CONNECTIVITY, DRIVER ASSISTANCE AND AUTOMATED DRIVING OVERVIEW

Standards Development: Enabling Technologies, Trends, & Transition

FMCSA - Motor Safety Advisory Committee

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Motivation

- Safety
- Productivity
- Environment
- Competitiveness
- Security
- Convenience
- Satisfaction
- …
FROM SAE STANDARD TO REGULATION TO PRODUCT COMPLIANCE

40 SAE references in Canadian regulations
78 SAE references in ISO regulations
27 SAE references in UNECE regulations
25 SAE references in Global Technical Regulations
9 SAE references in Japan’s regulations
37 SAE references in Australian regulations

New Technology in SAE Committees

- Wireless Charging
- Driver Distraction (Driver-Vehicle Interface)
- EV/Hybrid/F C Vehicle & Battery
- Functional Safety
- Automated Driving Systems
- Active Safety
- Vehicle Electronics & Cyber Security
- Intelligent Transportation Systems
- Automotive Electronics System Reliability

SAE INTERNATIONAL
Fundamental Relationships & Work at SAE: Automated Driving Systems

- Active Safety
- Vehicle Systems
- Human Factors
- Communication (DSRC or ?)
- Connected Vehicle
- Cyber Security
- Privacy
Driving Task / Driver’s Tasks

- Pre-Trip
- Roadside
- OOS
- Incident
- P & D (LTL / Cartage)
- Maintenance
- Diagnostics
- Logistics
- Vocational
Architecture Examples:

• SAE J560
• SAE J1939 (&J1587, J1708)
• Sensor and Component Developments
• ABS
• Electronic Engine Controls
• Automated Manual Transmissions
• Electronically Controlled Braking Systems
• Roll Stability Control / Electronic Stability Control Systems
• Adaptive Cruise Control (Terrain Function)
• Road/Lane Departure Warning Systems
• Automatic Emergency Braking
Established, Traditional, Legacy Suppliers
- Vehicle Manufacturers
- Major Component Suppliers / Strategic Development Partners
- Vertically Integrated Divisions
- Lower Tier Suppliers
- Modifiers / Body/Equipment Installers
- Aftermarket / Direct to End User Technology Providers

New Entrants’ / Entrepreneurs’ Dynamics (Disrupters)

General Public Perception
Motor Carriers
Law Enforcement
Regulators/Legislators
Special Interest Groups
Evolution or Revolution (continued)

- Closed
- Geofenced
- Conservative Domain
- Conservative Progression
- Regulated
- Disruptive
Recent Studies / Predictions:

- TNO (2016)
- ITF (2015)
- Frisoni et al (2016)
- Underwood (2014)
- PWC (2015)
- KPMG (2015)
- SAFE (2017)
- …
Terms and Definitions
- Taxonomy & Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems
- Operational Definitions of Driving Performance Measures & Statistics
- Definition of Hand-Free Operation of a Person to Person Wireless Communication System or Device
- Automated Vehicles Definitions: Key Terms Related to Human Interaction with Automated Driving Systems
- Active Safety Systems Sensors

Vehicle & System Performance Requirements
- DSRC Common Performance Requirements
- On-Board System Requirements for V2V Safety Communications
- Performance Requirements for Cooperative Adaptive Cruise Control and Platooning
- Performance Requirements for Safety Communications to Vulnerable Road Users
- Automatic Emergency Braking Test Methods and Performance Assessment
- Adaptive Cruise Control Operating Characteristics and User Interface
- Recommended Practice for Pas-Thru Vehicle Programming
- Automated Driving Reference Architecture

Interoperability (V2V, V2I, V2X)
- Dedicated Short Range Communication (DSRC) Message Set Dictionary
- On-Board System Requirements for V2V Safety Communications
- DSRC Requirements for V2V Safety Awareness
- Candidate Improvements to DSRC Using Systems Engineering Methods
- Mobile Device Application
- Road Side Equipment for I2V and V2I
- Performance Requirements for Safety Communications to Vulnerable Road Users
- Recommended Practices for MAP/SPaT Message Development
- Recommended Practices for Signal Preemption Message Development
- Recommended Practice for Pass-Through Vehicle Programming
- Automated Driving Reference Architecture
**SAE J3016 Standards for Automated Driving**

**SUMMARY OF SAE INTERNATIONAL’S LEVELS OF DRIVING AUTOMATION FOR ON-ROAD VEHICLES**

Issued January 2016, SAE International’s J3016 provides a common reference and descriptive language to inform stakeholders about the current state of driving automation. This is a living document intended to evolve over time to keep pace with the dynamic developments and challenges. It is not an exhaustive list or a summary of all features that can be enabled on different vehicles or different types of automation that are engaged.

