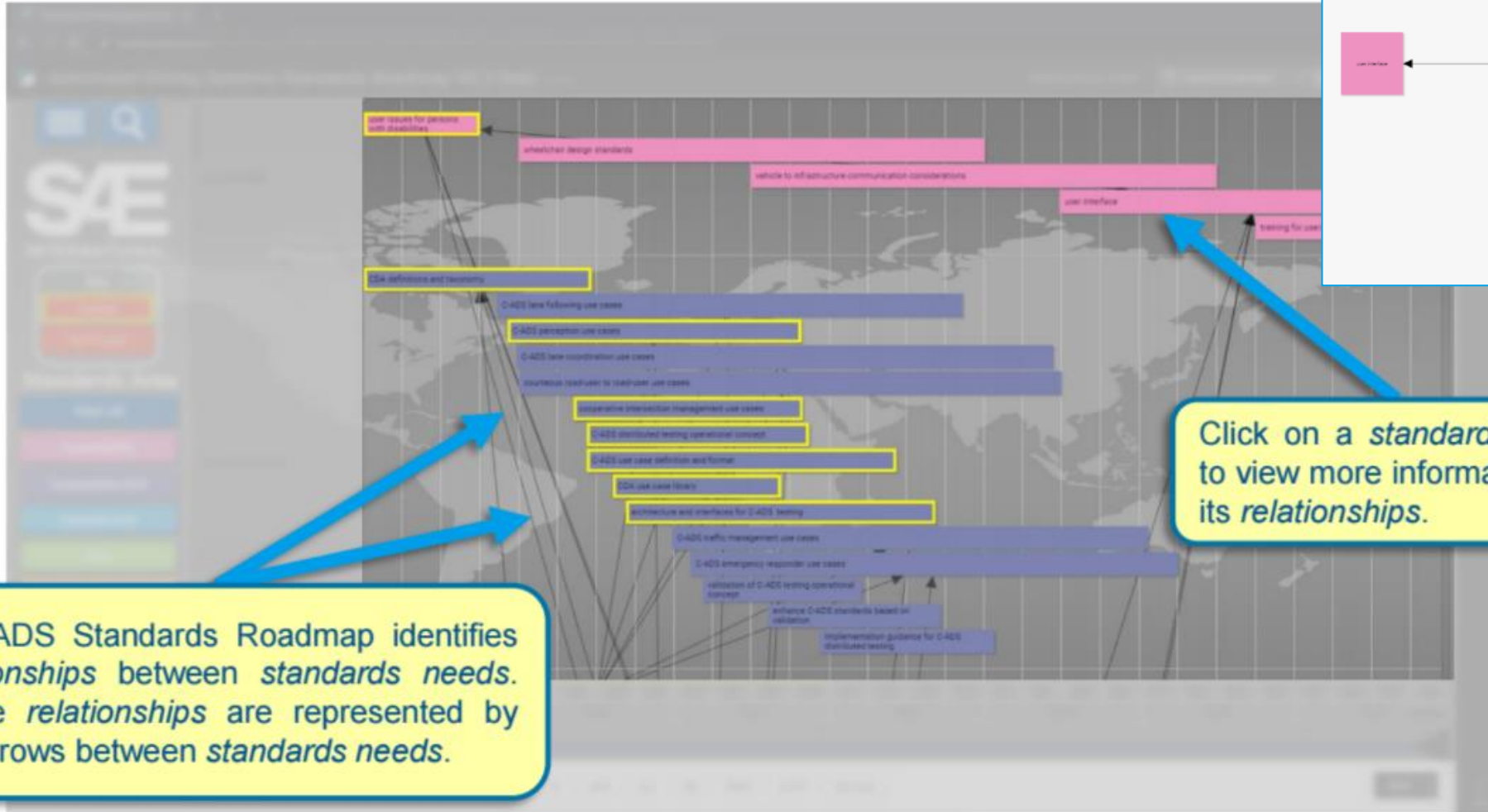
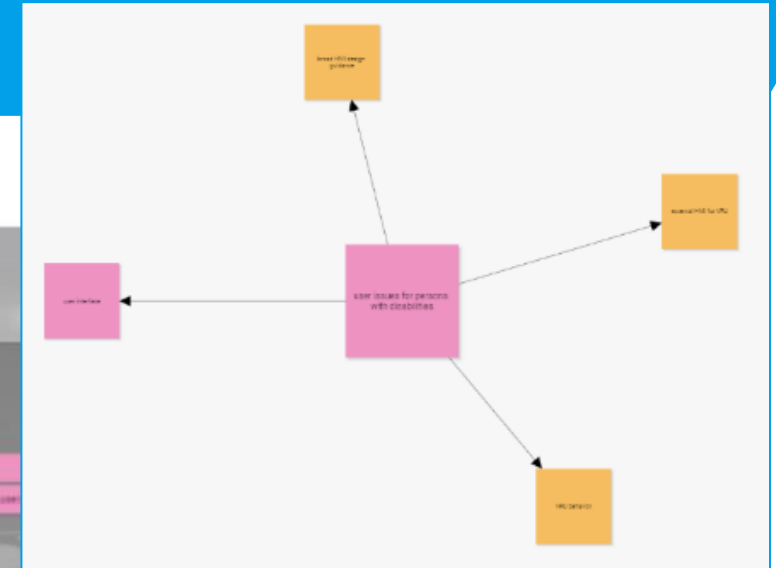
C-ADS use case definition and format

