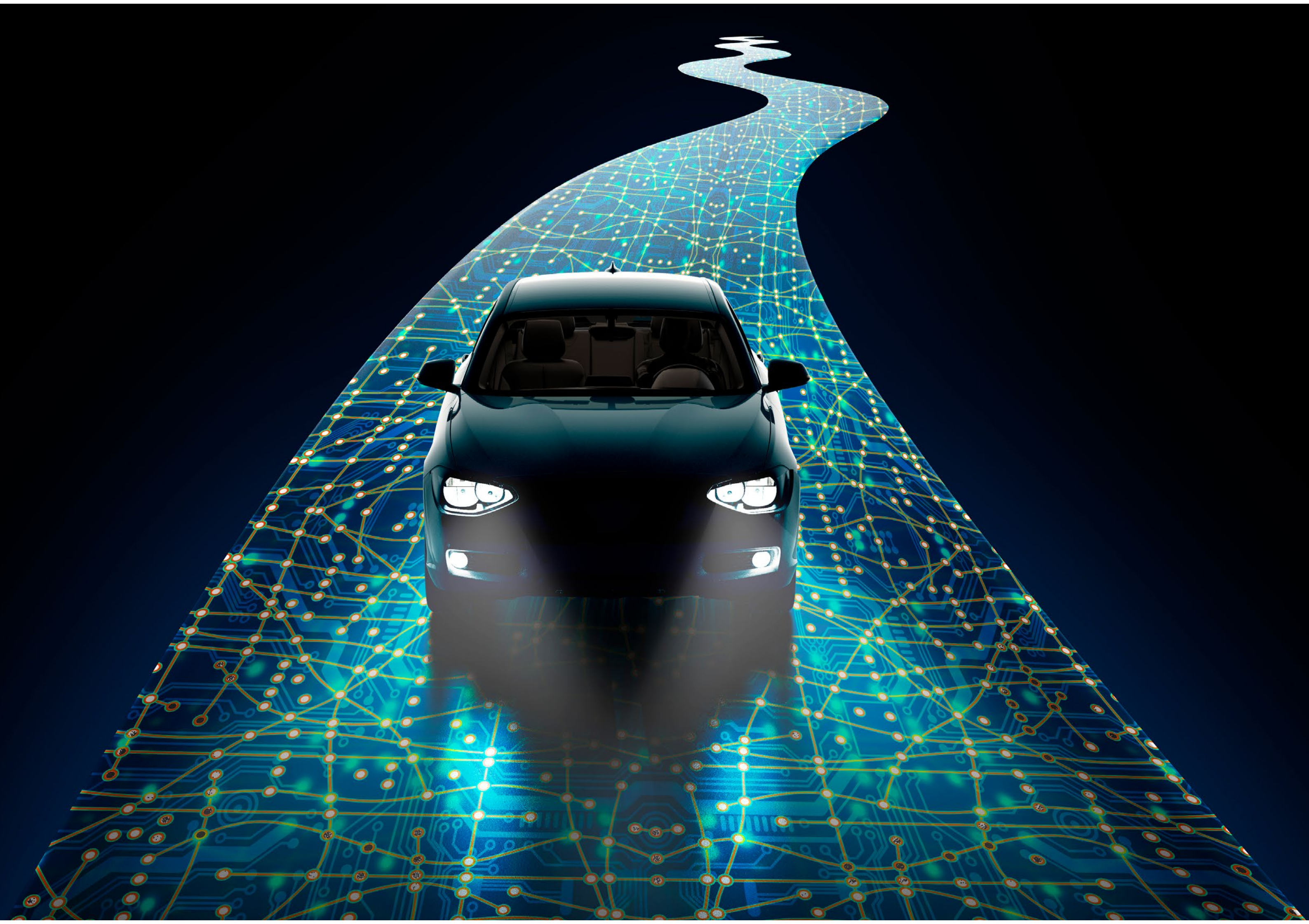
Connected and automated mobility – Vocabulary

April 2023 Version 5



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Foreword

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The definitions in this document are presented in roman (i.e. upright) type.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the *Shorter Oxford English Dictionary* is used (e.g. "organization" rather than "organisation").

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1 Scope

This document defines terms, abbreviations, and acronyms for the connected and automated mobility (CAM) sector, focused on those relating to vehicles and associated technologies.

