



SAE ADS Standards Roadmapping Initiative

Roadway Automation Readiness Roundtable

May 24, 2021

Tim Weisenberger

SAE International Ground Vehicle Standards

Automation with Cooperation

Automation



Cooperation

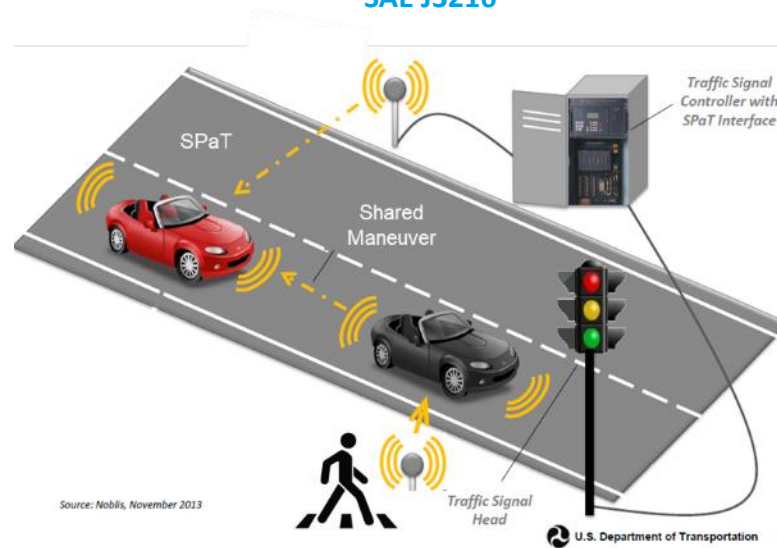


SAE J3016™ LEVELS OF DRIVING AUTOMATION

	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 are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			You are not 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"> • automatic emergency braking • blind spot warning • lane departure warning 	<ul style="list-style-type: none"> • lane centering OR adaptive cruise control 	<ul style="list-style-type: none"> • lane centering AND adaptive cruise control at the same time 	<ul style="list-style-type: none"> • traffic jam chauffeur 	<ul style="list-style-type: none"> • local driverless taxi • pedals/steering wheel may or may not be installed 	<ul style="list-style-type: none"> • same as level 4, but feature can drive everywhere in all conditions

For a more complete description, please download a free copy of SAE J3016: https://www.sae.org/standards/content/J3016_201806/