CDA use case library

architecture and interfaces for C-ADS testing



# Navigating Roadmap -Relationships



Click on a *standards need* to view more information on its *relationships*.

The ADS Standards Roadmap identifies *relationships* between *standards needs*. These *relationships* are represented by the arrows between *standards needs*.

# Navigating Roadmap -Inside Each Element

Automated Driving Systems Standards Roadmap V0.3 Beta

Accessibility user issues for persons with disabilities

1 Description

2 Relevant Existing Standards & Activities

3 Tags

4 Relationships

5 Exit Button

6 Relevant Existing Standards & Activities Panel

7 Resources

8 Comments Button

**Standards Need Anatomy**

1. Description Panel (active)
2. Standards Area Panel
3. Tags Panel
4. Relationships Panel
5. Exit Button
6. Relevant Existing Standards & Activities Panel
7. Resources Panel
8. Comments Button

To exit a *standards need* either click on the X button [5] or click anywhere on the screen that is not within one of the panels.

# Navigating Roadmap -User Feedback

The screenshot shows a user interface for 'User Feedback'. At the top, it says 'Welcome back, Jim' and has a 'Get Desktop App' button. Below this are three buttons: 'Create new story', 'Pin a story', and another 'Pin a story'. A navigation bar at the bottom includes 'STORIES', 'FORMS', 'COMMUNITY', 'ITEMS', and 'COMMENTS'. A search bar and 'RECENT STORIES' dropdown are also visible. The right side of the dashboard features several informational panels: 'Description' with a link to an SAE J2011/ACC-DV report, 'Standards Area' listing 'Accessibility/ACC-DV', 'Relevant Existing Standards & Activities' with links to SAE J2011 and an Alliance report, 'Resources' with links to an SAE J2011 report, an Alliance report, and an SAE J2011 report, and 'Relationships' with categories like 'user interface', 'broad HMI design guidance', 'external HMI for VRU', and 'VRU behavior'.

## SAE Feedback Forms

### General Feedback Form

Roadmap Item

15

General Feedback

Please Provide Your First Name

Please Provide Your Last Name

Please Provide Your Organization

Please Provide Your Email

Please Choose a Feedback Category

Please Provide Detailed Feedback

Submit

Clear

# Navigating Roadmap -Search Capability

Clicking on the *Search* button will open up the *search window* that allows searching for specific *standards needs* using a text query.

Search Query	Resources	Panel Data	All Attributes		
training for users with disabil...	use interface	use issues for persons with...	update to infrastructure con...	whenever design standards	software and interfaces fo...
use interface	0-400 emergency response	0-400 lane identification use	0-400 lane following use ca...	0-400 perception use cases	0-400 traffic management as...
use issues for persons with...	0-400 lane identification use	0-400 lane following use ca...	0-400 perception use cases	0-400 traffic management as...	0-400 traffic management as...
update to infrastructure con...	0-400 lane identification use	0-400 lane following use ca...	0-400 perception use cases	0-400 traffic management as...	0-400 traffic management as...
whenever design standards	0-400 lane identification use	0-400 lane following use ca...	0-400 perception use cases	0-400 traffic management as...	0-400 traffic management as...
software and interfaces fo...	0-400 lane identification use	0-400 lane following use ca...	0-400 perception use cases	0-400 traffic management as...	0-400 traffic management as...

