Global industry engagement makes a difference
Regulatory and Product Effect of SAE Standards

SAE Standards → MVC, ConAG, Truck Bus, MPPC, Fuels Lubes, SVEC

ISO/IEC, EN/ECE WP29 → NHTSA, EPA

World Regs → Germany, Sweden, Italy, France, UK, EU, Japan, China, S.Korea

Product Development

1 country 1 vote

1 expert 1 vote

Global Ground Vehicle Standards
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4 trends in mobility

- Electrified
- Connected
- Automated
- Shared
4 trends in mobility

- Electrified
- Connected
- Automated
- Shared
<table>
<thead>
<tr>
<th>Level</th>
<th>Name</th>
<th>Narrative Definition</th>
<th>DDT</th>
<th>OEDR</th>
<th>DDT Fallback</th>
<th>ODD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Driving Automation</td>
<td>The performance by the driver of the entire DDT, even when enhanced by active safety systems</td>
<td>Driver</td>
<td>Driver</td>
<td>Driver</td>
<td>N/A</td>
</tr>
<tr>
<td>1</td>
<td>Driver Assistance</td>
<td>The sustained and ODD-specific execution by a driving automation system of either the lateral or the longitudinal vehicle motion control subtask of the DDT (but not both simultaneously) with the expectation that the driver performs the remainder of the DDT.</td>
<td>Driver and System</td>
<td>Driver</td>
<td>Driver</td>
<td>Limited</td>
</tr>
<tr>
<td>2</td>
<td>Partial Driving Automation</td>
<td>The sustained and ODD-specific execution by a driving automation system of both the lateral and longitudinal vehicle motion control subtasks of the DDT with the expectation that the driver completes the OEDR subtask and supervises the driving automation system.</td>
<td>System</td>
<td>Driver</td>
<td>Driver</td>
<td>Limited</td>
</tr>
<tr>
<td>3</td>
<td>Conditional Driving Automation</td>
<td>The sustained and ODD-specific performance by an ADS of the entire DDT with the expectation that the DDT fallback-ready user is receptive to ADS-initiated requests to intervene, as well as to DDT performance-relevant system failures in other vehicle systems, and will respond appropriately.</td>
<td>System</td>
<td>System</td>
<td>Limited</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>High Driving Automation</td>
<td>The sustained and ODD-specific performance by an ADS of the entire DDT and DDT fallback without any expectation that a user will respond to a request to intervene.</td>
<td>System</td>
<td>System</td>
<td>System</td>
<td>Limited</td>
</tr>
<tr>
<td>5</td>
<td>Full Driving Automation</td>
<td>The sustained and unconditional (i.e., not ODD-specific) performance by an ADS of the entire DDT and DDT fallback without any expectation that a user will respond to a request to intervene.</td>
<td>System</td>
<td>System</td>
<td>System</td>
<td>Unlimited</td>
</tr>
</tbody>
</table>
SAE J3016™ principles

8.1 J3016 is not a specification and imposes no requirements.

J3016 provides a logical taxonomy for classifying driving automation features (and ADS-dedicated vehicles), along with a set of terms and definitions that support the taxonomy and otherwise standardize related concepts, terms and usage in order to facilitate clear communications.

As such, J3016 is a convention based upon reasoned agreement, rather than a technical specification.
Why level 3?

Time and safety critical conditions (examples)

Accidents

Inclement weather

Work zones
Why level 3?

Operational Design Domain

- Road markings
- Divided expressway
- Clear road signs
Automated Levels – consumer version

SAE J3016™ LEVELS OF DRIVING AUTOMATION

**SAE LEVEL 0**
- You are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering
- You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety

**SAE LEVEL 1**
- These features provide steering OR brake/acceleration support to the driver
- Example Features:
  - Automatic emergency braking
  - Blind spot warning
  - Lane departure warning

**SAE LEVEL 2**
- These features provide steering AND brake/acceleration support to the driver
- Example Features:
  - Lane centering OR adaptive cruise control
  - Lane centering AND adaptive cruise control at the same time

**SAE LEVEL 3**
- You are not driving when these automated driving features are engaged – even if you are seated in “the driver’s seat”
- These automated driving features will not require you to take over driving

**SAE LEVEL 4**
- These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met
- Example Features:
  - Traffic jam chauffeur
  - Local driverless taxi
  - Pedals/steering wheel may or may not be installed