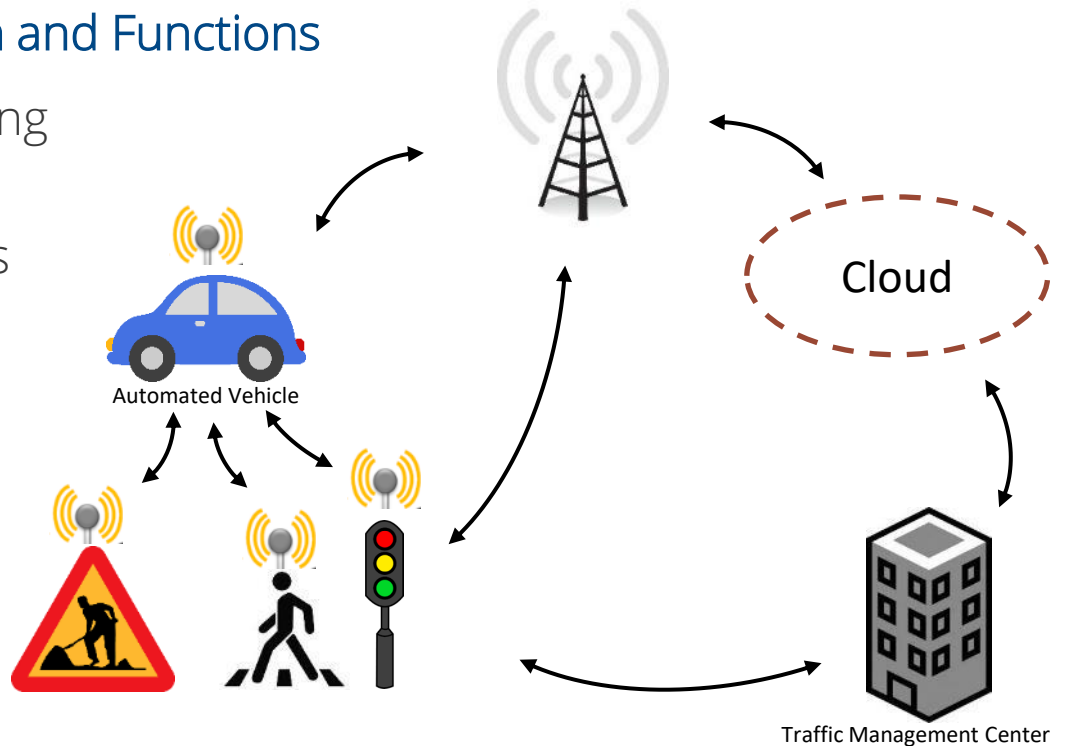
SAE J3216



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 image shows a digital interface for the 'Automated Driving Systems Standards Roadmap'. The background is a futuristic car interior with a steering wheel and a dashboard displaying various data points and a road ahead. The title 'Automated Driving Systems Standards Roadmap' is prominently displayed in the center. Below the title, 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 navigation bar. At the bottom of the interface, there is a footer with the version 'V0.3 Beta', the copyright notice '©2020 SAE International. All rights reserved.', and the text 'Created and Managed By BQS-2'.

Automated Driving Systems Standards Roadmap

Jump to standards area ▼

SAE INTERNATIONAL

► How-to for beta users

V0.3 Beta

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SAE ADS Standards Roadmap Introduction

Why build an ADS standards roadmap?

Technologies are emerging at varying timescales

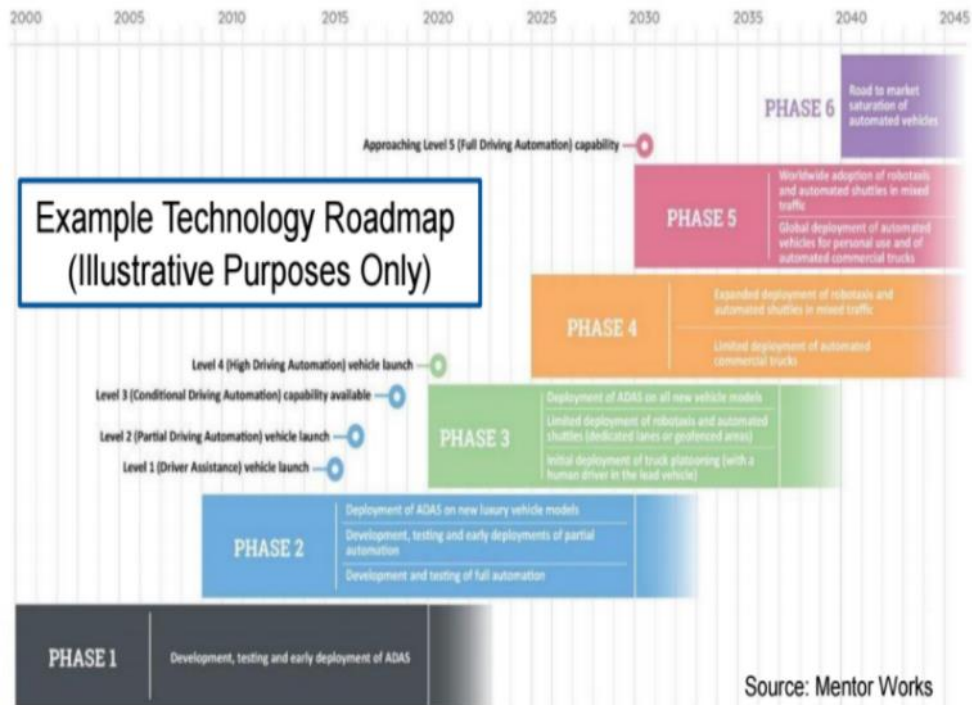
Standards can accelerate safe deployment