It covers terms relating to connectivity and automation of roadgoing, land-based vehicles and their users[1]. It does not cover terms that are manufacturer-specific.

This document is for use by insurers, regulators, legislators and organizations involved in CAM infrastructure, as well as CAM manufacturers, operators and consumers.

2 Normative references

There are no normative references in this document.[2]

[1] For terms and definitions related to connected and automated plant (machinery operating within the work site boundary for the purpose of construction works), refer to BSI PAS 1892 Connected and automated plant (CAP) – Defining, specifying and managing the use of CAP in construction works – Specification

[2] Documents that are referred to solely in an informative manner are listed in the Bibliography.

3 Terms, definitions and abbreviations

3.1 Terms and definitions

3.1.1 abort criteria

conditions defined through risk assessment that necessitate termination or non-initiation of the automated driving system (**3.1.9**) during authorized testing

3.1.2 active safety system

entity consisting of interdependent components that uses sensor input and processing to detect evidence of increases in road risk (such as an impending collision or loss of traction) and takes preventative or mitigating action

NOTE *Preventative action may take the form of providing an advanced warning or providing the human driver with assistance in vehicle control; for example, by applying the brakes.*

3.1.3 actor

entity with the capability to act and react in a scenario (**3.1.78**).

[SOURCE: BS ISO 34501:2022]

3.1.4 adaptive cruise control (ACC)

system that attempts to maintain the vehicle (**3.1.96**) at a driver-selected target speed and following distance, using sensors and actuators to regulate vehicle speed

NOTE 1 *The purpose is to keep a safe distance relative to other slower moving vehicles ahead before reverting to the set speed when the lane clears.*

NOTE 2 *Some early adaptive cruise control systems, especially those vehicles with manual transmission, are not capable of bringing the vehicle to a complete stop and require the human driver to intervene to do so. Systems that are capable of controlling the vehicle to a stop have a variety of additional names such as 'Stop & Go'.*

NOTE 3 *Some adaptive cruise control systems (e.g. those conforming to Regulation (EU) 2019/21441, known as the General Safety Regulation), do not allow the driver to set the maximum speed above the speed limit. Some manufacturers offer adaptive cruise control systems that automatically slow the vehicle in advance of a change to a lower speed limit [see intelligent speed assistance (**3.1.45**)].*

3.1.5 advanced driver assistance system (ADAS)

entity consisting of interdependent components that supports human drivers by performing a part of the dynamic driving task (**3.1.28**), by assisting human drivers to drive safely, by intervening to prevent an unsafe situation from developing or by providing safety relevant information and warnings

NOTE *Examples include adaptive cruise control and automatic emergency braking.*

3.1.6 advanced emergency braking system (AEBS)

vehicle system that uses sensors and computer processing to detect when the ego vehicle (**3.1.31**) could collide with an object in its path and applies the brakes automatically attempting to mitigate or avoid the collision, even if the driver takes no action

NOTE 1 *AEBSs may use different sensor types (e.g. camera, radar, lidar), work in different driving conditions (e.g. highways, urban) and act on the ego vehicle (**3.1.31**) in different ways (e.g. only slow the vehicle or bring it to a complete stop).*

NOTE 2 *This term was referred to as automatic emergency braking (AEB) in previous versions of this vocabulary.*

3.1.7 authorized self-driving entity (ASDE)

organization that puts an automated vehicle forward for authorization for use as self-driving and is responsible for its safe and lawful behaviour

NOTE 1 *This can be the vehicle manufacturer or software designer or a joint venture between the two.*

NOTE 2 *This term and definition is adapted from the Law Commissions' joint consultation paper 3 (2020)[2] and replaces the previous term automated driving system entity (ADSE).*

3.1.8 automated driving

when the dynamic driving task (**3.1.28**) is performed by the automated driving system (**3.1.9**)

NOTE 1 *An automated vehicle driving itself is performing automated driving.*

NOTE 2 *Automated driving may operate for some or all of a journey depending on the capabilities of the system, the suitability of infrastructure, any other constraints on its operational design domain (**3.1.60**) and the preferences of the user-in-charge (**3.1.94**).*

NOTE 3 With reference to self-driving features, the Law Commissions' joint report (2022)[3] extended this definition with the condition that the vehicle must drive "safely and legally, even if an individual is not monitoring the driving environment, the vehicle or the way that it drives".

