



SURFACE VEHICLE INFORMATION REPORT

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(R) Active Safety Systems Terms and Definitions

RATIONALE

This revision includes changes to definitions using NHTSA suggestions and those developed for the latest version of the "Clearing the Confusion" document, and to reflect technological updates.

TABLE OF CONTENTS

1.	SCOPE.....	3
2.	REFERENCES.....	3
2.1	Applicable Documents	3
2.1.1	SAE Publications.....	3
2.1.2	ISO Publications.....	3
2.1.3	Other Publications.....	4
3.	FEATURE ABBREVIATIONS	4
4.	GENERAL ABBREVIATIONS AND DEFINITIONS	4
4.1	Active Safety Systems	4
4.2	Dynamic Driving Task (DDT)	5
4.3	Subject Vehicle	5
5.	SYSTEM TERMS AND DEFINITIONS	5
5.1	Collision Warning	6
5.1.1	Blind Spot Warning (BSW).....	6
5.1.2	Forward Collision Warning (FCW)	6
5.1.3	Lane Departure Warning (LDW)	6
5.1.4	Parking Collision Warning (PCW).....	7
5.1.5	Rear Cross Traffic Warning	7
5.2	Collision Intervention.....	7
5.2.1	Automatic Emergency Braking (AEB).....	8
5.2.2	Automatic Emergency Steering (AES).....	8
5.2.3	Reverse Automatic Emergency Braking	9
5.2.4	Blind Spot Collision Intervention	9
5.2.5	Lane Keeping Assistance (LKA)	9
5.3	Driving Control Assistance	10
5.3.1	Adaptive Cruise Control (ACC).....	10
5.3.2	Lane Centering Assistance (LCA).....	10
5.3.3	Active Driving Assistance.....	10

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5.4	Parking Assistance.....	11
5.4.1	Backup Camera	11
5.4.2	Surround View Camera.....	11
5.4.3	Active Parking Assistance.....	11
5.4.4	Remote Parking Assistance.....	12
5.4.5	Trailer Assistance.....	12
5.5	Driver Monitoring.....	12
5.5.1	Indirect Driver Monitoring System.....	12
5.5.2	Direct Driver Monitoring System	13
5.5.3	Driver Reengagement System.....	13
5.6	Other Driving Assistance Systems.....	13
5.6.1	Automatic High Beam	13
5.6.2	Adaptive Driving Beam.....	13
5.6.3	Head-Up Display (HUD).....	14
5.6.4	Night Vision	14
5.6.5	Speed Warning	15
5.6.6	Intoxication Detection and Interlock System.....	15
6.	NOTES.....	15
6.1	Revision Indicator.....	15
Figure 1	Adaptive driving beam.....	14

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1. SCOPE

This SAE Information Report provides a compendium of terms, definitions, abbreviations, and acronyms to enable common terminology for use in engineering reports, diagnostic tools, and publications related to active safety systems. This information report is a survey of active safety systems and related terms. The definitions offered are descriptions of functionality rather than technical specifications. Included are warning and momentary intervention systems, which do not automate any part of the dynamic driving task (DDT) on a sustained basis (SAE Level 0 as defined in SAE J3016), as well as definitions of select features that perform part of the DDT on a sustained basis (SAE Level 1 and 2).

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J3016 Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles

2.1.2 ISO Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ISO 11067:2015	Intelligent Transport Systems - Curve Speed Warning Systems (CSWS) - Performance Requirements and Test Procedures
ISO 11270:2014	Intelligent Transport Systems - Lane Keeping Assistance Systems (LKAS) - Performance Requirements and Test Procedures
ISO 15622:2018	Intelligent Transport Systems - Adaptive Cruise Control Systems - Performance Requirements and Test Procedures
ISO 15623:2013	Intelligent Transport Systems - Forward Vehicle Collision Warning Systems - Performance Requirements and Test Procedures
ISO 16787:2017	Intelligent Transport Systems - Assisted Parking System (APS) - Performance Requirements and Test Procedures
ISO 17361:2017	Intelligent Transport Systems - Lane Departure Warning Systems - Performance Requirements and Test Procedures
ISO 17386:2010	Intelligent Transport Systems - Manoeuvring Aids For Low Speed Operation (MALSO) - Performance Requirements and Test Procedures
ISO 17387:2008	Intelligent Transport Systems - Lane Change Decision Aid Systems (LCDAS) - Performance Requirements and Test Procedures
ISO 19237:2017	Intelligent Transport Systems - Pedestrian Detection and Collision Mitigation Systems (PDCMS) - Performance Requirements and Test Procedures