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

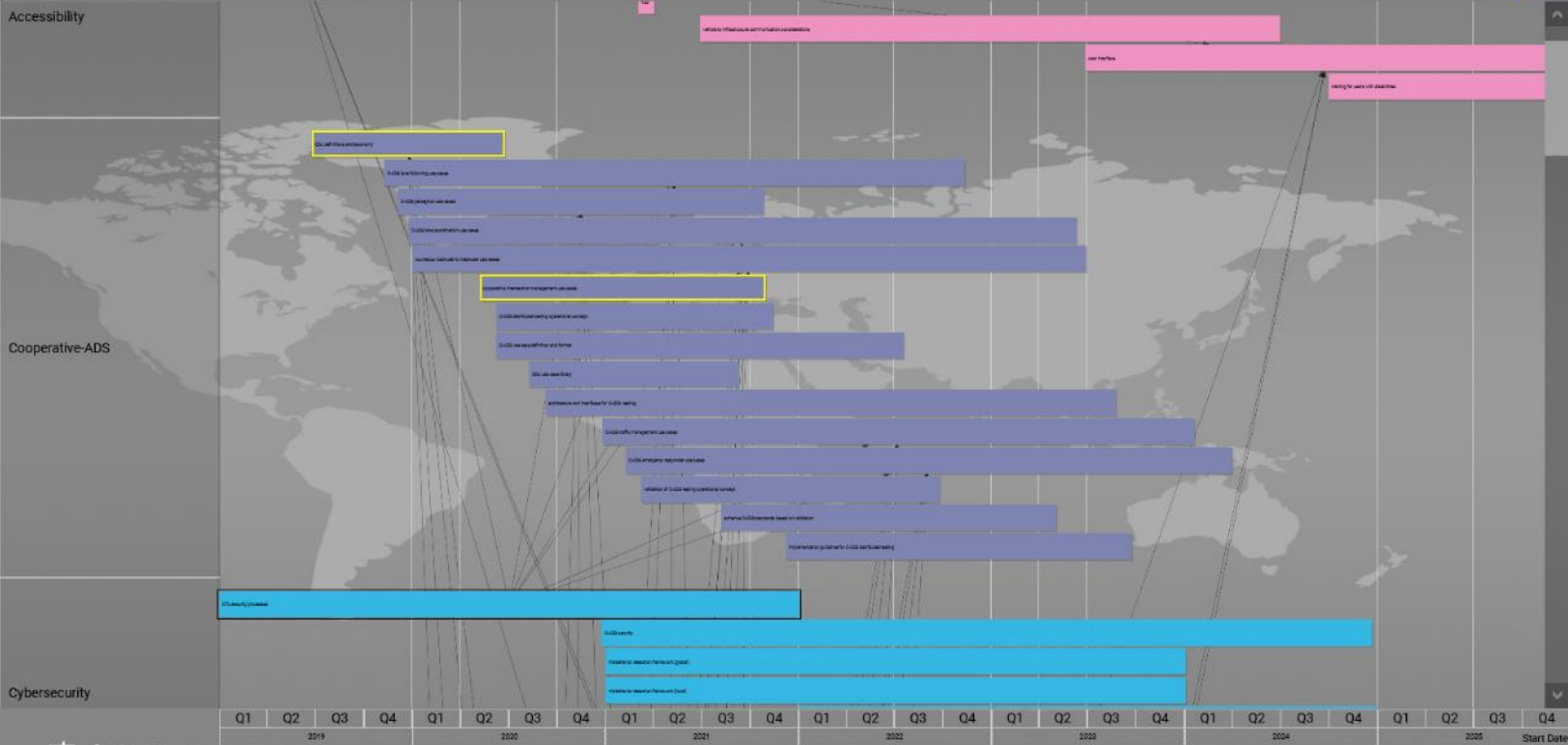
SAE INTERNATIONAL

Key

- Funded
- Not Funded

Standards Area

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



Created & Managed By QS-2

Navigating Roadmap -Roadmap Overview

The image shows a screenshot of the SAE International Driving Systems Standards Roadmap V0.3 Beta interface. The interface is annotated with eight numbered callouts (1-8) pointing to specific UI elements. A central yellow callout box titled "Roadmap Anatomy" lists the following items:

- 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 top navigation bar with a search icon (2), a main menu icon (1), and a share button. The left sidebar (6) features the SAE International logo and a "Standards Area" list with buttons for View All, Accessibility, Cooperative-ADS, Cybersecurity, Data, Human Factors, Infrastructure, and Safety. The main content area (4) displays a world map with a timeline (8) at the bottom showing quarters from 2019 to 2025. A filter bar (7) is located at the bottom of the page, containing various tags like "AVSC", "BP", "Funder", etc. A comments button (5) is located in the top right corner.