The results of a search, *standards needs*, are displayed as the boxes shown above. By default, without entering a query or selecting any options the search window displays all of the *standards needs*.

**Search Window Anatomy**

1. Search Query Textbox
2. Resources Checkbox
3. Panel Data Checkbox
4. All Attributes Checkbox
5. More Info Checkbox
6. Peek Button
7. Search Results

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Hide Area Definitions

Standards needs related to Infrastructure can be found below, and are further divided into the eleven subcategories defined to the right.

Assessments	Curb Use	Intersections and Roundabouts	Intersections - Signalized Control	Intersections - Stop Sign Control	Markings Design	Markings Maintenance
Guidance from ADS technology developers to infrastructure owner operators to support assessing and monitoring readiness of infrastructure assets.	Rules for curb use for ADS vehicles.	Design standards for roundabout intersections to facilitate ADS interaction and compliance.	Traffic signal standards to facilitate AV perception.	Design standards for stop-sign-controlled intersections to facilitate ADS interaction and compliance.	Design standards for machine readable infrastructure markings.	Maintenance standards for machine readable infrastructure markings.
Roadway Geometric Design	Signage Design	Signage Maintenance	Work Zone			
Design standards for navigable roadways that consider line of sight and opportunities to change lane widths.	Design standards for machine readable infrastructure signage.	Maintenance standards for machine readable infrastructure signage.	Work zone markings, identification devices (beacons), and information sharing.			

Key: Funded (Yellow), Not Funded (Red)

Standards Area Filtered: Assessments, Curb Use

Standards Area: Accessibility, Cooperative-ADS, Cybersecurity, Data, Human Factors, Infrastructure, Safety

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Map annotations:

- infrastructure - readiness for ADS
- roadway readiness rating
- curb use rules and availability

Start Date

Tags: NOT OR AND

ASAM AVSC BP FHWA Funded IEEE ISO ITU JAMA NIST PAS SAE

UL UNECE US DOT Work Zone

Reset

Help

# Navigating Roadmap -Filtering by Tags

The *Filter Bar* shown below [1] allows for the filtering of *standards needs* based on their assigned *tags*. Filtering begins when one or more of the *tags* is selected by clicking. Doing so will enable the *NOT* and *OR/AND* option switches. These switches change the filtering behavior.

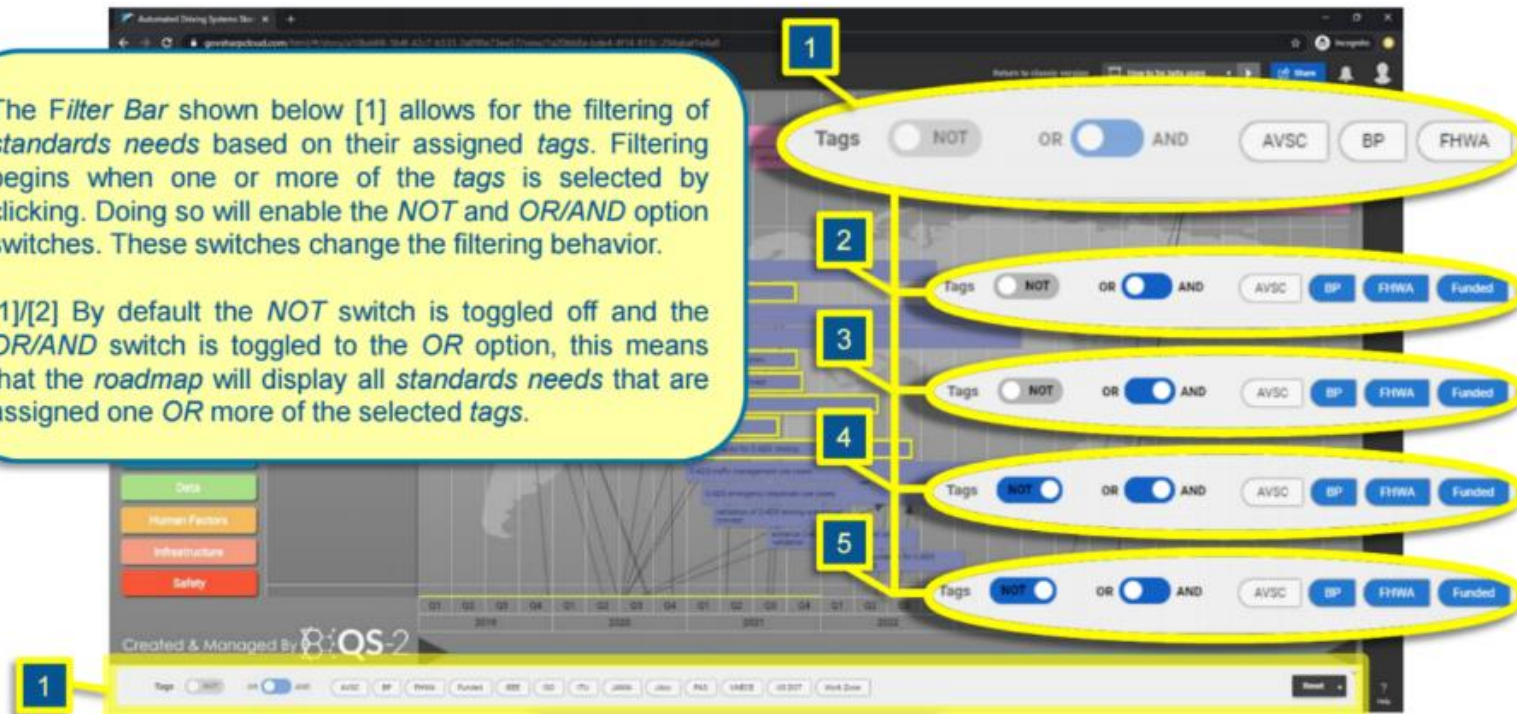
[1]/[2] By default the *NOT* switch is toggled off and the *OR/AND* switch is toggled to the *OR* option, this means that the *roadmap* will display all *standards needs* that are assigned one *OR* more of the selected *tags*.