**SAE Levels**

- **0: No Automation**
  - Full-time, manual driving.
  - Human driver is always in control.

- **1: Low Level of Automation**
  - Designated driver assistance systems that provide some assistance to the driver.
  - No upgrade of the overall driving task.

- **2: Moderate Level of Automation**
  - Automated driving system capable of operating in certain environmental contexts.
  - NO upgrade of the overall driving task.

- **3: Partial Automation**
  - The automated driving system can handle the full driving task in certain environmental contexts.
  - NO upgrade of the overall driving task.

- **4: Full Automation**
  - The automated driving system handles the full driving task in certain environmental contexts.
  - NO upgrade of the overall driving task.

- **5: Full Automation**
  - The automated driving system handles the full driving task in certain environmental contexts.
  - NO upgrade of the overall driving task.

**Key Definitions**

- **Dynamic Driving Task**: The task of maneuvering a vehicle to its intended destination in a way that complies with all relevant laws and regulations.
- **Static Driving Task**: The task of maintaining a vehicle in its current position, including tasks such as parking or stationary idle.
- **Minimum Dynamic Driving Task**: The task of keeping a vehicle moving, including tasks such as low-speed cruising.
- **Minimum Static Driving Task**: The task of maintaining a vehicle in its current position, including tasks such as parking or stationary idle.
- **Supervised Minimum Dynamic Driving Task**: The task of keeping a vehicle moving, including tasks such as low-speed cruising, typically with a human driver in the vehicle.
- **Supervised Minimum Static Driving Task**: The task of maintaining a vehicle in its current position, including tasks such as parking or stationary idle, typically with a human driver in the vehicle.

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Published and Works in Progress: Safety (sample)

Functional Safety
Safety and Reliability
Active Safety
Safety & Human Factors
Other Safety /
Crosscutting
Functional Safety
Safety and Reliability
Active Safety
Safety & Human Factors
Other Safety / Crosscutting

Advanced Driver Assistance Systems & Levels of Automation
- Active Safety Systems Sensors
- Automatic Emergency Braking Test Methods & Performance Assessment
- Specifications of Pedestrian Mannequins for Vehicle Pedestrian Detection Systems
- Truck & Bus Lane Departure Warning Systems Test Procedure
- Truck & Bus Forward Collision Warning & Mitigation Vehicle Test Procedure
- Recommended Practice for Braking, Stability, & Control Performance Test Procedure of Air-Brake-Equipped Trucks
- Taxonomy & Definitions for Terms related to On-Road Motor Vehicle Automated driving Systems
- Test Target Correlation
Advanced Driver Assistance Systems & Levels of Automation
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Other Safety
- Truck & Bus Automated Commercial Vehicle
- Uniform Pavement Markings for Machine Vision Systems
- Adaptive Driving Beam System
- Guidelines for Safe On-Road Testing of Automated Driving Systems
- Identifying Automated Driving System Dedicated Vehicles (ADS-DV) User Issues for Persons With Disabilities
Privacy
• Data Collection, Retention, Ownership & Access
• Pedestrian Protection EDR Parameters
• Permanently or Semi-Permanently Installed Diagnostic Communication Devices

Security
• Cybersecurity Recommended Practice for Cyber-Physical Vehicle Systems
• Requirements for Hardware Protected Security for Ground Vehicle Applications
• OBD II Telematics, Vehicle Health Management, Data Access
• Vulnerabilities & Cyber Threat Analysis
• Over the Air Updates
• Automotive Networks of Connected Systems, Sensors & Physical Objects
**SAE Cybersecurity Standards**

| SAE J3061 “Cybersecurity Guidebook for Cyber-Physical Automotive Systems” | **Scope:**  
- Consistent with Process Framework for ISO 26262 Functional Safety Standard  
- Contains automotive cybersecurity framework and processes  
- Evaluates Threat Analysis and Risk Assessment (TARA) methods  
- Simple approach to allow effective implementation across the automotive industry  
- Contains elements of existing industry security standards  
- Definitions, Acronyms, and sample templates provided |
|---|---|
| SAE J3101: “Requirements for Hardware-Protected Security for Ground Vehicle Applications” | **Scope:**  
Define a common set of requirements for security to be implemented in hardware for ground vehicles to facilitate security enhanced applications, developing expectations for necessary functionality to achieve an ideal system for hardware protection for ground vehicle applications, including examples, but not explicitly detailing implementation requirements. |
Thank you

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