Navigating Roadmap- Main Menu

The screenshot displays the SAE International website's main menu for the Automated Driving Systems Standards Roadmap. The menu is a vertical list of colored buttons: Accessibility (pink), Cooperative-ADS (purple), Cybersecurity (blue), Data (green), Human Factors (orange), Infrastructure (red), Safety (red), and All Standards Areas (grey). A yellow callout box with a blue border contains the following text: "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." The background shows a world map and a timeline from 2019 to 2025.

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.

Hide Area Definitions

Definition and Architecture

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

Testing

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

Use Cases

Standards for the testing of cooperative use cases.

Standards for defining use cases for cooperative ADS features.

Definition and Architecture

Testing

Cooperative-ADS

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 AGAM AVSC BP FHNA Funded IEEE ISO ITU JAMA NIST PAG SAE XL UNECE US DOT Work Zone

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

C-ADS distributed testing operational concept

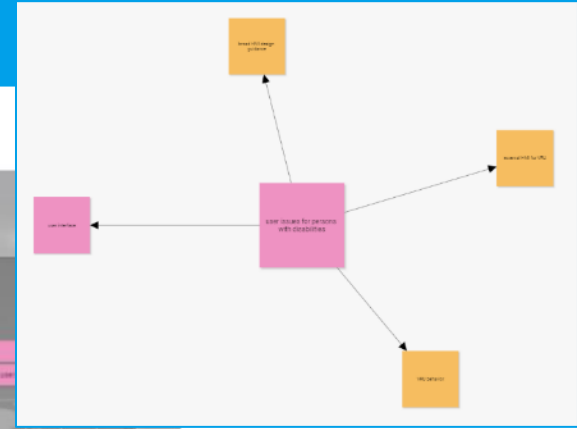
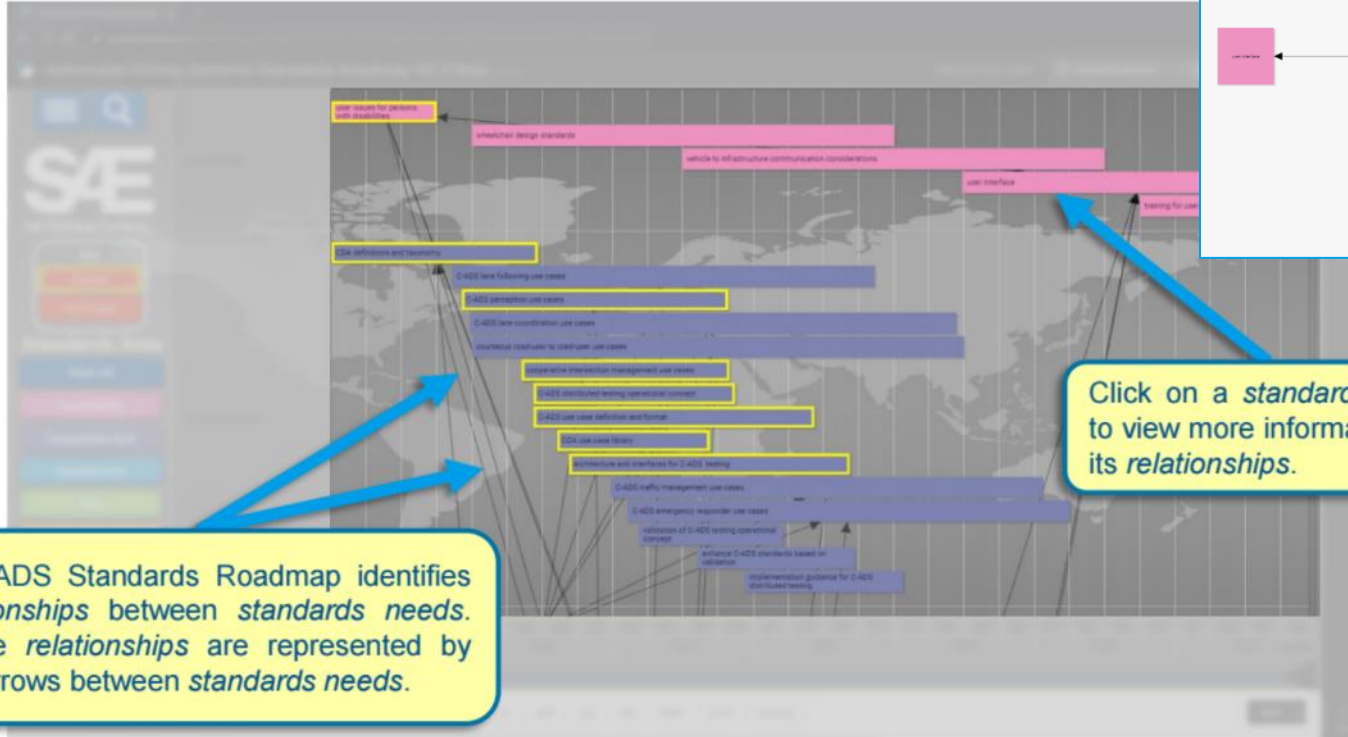
C-ADS use case definition and format