[3] If *OR/AND* is toggled to the *AND* position it will change the way in which the *standards needs* are filtered, but only if more than one tag has been selected, otherwise the behavior will remain unchanged. Toggling to the *AND* position means that now, in order for a *standards need* to be displayed, it must have been assigned all of the selected *tags*.

[4]/[5] *NOT* can be toggled for both options of the *OR/AND* switch. Toggling *NOT* to the *ON* position shown in [4]/[5] will result in inverted filtering behavior.

[4] With *NOT* toggled *ON* and *OR/AND* toggled to *OR*, the *roadmap* will display only *standards needs* that are not assigned any of the selected *tags*.

[5] With *NOT* toggled *ON* and *OR/AND* toggled to *AND*, the *roadmap* will display only *standards needs* that are not assigned all of the selected *tags*.



# What's Next

## New features:

- Additional user feedback options
- Improved relationship visuals
- Expanded content and resources

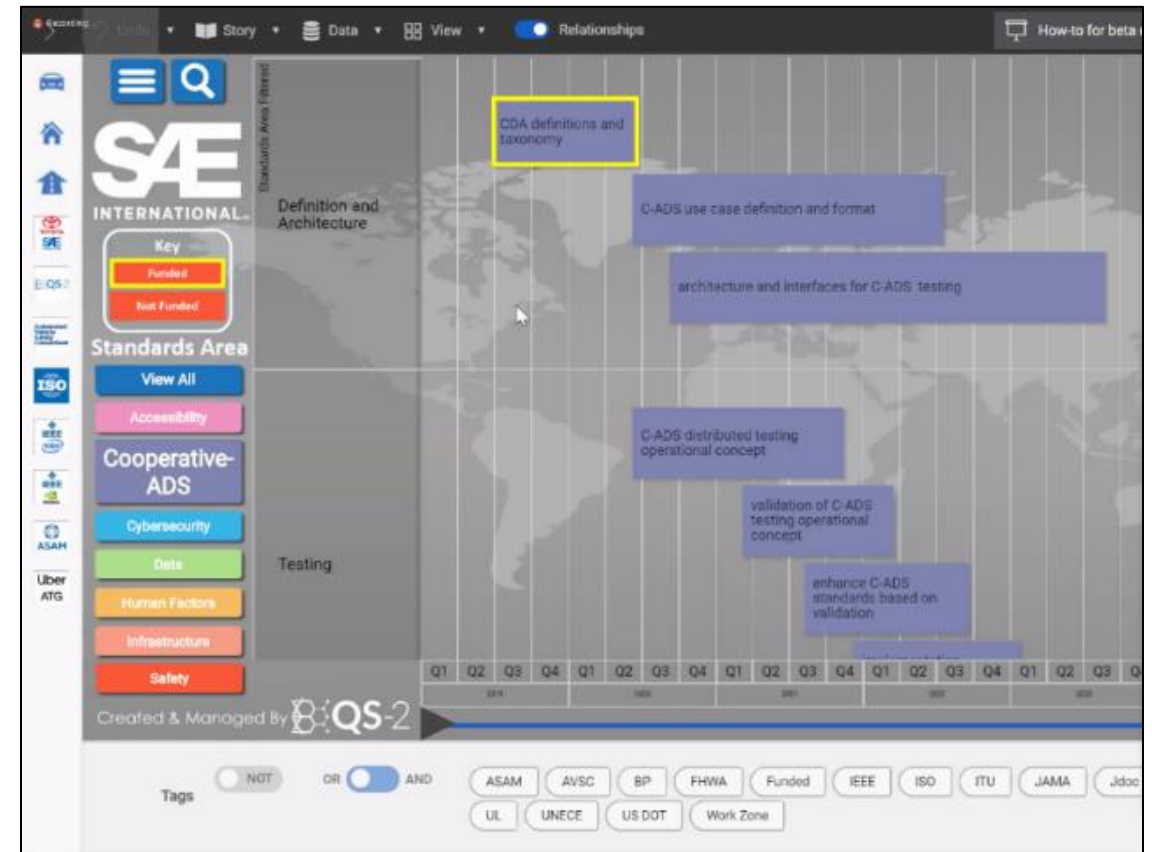
## Upcoming Professional Events

- SAE/AUVSI Business of Automated Mobility (BAM); June 23-24

<https://www.bam-forum.org/home>

- Automated Road Transportation Symposium (ARTS21); July 12-15

<http://www.trb.org/Main/Blurbs/181880.aspx>



# Get Involved Today!

Email - [adam.duran@qs-2.com](mailto:adam.duran@qs-2.com) to register





# Addressing Industry Transformation Through Standards



Automated Vehicles



Shared & Digital Mobility



EV, Fuel Cell & Battery



Advanced Driver Assist



Micromobility



Wireless Charging



Infrastructure Needs Related to Automated Driving



Cyber Security



Human Factors

# Standards in Disruptive Technologies

Require new methods...