**SAE LEVEL 5**
- This feature can drive the vehicle under all conditions
- 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/](https://www.sae.org/standards/content/j3016_201806/)

Global Ground Vehicle Standards
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Automated – where SAE standards are developed

**On-Road Automated Driving (ORAD) Committee**

- **Definitions Task Force ISO/SAE Joint**
  - **Scope:** Taxonomy for motor vehicle driving automation systems that perform part or all of the dynamic driving task on a sustained basis

- **Planning Task Force**
  - **Scope:** Coordinates with other SAE committees and with external organizations doing complementary work, including ISO, UNECE, NHTSA, IEEE, ULC

- **Verification and Validation Task Force**
  - **Scope:** Information and guidelines for verification and validation (V&V) of Automated Driving Systems (ADS)

- **Reference Architecture Interfaces Task Force**
  - **Scope:** automated driving reference architecture that contains functional modules supporting future application interfaces for Levels 3 through 5

- **ADS-DV User Issues for Persons with Disabilities Task Force**
  - **Scope:** gather and develop information on user issues specific to this population of ADS-DV users

- **On Road Automated Driving Maneuver Task Force**
  - **Scope:** Define information, best practices, and standards for maneuvers of on road automated driving systems (ADSs) for automation levels 3, 4, 5

- **ADS Testing Task Force**
  - **Scope:** Gathering point for the ADS Testing project

- **J3018 Task Force**
  - **Scope:** Infrastructure Needs Related to Automated Driving ORAD Task Force
  - **Scope:** In-Progress
## Standards Overview

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
<th>Status / Timing</th>
</tr>
</thead>
</table>
| **J3016™** | Recommended Practice: Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles  
Seminal standard for automated driving systems (ADS) that defines key terms and a hierarchy of automation (levels 0-5). Allows industry to speak with a common language about ADS. | Originally published as an information report in 2014. Current Recommended Practice was published in September 2016.  
A revision was published by June 2018. Associated 1-page infographic expected to be issued soon.  
Currently being revised jointly with ISO TC204 WG14 to further clarify and refine definitions and specifically deepen the Operational Design Domain (ODD) definition. May be published by end of 2019. |
This document provides guidelines for the safe conduct of on-road tests of vehicles equipped with prototype conditional, high, and full (levels 3-5) automated driving systems (ADSS), as defined by SAE J3016. | Originally Published March 2015.  
The standard was re-opened in April 2018. Document revision is underway. Updating contents by incorporating lessons-learned and making it compatible with related standards. Publication timing not yet finalized, but potentially by Q2 2019. |
| **J3131** | Recommended Practice: Automated Driving Reference Architecture  
Defines an ADS reference architecture that contains functional modules supporting future application interfaces for Levels 3 through 5 (J3016) with supporting terminology and best practices.  | In development. Finalizing draft text prior to starting an ORAD committee ballot. The first document, J3131/1 expected to ballot in early 2019. ORAD experts anticipate follow-on document parts. |
# Standards Overview

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<tbody>
<tr>
<td>J3092 Information Report: Dynamic Test Procedures for Verification and Validation of Automated Driving Systems</td>
<td>In development. Completing literature review of activities for more than 20 entities across the world working on automated vehicles. Task Force intends for an eventual V&amp;V Recommended Practice, but is currently is pursuing an Information Report.</td>
<td></td>
</tr>
<tr>
<td>J3171 Information Report: ADS-DV User Issues for Persons with Disabilities</td>
<td>In development. The information report is being developed through literature review (including regulatory requirements, research papers and policy statements) and interviews with advocacy groups, government agencies, and researchers. Publication timing not yet finalized, but potentially by mid-2019.</td>
<td></td>
</tr>
<tr>
<td>J3164 Taxonomy and Definitions for Terms Related to Automated Driving System Behaviors and Maneuvers for On-Road Motor Vehicles</td>
<td>In development. Begun in January 2018. The task force will seek to codify the behaviors and maneuvers for ADS levels 3-5. Reviewing NHTSA documents regarding human drivers and research from California PATH and University of Waterloo. ORAD Committee feels that Variable Performance Testing for ADS activities outside of the SAE standards committee structure will feed this task force to develop more robust SAE standards. Likely stemming from a common approach to developing testing scenarios will arise.</td>
<td></td>
</tr>
</tbody>
</table>
Non-ORAD Automation Standards