ISO 19638:2018	Intelligent Transport Systems - Road Boundary Departure Prevention Systems (RBDPS) - Performance Requirements and Test Procedures
ISO 20900:2019	Intelligent Transport Systems - Partially Automated Parking Systems (PAPS) - Performance Requirements and Test Procedures
ISO 21717:2018	Intelligent Transport Systems - Partially Automated In-Lane Driving Systems (PADS) - Performance Requirements and Test Procedures.
ISO 22078:2020	Intelligent Transport Systems - Bicyclist Detection and Collision Mitigation Systems (BDCMS) - Performance Requirements and Test Procedures
ISO 22839:2013	Intelligent Transport Systems - Forward Vehicle Collision Mitigation Systems - Operation, Performance, and Verification Requirements
ISO 22840:2010	Intelligent Transport Systems - Devices to Aid Reverse Manoeuvres - Extended-Range Backing Aid Systems (ERBA)

2.1.3 Other Publications

AAA, Consumer Reports, J.D. Power, NSC, PAVE, and SAE International. (2022). Clearing the confusion: Common naming for advanced driver assistance systems. Available at <https://newsroom.aaa.com/wp-content/uploads/2023/02/Clearing-the-Confusion-One-Pager-New-Version-7-25-22.pdf>.

3. FEATURE ABBREVIATIONS

ACC	Adaptive Cruise Control
AEB	Automatic Emergency Braking
AES	Automatic Emergency Steering
BSW	Blind Spot Warning
FCW	Forward Collision Warning
HUD	Head-Up Display
LCA	Lane Centering Assistance
LDW	Lane Departure Warning
LKA	Lane Keeping Assistance
PCW	Parking Collision Warning

4. GENERAL ABBREVIATIONS AND DEFINITIONS

4.1 Active Safety Systems

Active safety systems are vehicle systems that sense and monitor conditions inside and outside the vehicle for the purpose of identifying perceived present and potential dangers to the vehicle, occupants, and/or other road users, and automatically intervene to help avoid or mitigate potential collisions via various methods, including alerts to the driver, vehicle system adjustments, and/or active control of the vehicle subsystems (brakes, throttle, suspension, etc.).

NOTE: For purposes of this report, systems that meet the definition of active safety systems are considered to have a design purpose focused on improving safety, comfort, convenience, or other driver assistance. Active safety systems warn or intervene during a maneuver or a high risk event.

4.2 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, the following subtasks:

- 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, sounding the horn, signaling, gesturing, etc. (tactical).

Refer to SAE J3016.

4.3 Subject Vehicle

The vehicle that contains the active safety system, Level 1 driving automation system, or Level 2 driving automation system.

5. SYSTEM TERMS AND DEFINITIONS

This section contains terms and definitions related to active safety systems and comfort and convenience-oriented driver assistance systems. The definitions are not meant to replace an automaker's proprietary system or package names, but rather to help identify key functions and capabilities within those packages and provide clarity to industry, governmental entities, and consumers.

Most features that provide a warning or intervention action contain a means to estimate if the driver would benefit from the action or not. In certain circumstances, based on driver inputs, a particular warning, or intervention action could be suppressed before it occurs or could terminate early (overridden).

In addition, many features can be tailored to the driver's preference. Many of the timings for warnings and motion control can be adjusted or shut off entirely. Such customizations may be remembered over subsequent ignition cycles or they may revert back to the default setting.

Where actions described for system definitions in this document are dependent on traffic, weather, and roadway sensing, those actions should be understood as probabilistic, rather than deterministic. Systems are intended to notify, alert, intervene, or control, but sensing may not correctly interpret the driving environment in all cases, and these actions may not occur or may occur unnecessarily. The systems are intended to support drivers in driving, not replace them.