3.1.9 automated driving system (ADS)

hardware and software that are collectively capable of performing the dynamic driving task (**3.1.28**) on a sustained basis, regardless of whether it is limited to a specific operational design domain (**3.1.60**)

*NOTE 1 This definition is adapted from SAE J3016 (2018)[4] and is used specifically for driving automation systems that can deliver SAE level 3, 4, or 5 driving (the generic term driving automation system (**3.1.27**) covers systems that deliver SAE level 1 to 5 driving features).*

3.1.10 automated lane keeping system (ALKS)

hardware and software for motorway application activated by a human driver within its operational design domain for travelling speed of up to 130kph by controlling the lateral and longitudinal movements of the vehicle for extended periods without the need for further driver input

NOTE 1 Definition adapted from UN Regulation No. 157 Uniform provisions concerning the approval of vehicles with regard to Automated Lane Keeping Systems (2022).[5]

NOTE 2 ALKS up to 60kph keeps the vehicle within its lane of travel, whereas ALKS up to 130kph must be equipped with lane-change capability.

NOTE 3 Vehicles using with ALKS are still subject to speed limits according to vehicle class and road type (e.g. the UK speed limit for cars, motorcycles, car-derived vans and dual-purpose vehicles on motorways is 70mph / 112kph)

3.1.11 automated vehicle (AV)

vehicle (**3.1.96**) fitted with an automated driving system (**3.1.9**) that uses both hardware and software to perform dynamic driving tasks associated with moving the vehicle within a defined operational design domain (ODD) (**3.1.60**)

[SOURCE: BSI PAS 1883:2020]

NOTE 1 The Automated and Electric Vehicle Act (2018)[6] refers to the vehicle being capable of driving itself safely, in at least some circumstances or situations, on roads or other public places in Great Britain.

3.1.12 automatic emergency steering (AES)

vehicle system that uses sensors and computer processing to detect when the ego vehicle (**3.1.31**) could collide with an object in its path and applies steering inputs automatically attempting to mitigate or avoid the collision, even if the driver takes no action

NOTE 1 AES systems may use different sensor types (e.g. camera, radar, lidar), work in different driving conditions (e.g. highways, urban) and act on the ego vehicle in different ways depending on the situation.

*NOTE 2 AES systems may consider the ego vehicle's (**3.1.31**) surroundings and other objects and their trajectories to determine a predicted minimal risk steering trajectory.*

NOTE 3 AES systems are distinct from steering support systems which augment a driver's steering input to avoid a collision only when the driver has initiated a steering movement.

3.1.13 automatically commanded steering function (ACSF)

electronic control system where actuation of the steering system can result from automatic evaluation of signals initiated on-board the vehicle (**3.1.96**), possibly in conjunction with passive infrastructure features, to generate continuous control action in order to assist the driver

[SOURCE: UNECE/TRANS/WP.29/2017/10][7]

3.1.14 beyond line-of-sight

outside the vehicle (**3.1.96**) or its trailer and reliant on external aids (other than corrective spectacles) to see some or all of the safety critical elements of the driving environment

NOTE This definition is adapted from Remote Driving Advice to Government, Law Commission (2023)[8]

3.1.15 blind spot monitoring

vehicle system that warns of the presence of other road users in areas that a human driver might have difficulty observing and that could present a hazard

3.1.16 cellular vehicle-to-everything (C-V2X)

short-range communication with and between vehicles (**3.1.96**), infrastructure and/or pedestrian devices using 4G and 5G cellular chipsets

NOTE Cellular V2X (C-V2X) is a 3GPP standard describing a technology to achieve the V2X requirements. C-V2X is an alternative to ITS-G5 802.11p, the IEEE specified standard for V2V and other forms of V2X communications.