# Related SAE Standards Development

## SAE standards are...

- Open to all
- Transparent, collaborative, and consensus-based
- Driven by industry experts

## Automated Driving

- [ORAD Committee](#)
  - [Definitions TF](#)
  - [Infrastructure Needs Related to Automated Driving](#)

## V2X Communications

- [V2X Core Technical Committee](#)
- [C-V2X Technical Committee](#)
- [Infrastructure Applications Technical Committee](#)

## [CADS Committee](#)

# SAE Pre-Competitive Research

## SAE Industry Technologies Consortia (SAE ITC)

- Automated Vehicle Safety Consortium

## **SAE Cooperative Research Program (CRP)**

### *Solutions by Industry for Industry*

- Unique, pre-competitive R&D projects
  - Joint Ventures of industry companies
  - Agile development of targeted research



# Thank You

Tim Weisenberger, [tim.weisenberger@sae.org](mailto:tim.weisenberger@sae.org)  
Program Manager, Emerging Technologies

Edward Straub, DM, [Edward.Straub@sae.org](mailto:Edward.Straub@sae.org)  
SAE Director, Office of Automation

# Announcements and Closing Remarks

## Brief Updates and Announcements from Partners

## Ongoing Commitment to Outreach and Knowledge Transfer

- Suggestions from WG Members on Ways to Enhance Impact:
  - Proposed new WG Members
  - Communications with/involvement in other initiatives outside the CAT Coalition
  - Knowledge resources to include on CAT Coalition website
  - E-mail suggestions to [schroeder@acconsultants.org](mailto:schroeder@acconsultants.org)

# Next Infrastructure-Industry WG Meetings

- Thursday, July 15, 1:30-3:00 pm (Eastern)
- Thursday, September 30, 1:30-3:00 pm (Eastern)
- Thursday, November 18, 1:30-3:00 pm (Eastern)