<table>
<thead>
<tr>
<th>Committee</th>
<th>Overview</th>
</tr>
</thead>
</table>
| Driving Automation Systems       | This Technical Committee is responsible for all safety & human factors issues concerning driving automation systems and how these new technologies will impact the driving experience. This includes any vehicle that involves human operation, either in-vehicle or remotely located, transitioning into or out of Level 1 driving automation and above, and/or based on any interaction of human road users with driving automation systems.  
**J3114**- Human Factors Definitions for Automated Driving and Related Research Topics (Dec 2016) |
| ADS Logger Task Force            | The Event Data Recorder Committee established this Task Force to detail ADS data elements and definitions that can be gathered in crash or near-crash events in ADS. These additional data elements may be those useful for accident reconstruction involving an ADS-equipped vehicle or allowing determination of whether further analysis into the ADS system performance or non-ADS system performance is needed. |
| ADS Lamps Task Force             | Signaling and Marking Devices Standards Committee established this Task Force to develop test procedures, performance requirements, and design guidelines for autonomous vehicle lighting (J3134).                                                                                                                                       |
| Driving Skills Committee         | Drafting **J3300 AV Safety Operator** endorsement for test drivers (safety operators) on proving grounds as a complement to the four skill levels defined in the foundational license.                                                                                                                                                     |
WP 29 Automated Vehicle Activities

WP29

ITS/AD

AutoVeh TF
Chair – Mr. Yarnold, UK
Secretary – Mr. Alburno, CLEPA

Physical Certifican Tests & Audit SG-1
Chair – Mr. Onoda, Japan
Secretary – Mr. Oshita, OICA

Real World Test Drive SG-2
Chair – Mr. Striekwold, NL
Secretary – Mr. Gouse, SAE

GRVA

GRSG

GRPE

GRB

GRSP

GRE

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SAE Office Of Automation
4 trends in mobility
Connected – where SAE standards are developed

- **V2X Communications Steering Committee**

- **DSRC Technical Committee**
  - Scope: DSRC Radio access-specific items

- **C-V2X Technical Committee**
  - Scope: C-V2X Radio access-specific items

- **Advanced Applications Technical Committee**
  - Scope: Lower layer-unknown applications that may require new communication technologies

- **Security Technical Committee**
  - Scope: Over the air security

- **Cross-Cutting Technical Committee**
  - Scope: Common to multiple applications or communication technologies

- **Infrastructure Applications Technical Committee**
  - Scope: Infrastructure applications that do not require traffic signal data or interface

- **Traffic Signal Applications Technical Committee**
  - Scope: Infrastructure applications that require traffic signal data or interface

- **Vehicular Applications Technical Committee**
  - Scope: Vehicle communication needs

- **Tolling Applications Technical Committee**
  - Scope: Applications for tolling and financial transactions
Connected - SAE DSRC Standards

- Supports interoperability
- Defines standardized message sets
- Defines formats for basic safety message set dictionary
- Being revised to meet new needs/applications

- Specifies minimum communication performance requirements
- Defines message transmission rate, channel usage, optional data usage in various situations

J2735 Message Set Dictionary
- Basic Safety Message (BSM)
- MapData (Map) message
- Signal Phase and Timing (SPaT)
- Personal Safety Message (for pedestrian and other vulnerable road users)
- Traveler Information Message (TIM)

J2735/1 On-Board System Requirements for V2V Safety Communications

J2735/2 Performance Requirements for V2V Safety Awareness

J2735/3 Requirements for V2I Weather Applications

J2735/4 V2I Road Safety (title TBD) Applications

J2735/5 Message Security

J2735/6 CACC/Platooning Performance Requirements

- System engineering example
- Communication protocol
- Channel use
- V2X message/application priority

Published

Published

Published
J2945/1 “On-Board System Requirements for V2V Safety Communications”

- 1st edition of on-board system requirements standard for V2V safety communications
- Support interoperability and data integrity
- Largely referenced by USDOT’s V2V safety system NPRM
Human Factors – where SAE standards are developed

**Safety & Human Factors Committee**

**Driver Metrics, Performance, Behaviors & States**
*Scope:*
This Technical Committee is responsible for all safety & human factors issues that impact the driver metrics (e.g., navigation & route guidance & calculations, driver visual behavior using video-based techniques, operational definitions of driving performance measures, evaluation approaches & metrics, and driver fatigue & drowsiness states, etc.). – J2364, J2365, J2396, J2944, J3151, and more.