Where new definitions have been developed, terms from the prior version of this document are provided for reference under "includes."

5.1 Collision Warning

Collision warnings provide alerts to the driver; they do not perform interventions to prevent possible collisions.

5.1.1 Blind Spot Warning (BSW)

Detects vehicles in the blind spot while driving and notifies the driver to their presence. Some systems provide an additional warning if the driver activates the turn signal.

NOTE 1: The blind spot is an area to the side and rear of the subject vehicle in an adjacent lane.

NOTE 2: This notification is most often visual and typically is found on the corresponding A-pillar or side mirror.

Variants:

- Some systems provide an additional warning (e.g., audible or haptic) if the driver activates the turn signal in the direction of a vehicle detected to the side and the rear of the subject vehicle and moving in the same direction as the subject vehicle. Some systems provide a warning if there is a vehicle quickly approaching the blind spot from behind.

Refer to ISO 17387:2008.

Includes:

- Lane change decision aid systems (LCDAS).

5.1.2 Forward Collision Warning (FCW)

Detects a potential collision with a vehicle ahead and alerts the driver. Some systems also alert the driver to a potential collision with a pedestrian or other object.

NOTE : This warning is typically multimodal, and can include an auditory alert, visual alert, haptic vibration, kinesthetic cue (for example, braking vibration, steering vibration, or seat vibration), or any combination thereof.

Variants:

- Some systems warn the driver of potential collisions with pedestrians, cyclists, and/or large animals.
- Systems present the visual warning in different locations, such as the instrument cluster or a head-up display.
- Some systems provide an alert for a vehicle crossing the path of travel or oncoming traffic.

Refer to ISO 15623:2013.

Includes:

- Forward vehicle collision warning systems (FVCWS).
- Cross traffic alert (in front of vehicle, for vehicles approaching from the side).
- Cooperative intersection collision avoidance systems (CICAS).

5.1.3 Lane Departure Warning (LDW)

Monitors vehicle's position within the driving lane and alerts driver as the vehicle approaches or crosses lane markers.

NOTE: This warning is typically multimodal, and can include an auditory alert, visual alert, haptic vibration, or any combination thereof.

Variants:

- Some systems also provide a warning when the vehicle approaches or crosses the road edge in the absence of lane markers.
- Some systems provide a warning for oscillations or drifting within the driving lane.

Refer to ISO 17361:2017.

Includes:

- Lane sway warning.

5.1.4 Parking Collision Warning (PCW)

Detects objects close to the vehicle during parking maneuvers and notifies the driver.

Variants:

- Some systems only provide warnings corresponding to the rear of the vehicle, others provide front and rear, while others provide warnings all around.
- Some systems provide progressive warnings.
- Some systems provide a longer detection range to the rear.

Refer to ISO 17386:2010 and ISO 22840:2010.

Includes:

- Backup aids.
- Backup warning systems.
- Extended range backing aid (ERBA).
- Maneuvering aid for low speed operation (MALSO).

5.1.5 Rear Cross Traffic Warning

Detects vehicles approaching from the side at the rear of the vehicle while in reverse gear and alerts the driver. Some systems also warn for pedestrians or other objects.

Includes:

- Cross traffic alert (behind subject vehicle, for vehicles approaching from the side).

5.2 Collision Intervention

Collision intervention systems provide momentary intervention during potentially hazardous situations. Depending on the situation, the collision intervention system intervention may result in collision avoidance or it may result in a reduction in the severity of the collision. Due to the momentary nature of the actions of these systems, their intervention does not change or eliminate the role of the driver.

5.2.1 Automatic Emergency Braking (AEB)

Detects potential collisions with a vehicle ahead, provides forward collision warning, and automatically brakes to avoid a collision or lessen the severity of impact. Some systems also detect pedestrians or other objects.

NOTE 1: Automatic braking is typically provided for other vehicles seen moving in the same direction in the path of travel.

NOTE 2: These systems provide braking without driver input and they also increase the vehicle braking beyond that commanded by the driver when the system senses the driver-initiated braking is not sufficient to avoid a crash.