CDA use case library

architecture and interfaces for C-ADS testing

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

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

The screenshot displays a web page titled "Automated Driving Systems Standards Roadmap V0.3 Beta" with a sub-header "Accessibility user issues for persons with disabilities". The main content area is titled "Description". The page is divided into several panels: a main description panel (1), a "Relevant Existing Standards & Activities" panel (2), a "Tags" panel (3), a "Resources" panel (7), and a "Relationships" panel (4). A navigation sidebar on the right contains an "Exit" button (5), a close button (6), and a comments button (8). A yellow callout box on the left lists the panels, and another on the right explains how to exit a standards need.

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

User Feedback

Welcome back, Jim

Get Desktop App

Other downloads

Create new story

Pin a story

Pin a story

DESCRIPTION

Description

SAE 2017-0020 User Issues for Personalized Driver's License Identification and Access for Persons with Disabilities, including drivers and digital licenses. The report describes user feedback on current and proposed solutions, as well as a range of considerations for the implementation of digital licenses with AD/DA. The Auto Alliance report describes 77 technical considerations for user accessibility that were identified during an extensive review.

STANDARDS AREA

Standards Area

Accessibility/AD/DA

RELEVANT EXISTING STANDARDS & ACTIVITIES

Relevant Existing Standards & Activities

Full form information report (Standard), Alliance of Automobile Manufacturers Integrity Data Report

RESOURCES

- Identifying and addressing driving license-related rights (AD/DA) "Passenger" issues for Persons with Disabilities. This information report focuses on these disabilities, but also provides guidance for those with other disabilities.
- Auto Alliance Accessibility Informed Report Identifies Technical Considerations for AD/DA Accessibility
- Original Data and Accessibility (DS) Accessibility of the Full User

RELATIONSHIPS

- user interface
- broad HMI design guidance
- external HMI for VRU
- VRU behavior