**Driver Vehicle Interface (DVI)**
*Scope:*
This Technical Committee is responsible for all safety & human factors issues that impact the driver vehicle interface (e.g., in-vehicle message priority, in-vehicle alphanumeric messages, comprehension testing, hands-free, speech input, DVI definitions, portable device pairing, etc.), but is not advanced technology related. J2395, J2830, J2831, J2972, J2988, J3077 and more.

**Advanced Driving Assistance Systems (ADAS)**
*Scope:*
This Technical Committee is responsible for all safety & human factors issues that affect a vehicle’s advanced technologies (e.g., ACC, FCW, BSM, LDW, LKA, vehicle sound, etc.). J2399, J2400, J2802, J2808, J2889, J2889-1, J3048.

**Automated Driving**
*Scope:*
This Technical Committee is responsible for all safety & human factors issues concerning automated vehicles and how these new vehicles will impact the driving experience J3114.
4 trends in mobility

Electrified

Connected

Automated

Shared
What is Shared Mobility?

**Shared mobility** is the **shared** use of a vehicle, motorcycle, scooter, bicycle, or other travel mode. **Shared mobility** provides users with short-term **access to one of these modes** of travel as they are needed.

---

**Background**

- Rapidly advancing technology
- Congestion & Travel time
- Increasing traveler expectations
- Environmental concerns
- Demographic changes
- Limited Resources

[https://www.sae.org/shared-mobility](https://www.sae.org/shared-mobility)
SAE Shared and Digital Mobility Committee embarked on the task of standardizing terms and definitions related to shared mobility.

**MILESTONES**

- Established in September 2017
- First technical report: *J3163 – Taxonomy and Definitions for Terms Related to Shared Mobility and Enabling Technologies.*

It covers six categories of terms related to shared mobility:

- Symbols and signage for shared mobility
- Data format for data sharing
- Household travel surveys
- Exploring intersect with core GV technologies
- Revision in second half of 2019
This committee will initially focus on low-speed personal mobility devices and the technology and systems that support them that are not normally subject to the United States Federal Motor Vehicle Safety Standards or similar regulations. These may be device-propelled or have propulsion assistance.

Initial standards:
1. Taxonomy of Micromobility Devices
2. J3171 ADS-DV User Issues for Persons with Disabilities

Emerging and innovative mobility vehicles and devices, sometimes referred to as micro-mobility, are proliferating in cities around the world. These technologies have the potential to expand mobility options for a variety of people. Some of these technologies fall outside traditional definitions, standards, and regulations.
5th trend in mobility - cybersecurity
Cybersecurity – where SAE standards are developed

SAE J3061™

Vehicle
Cybersecurity
Systems
Engineering
Committee

ISO/SAE
Automotive
Security
Engineering
Joint WG

Risk
Management
Project Group

Product
Development
Project Group

Operations,
Maintenance,
and other
Processes
Project Group

Process Overview &
Interdependences
Project Group

Vehicle
Electrical
Hardware
Security
Task Force

Trust Anchors
and Authentication
Task Force

Cybersecurity
Assurance
Testing
Task Force

WIP J3101
Hardware Protected Security for Ground Vehicles

Information Report on Trust Anchors and Authenticatio n needs in the automotive industry

WIPs J3061/2 Security Testing Methods and Security Testing Tools

Joint development of SAE/ISO standards
Road Vehicle & Intelligent Transportation Systems (ITS)
SAE is providing Secretariat function
To ISO TC204 Intelligent Transport System
Dear NGO Representative,

Subject: Follow-up to the decision of the Economic and Social Council

I am pleased to inform you that the Economic and Social Council (ECOSOC) at its Coordination and management meeting of 25 July 2017 adopted the recommendation of the Committee on Non-Governmental Organizations (NGOs) to grant special consultative status to your organization. SAE International. On behalf of all staff of the Non-Governmental Organizations Branch/OESC/DESA, please accept our heartfelt congratulations.
Questions?

JACK POKRZYWA
jack.Pokrzywa@sae.org

https://www.linkedin.com/in/jpokrzywa/