Variants:

- Some systems provide braking for pedestrians, cyclists, and/or large animals in various paths of travel.
- Some systems provide braking for a vehicle crossing the path of travel or oncoming traffic.
- Some systems also reduce the acceleration available to the driver when a potential collision is detected.

Refer to ISO 22839:2013, ISO 19237:2017 (pedestrians), and ISO 22078:2020 (cyclists).

Includes:

- Brake assist systems.
- Dynamic brake support (DBS).
- Forward vehicle collision mitigation systems (FVCMS).
- Pedestrian collision mitigation systems (PCMS).
- Pre-collision throttle management.

5.2.2 Automatic Emergency Steering (AES)

Detects potential collisions with a vehicle ahead and automatically steers to avoid or lessen the severity of impact. Some systems also detect pedestrians or other objects.

NOTE: Automatic steering is typically provided in response to other vehicles seen moving in the same direction in the path of travel.

Variants:

- Some systems increase the vehicle steering beyond that commanded by the driver when the system senses the driver-initiated steering is not sufficient to avoid a crash.
- Some systems provide steering without driver input.
- Some systems intervene while staying within the lane.
- Some systems intervene for pedestrians, cyclists, and/or large animals in various paths of travel.
- Some systems provide steering for a vehicle crossing the path of travel or oncoming traffic.

Includes:

- Automatic evasive steering systems.

5.2.3 Reverse Automatic Emergency Braking

Detects potential collisions while in reverse gear and automatically brakes to avoid or lessen the severity of impact. Some systems also detect pedestrians or other objects.

NOTE: These systems typically provide automatic braking with or without driver braking.

Variants:

- Some systems provide braking for pedestrians or other objects. Some systems provide braking for crossing traffic while reversing.

5.2.4 Blind Spot Collision Intervention

Detects potential collisions with adjacent vehicles and automatically steers and/or brakes to avoid or lessen the severity of impact.

Variants:

- Some systems only intervene if the driver engages the turn signal in the direction of the adjacent vehicle.
- Some systems intervene when there are adjacent vehicle(s) that may be in the subject vehicle's blind spot.
- Some systems intervene when there are adjacent vehicle(s) that are ahead of the subject vehicle.
- Some systems intervene for vehicles that are quickly approaching the blind spot from behind.

5.2.5 Lane Keeping Assistance (LKA)

Provides steering support to assist the driver in keeping the vehicle in the lane. The system reacts only when the vehicle approaches or crosses a lane line or road edge.

NOTE: Most LKA systems operate above a minimum speed determined by the manufacturer and are paired with lane departure warning.

Variants:

- Some systems intervene by applying steering torque.
- Some systems intervene by applying differential braking.
- Some systems can detect the edge of the road. Systems may react differently to the road edge than for a lane line.
- Some systems provide a greater margin to the lane line if there is a vehicle, pedestrian, or cyclist in an adjacent lane.

Includes:

- Road boundary departure prevention systems (RBDPS).

Refer to ISO 11270:2014 and ISO 19638:2018.

5.3 Driving Control Assistance

Driving control assistance systems provide sustained support to the driver during the dynamic driving task (DDT). They provide assistance to the driver, up to partial automation of the driving task. The driver performs the rest of the DDT, continually supervises the performance of the system, and has the authority to override the system at any time.

5.3.1 Adaptive Cruise Control (ACC)

Cruise control that also assists with acceleration and/or braking, based on a maximum set speed, to maintain a driver-selected gap to the vehicle in front.

NOTE: This feature, when used alone (i.e. without the simultaneous use of LCA), is considered an SAE J3016 Level 1 driving automation feature.

Variants:

- Most systems are able to slow the vehicle to a stop and then continue.
- Some systems will disengage at a minimum speed threshold without coming to a stop.
- Some systems will adjust the set speed based on the detected speed limits.
- Some systems will react to traffic signals and stop signs.
- Some systems are able to maintain a driver-selected gap to other objects such as scooters and pedalcyclists.

Refer to ISO 15622:2018 and SAE J2399.

5.3.2 Lane Centering Assistance (LCA)

Provides steering support to assist the driver in continuously maintaining the vehicle at or near the center of the lane.