TAGS

SAE

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

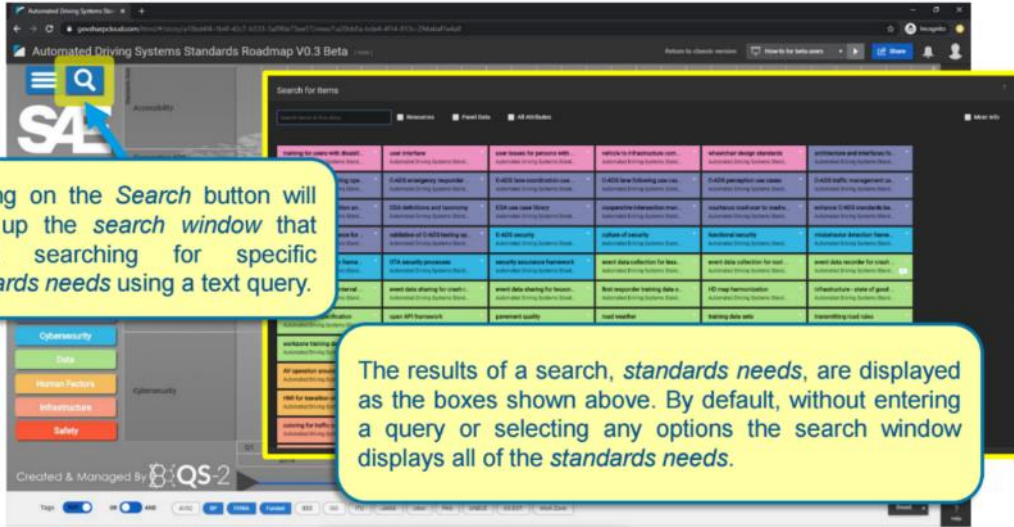
Please Choose a Feedback Category

Please Provide Detailed Feedback

Submit

Clear

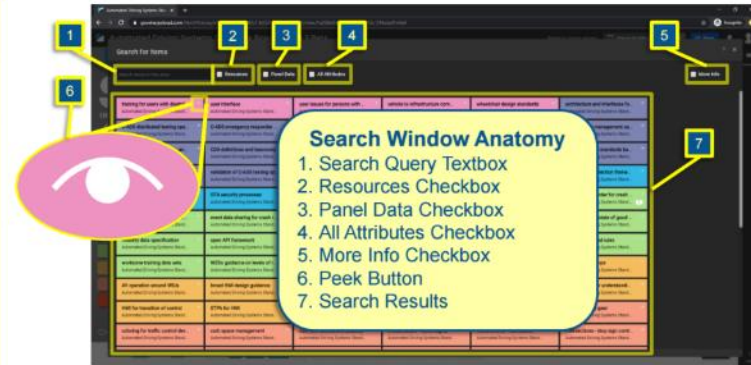
Navigating Roadmap -Search Capability



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

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*.

Looking for users with shared	User interface	User inputs for presence with	Vehicle to infrastructure com-	Validation design elements	Authentication and authorization for
SAE J3051 (2020) - Shared driving system (SDS) - User interface	SAE J3051 (2020) - Shared driving system (SDS) - User interface	SAE J3051 (2020) - Shared driving system (SDS) - User interface	SAE J3051 (2020) - Shared driving system (SDS) - User interface	SAE J3051 (2020) - Shared driving system (SDS) - User interface	SAE J3051 (2020) - Shared driving system (SDS) - User interface
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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



