Vehicle Code Amendments and Public Safety
Subcommittee Meeting #2
April 8, 2019
Welcome and Introductions
Review of Minutes
SAE Levels of Automation
Levels of automation

• Lower levels of automation may be called “advanced driver-assistance systems” (ADAS) where a human is always required to monitor the driving environment.

• Higher levels of automation may be called “automated driving systems,” which are capable of monitoring the driving environment. Vehicles with this capability may be called autonomous, not just automated, vehicles.

• More information can be found here.
Levels of automation

- A Level 1 vehicle might be equipped with adaptive cruise control or lane keeping assist.

- A Level 2 Vehicle might combine these types of driver-assistance systems to accelerate, brake, and steer the vehicle in certain traffic situations.

- However, these are driver assistance systems. The driver must always remain attentive and in control of the vehicle.
Levels of automation

- A Level 3 vehicle might allow a vehicle to travel without human oversight under certain circumstances, but requires a human backup driver to take over in conditions it cannot handle.

- A Level 4 vehicle may be able to travel without human oversight at all times, only limited by geographic or other conditions. They may not have manual controls.

- A Level 5 vehicle can navigate any circumstances that a human driver can, and may or may not have manual controls.
# SAE J3016™ Levels of Driving Automation

## What does the human in the driver's seat have to do?

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong>Level 0</strong></td>
<td>You are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering.</td>
</tr>
<tr>
<td><strong>Level 1</strong></td>
<td>You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety.</td>
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<tr>
<td><strong>Level 3</strong></td>
<td>You are not driving when these automated driving features are engaged – even if you are seated in &quot;the driver's seat.&quot;</td>
</tr>
<tr>
<td><strong>Level 4</strong></td>
<td>When the feature requests, you must drive.</td>
</tr>
<tr>
<td><strong>Level 5</strong></td>
<td>These automated driving features will not require you to take over driving.</td>
</tr>
</tbody>
</table>

## These are driver support features

- **Level 0**: These features are limited to providing warnings and momentary assistance.
- **Level 1**: These features provide steering OR brake/acceleration support to the driver.
- **Level 2**: These features provide steering AND brake/acceleration support to the driver.

**Example Features**
- Automatic emergency braking
- Blind spot warning
- Lane departure warning
- Lane centering
- Adaptive cruise control
- Lane centering AND adaptive cruise control at the same time

## These are automated driving features

- **Level 3**: These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met.
- **Level 4**: This feature can drive the vehicle under all conditions.
- **Level 5**: Same as level 4, but feature can drive everywhere in all conditions.

- Traffic jam chauffeur
- Local driverless taxi
- Pedals/steering wheel may or may not be installed
SAE Vehicle Definitions
Automated driving systems (ADS)
The hardware and software that are collectively capable of performing the entire
DDT on a sustained basis, regardless of whether it is limited to a specific
operational design domain (ODD); this term is used specifically to describe a level
3, 4, or 5 driving automation system.*

— NOTE: Driving automation system refers to any level 1-5 system or feature
that performs part or all of the driving task.

Operation design domain (ODD)
Operating conditions under which a given driving automation system or feature
thereof is specifically designed to function, including, but not limited to,
environmental, geographical, and time-of-day restrictions, and/or the requisite
presence or absence of certain traffic or roadway characteristics.
Dynamic driving task (DDT)

All of the real-time operational and tactical functions required to operate a vehicle in on-road traffic, excluding the strategic functions such as trip scheduling and selection of destinations and waypoints, and including without limitation:

- Lateral vehicle motion control via steering (operational);
- *Longitudinal vehicle motion control* via acceleration and deceleration (operational);
- *Monitoring* the driving environment via object and event detection, recognition, classification, and response preparation (operational and tactical);
- Object and event response execution (operational and tactical);
- Maneuver planning (tactical); and
- Enhancing conspicuity via lighting, signaling and gesturing, etc. (tactical).
Conventional vehicle
A vehicle designed to be operated by a conventional driver during part or all of every trip.

[ADS-equipped] Dual-mode vehicle
A type of ADS-equipped vehicle designed for both driverless operation and operation by a conventional driver for complete trips.*

— NOTE: A Level 3 AV would not be considered a dual-mode vehicle because the ADS cannot operate the vehicle for a complete trip.

ADS-dedicated vehicle (ADS-DV)
A vehicle designed to be operated exclusively by a level 4 or level 5 ADS for all trips within its given ODD limitations (if any).
State and SAE User Definitions
**SAE Definitions for AV Users**

**Human user**
A general term referencing the human role in driving automation.

– **NOTE 1:** The following four terms (1 – driver, 2 – passenger, 3 – DDT fallback-ready user, and 4 – driverless operation dispatcher) describe categories of (human) users.

– **NOTE 2:** These human categories define roles that do not overlap and may be performed in varying sequences during a given trip.
State Definitions for AV Users

- User/human user
- Conventional driver/human driver/human operator
- Driver/operator
- Autonomous test driver
- Remote operator/driver
- Driverless operation dispatcher
- Fallback-ready user
- Passenger
- Person
Law Enforcement Interaction Plans
Law Enforcement Interaction Plans – States and Manufacturers

Examples: Recommendations of the Oregon AV Task Force, Arizona, California, Nuro and Waymo
User Roles & Responsibilities Discussion
Driver license requirements:

ODOT should establish requirements that any user who performs any aspect of the driving task during a trip must be licensed. A Level 3 vehicle requires a licensed fallback-ready user. Level 4 and 5 vehicles may operate with or without a human driver, and may or may not have manual controls. In vehicles with manual controls, any user who performs any aspect of the driving task must be licensed. AV users who perform no aspect of the driving task are passengers and do not require a license.
Types of Automated Vehicles

- Conventional vehicles with no automation (Level 0)
- Conventional vehicles with driver assistance technology (Levels 1-2)
- Vehicles with conditional automation (Level 3)
- Dual-mode vehicles (Levels 4-5)
- ADS-dedicated vehicles (Levels 4-5)

Potential Ownership Models

- Personally owned vehicles (passenger or freight)
- Fleets of shared passenger vehicles owned by private companies
- Fleets of shared passenger vehicles owned by transit authorities or other public agencies
- Fleets of local delivery vehicles owned by private companies
- Fleets of freight trucks owned by private companies
Questions

• Is a human user or an ADS responsible for monitoring the driving environment and performing the driving task?
• Does the user have a responsibility to take control from the ADS?
• Does a user who engages an ADS bear any responsibility for how the ADS operates?
• What about a user who tricks or tampers with the ADS technology?
• What are the responsibilities of an AV owner?
• Who is responsible for fulfilling other driver responsibilities besides the physical driving of a vehicle, such as exchanging insurance information with other drivers in the event of a crash?
Public Comment
Recap and Next Steps