NOTE: This feature, when used alone (i.e. without the simultaneous use of ACC), is considered an SAE J3016 Level 1 driving automation feature.

Variants:

- The activation of some systems is contingent on the use of ACC.
- Some systems can adjust lateral lane placement based on the presence of vehicles or other traffic participants in adjacent lanes.

Refer to ISO 11270:2014.

5.3.3 Active Driving Assistance

Simultaneous use of lane centering assistance and adaptive cruise control features. The driver must constantly supervise this support feature and maintain responsibility for driving.

NOTE 1: These systems are typically paired with a driver monitoring system.

NOTE 2: Active driving assistance is classified as Level 2 driving automation (refer to SAE J3016).

Variants:

- Some systems are designed for sustained hands-free steering.
- Some systems have engagement restrictions such as geo-locations and speed ranges.
- Some systems are capable of suggesting a lane change to the driver.
- Some systems are capable of performing an automatic lane change, with or without a driver confirmation and/or driver request. This lane change could be due to preceding traffic, the planned route, or lane merges/exits.
- Some systems are capable of executing turns at intersections.

Refer to ISO 21717:2018.

5.4 Parking Assistance

5.4.1 Backup Camera

Displays the area behind the vehicle when in reverse gear.

NOTE 1: Many of these systems provide distortion correction to enhance the image.

NOTE 2: The image display can be provided at different interior locations.

Variants:

- Some systems stay active for a period of time after a shift out of reverse.
- Some systems include fixed or dynamic graphical overlays depicting vehicle path lines and detected objects.

5.4.2 Surround View Camera

Displays the immediate surroundings of some or all sides of the vehicle while stopped or during low-speed maneuvers.

NOTE: These systems typically combine images obtained from multiple cameras on the vehicle. The images are typically corrected to adjust for camera perspectives.

Variants:

- Some systems allow the driver to select different views.
- Some systems display a reference image of the subject vehicle.
- Some systems include fixed or dynamic graphical overlays depicting vehicle path lines and detected objects.

5.4.3 Active Parking Assistance

Assists with steering and potentially other functions during parking maneuvers. Driver may be required to accelerate, brake, and/or select gear position. Some systems are capable of parallel and/or perpendicular parking. The driver must constantly supervise this support feature and maintain responsibility for parking.

Variants:

- All systems are capable of parallel parking, some systems are capable of parking in perpendicular or angled spaces.
- All systems provide automatic steering, and some systems provide automatic braking/acceleration and/or gear selection.
- Some systems provide assistance to exit a parking space.
- Some systems need to have other parked vehicles present to recognize a parking space, other systems detect the parking space markings.

Refer to ISO 16787:2017 and ISO 20900:2019.

5.4.4 Remote Parking Assistance

Without the driver being physically present inside the vehicle, provides steering, braking, accelerating, and/or gear selection while moving a vehicle into or out of a parking space. The driver must constantly supervise this support feature and maintain responsibility for parking.

Remote parking assistance is classified as Level 2 driving automation (refer to SAE J3016).

Refer to ISO 20900:2019.

5.4.5 Trailer Assistance

Assists the driver with visual guidance while backing towards a trailer or during backing maneuvers with a trailer attached. Some systems may provide additional images while driving or backing with a trailer. Some systems may provide steering assistance during backing maneuvers.

5.5 Driver Monitoring

Driver monitoring systems interact with drivers to elicit proper engagement. These systems include an estimation of the driver's current level of engagement along with a series of actions that seek to improve driver attentiveness or readiness. These systems may be able to detect driver drowsiness and/or distraction.

5.5.1 Indirect Driver Monitoring System

Observes vehicle states, motions, and/or driver performance indicators to estimate driver distraction, inattention, or misuse. This may include monitoring steering wheel input, vehicle sway within the lane, or a combination of other factors monitored by the vehicle systems. Some systems may provide a warning to the driver and/or limit the use of other features.

Variants:

- Some systems incorporate a driving trip timer that provides a notification to the driver that it may be time to rest.
- Some systems measure the driver inputs into the steering, either using torque-based or capacitive touch sensors.
- Some systems monitor steering input patterns suggesting a driver that may be falling asleep.