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

Key

- Funded
- Not Funded

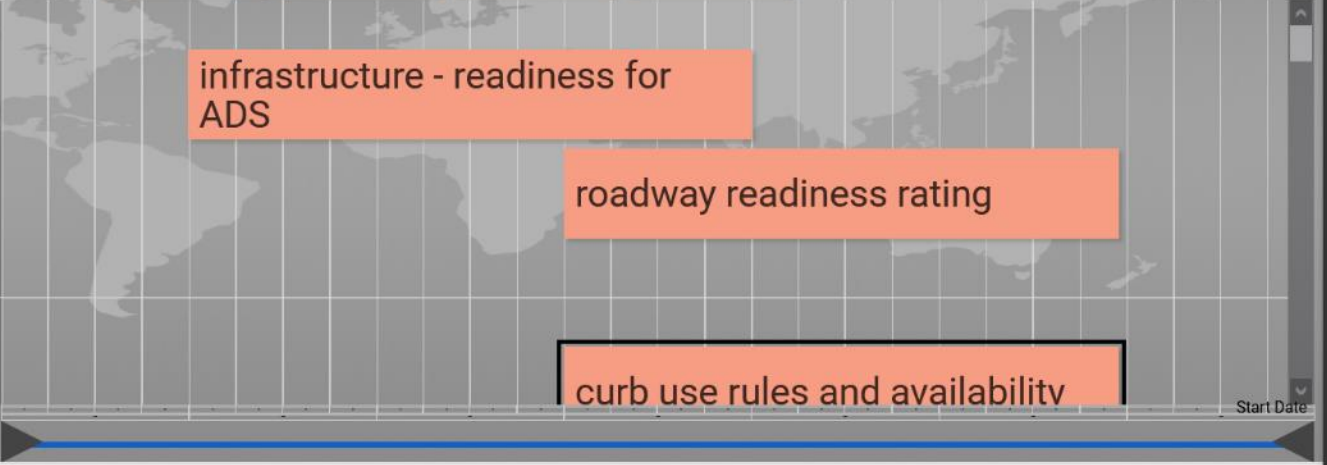
Standards Area

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

Standards Area Filtered

Assessments

Curb Use



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Tags: NOT OR AND

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

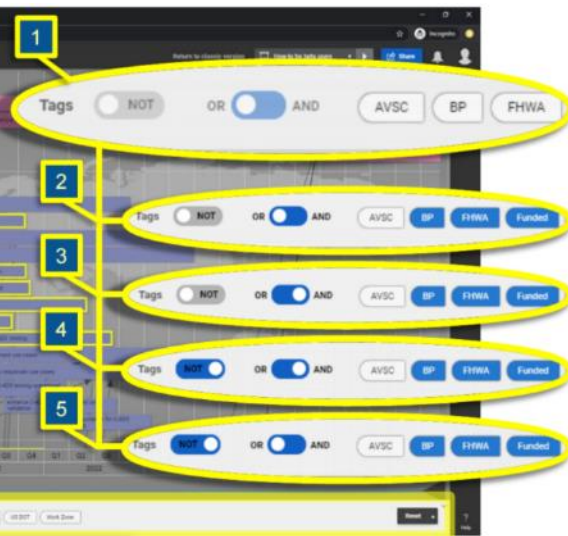
UL UNECE US DOT Work Zone

Reset

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

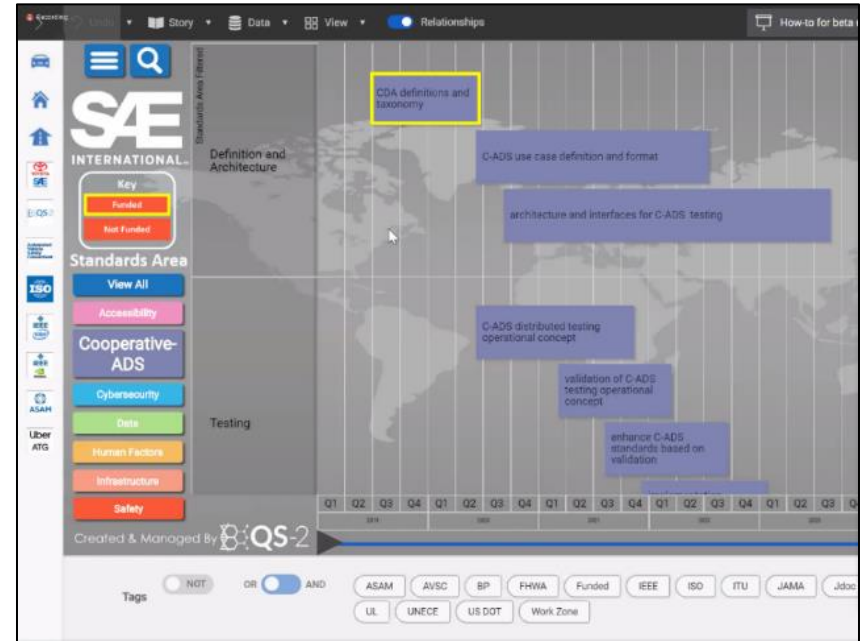
Upcoming Professional Events

- 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 to register



Addressing Industry Transformation Through Standards



Automated Vehicles



Shared & Digital Mobility



EV, Fuel Cell & Battery



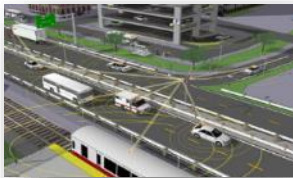
Advanced Driver Assist



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
Program Manager, Emerging Technologies

Edward Straub, DM, Edward.Straub@sae.org
SAE Director, Office of Automation