3.1.17 combined authorized self-driving operator (CASDO)

a single organisation acting as both an ASDE (**3.1.7**) and NUIC operator (**3.1.56**)

3.1.18 connected and automated mobility (CAM)

transport services that use connected and automated vehicles **(3.1.11)**

3.1.19 connected and automated vehicle (CAV)

automated vehicle (**3.1.11**) equipped with communications technology that enables data transfer with other vehicles, infrastructure or other networks

3.1.20 connected vehicle

vehicle (**3.1.96**) equipped with wireless communications technology that enables data transfer with other vehicles, infrastructure or other networks

3.1.21 conventional vehicle

vehicle (**3.1.96**) designed to be operated by an in-vehicle driver during part or all of every trip using standard controls within the type approval for that vehicle class

NOTE 1 *This definition is adapted from SAE J3016 (2021).*[9]

NOTE 2 *A conventional vehicle may be equipped with driving automation system (**3.1.27**) features that support the driver in performing the dynamic driving task (**3.1.28**) but do not perform the complete dynamic driving task. A conventional vehicle may also be equipped with sub-trip feature(s) that require an in-vehicle driver to operate the vehicle during portions of each trip.*

3.1.22 cooperative

two or more roadside or vehicle systems that communicate to facilitate transportation

NOTE *This term is defined in relation to CAVs. Examples of cooperative systems in road transport include those providing communication with vehicles upstream of hazardous conditions such as a collision or extreme weather conditions.*

3.1.23 corner case

rare but plausible combination of two or more independent parameter values within a scenario (**3.1.78**)

NOTE *Contrast with edge case (**3.1.30**) which represents a single rare but plausible independent parameter value.*

3.1.24 current operational domain (COD)

real-time real-world conditions that the automated driving system (**3.1.9**) is experiencing

[SOURCE: BS ISO 34503 Road vehicles. Taxonomy for operational design domain, 2023]

3.1.25 dedicated short range communication (DSRC)

One or two-way short to medium range wireless communications using a corresponding set of protocols and standards designed for automotive use

NOTE *In Europe, standards for DSRC have been developed by CEN (TC278) and test specifications have been developed by European Telecommunications Standards Institute (ETSI).*

3.1.26 driver monitoring system (DMS)

entity consisting of interdependent components for assessing the state of the human driver with respect to their ability to engage with the dynamic driving task (**3.1.28**)

NOTE *Typically camera based, DMS might also play a role in occupant recognition for identity/security purposes.*

3.1.27 driving automation system (DAS)

hardware and software that are collectively capable of performing part or all of the dynamic driving task (**3.1.28**) on a sustained basis

NOTE *This definition is adapted from SAE J3016 (2018)*[4] *and is used specifically to describe systems that can deliver SAE level 1 to 5 driving (the specific term automated driving system (**3.1.9**) covers systems that deliver SAE level 3 to 5 driving features).*

3.1.28 dynamic driving task (DDT)

real-time operational and tactical functions required to operate a vehicle (**3.1.96**) safely in on-road traffic, including longitudinal and lateral control, object and event detection and response (**3.1.58**), prediction of other road users' actions and manoeuvring

NOTE *Michon (1985)*[10] *defines operational driving functions as those delivered over a time constant of milliseconds and include tasks such as steering inputs to keep within a lane or braking to avoid an emerging hazard; tactical driving functions are those delivered over a time constant of seconds and include tasks such as lane choice, gap acceptance and overtaking. The DDT excludes strategic functions, which are those delivered over a longer time constant and include tasks such as trip scheduling and selection of destinations and waypoints.*

3.1.29 dynamic entity

entity that experiences state change(s) during a scenario (**3.1.78**)

[SOURCE: BS ISO 34501:2022]

NOTE 1 *Static entities in a scenario (**2.1.78**) may become dynamic e.g. a traffic light at green is a static entity until it changes state when it becomes a dynamic entity.*

NOTE 2 *Examples of dynamic entities include moving traffic vehicles, moving pedestrians and changing traffic lights.*

3.1.30 edge case

rare but plausible independent parameter value within a scenario (**3.1.78**)

NOTE *Edge case contrasts with corner case (**3.1.23**) which represents a combination of rare but plausible parameter values.*

3.1.31 ego vehicle

connected and/or automated vehicle, the behaviour of which is of primary interest in testing, trialling or operational scenarios (**3.1.78**)

NOTE *Ego vehicle is used interchangeably with subject vehicle (**2.1.83**) and vehicle under test (VUT) (**3.1.101**)*

3.1.32 electronic stability control (ESC)

vehicle (**3.1.96**) system that continuously monitors steering and vehicle direction and compares intended direction to the vehicle's actual direction and intervenes by applying the brakes independently to each of the wheels to correct loss of control much faster than a typical human driver

NOTE *Also referred to as dynamic stability control (DSC) and other proprietary names. Intended direction is determined by measuring steering wheel angle; the vehicle's actual direction is determined by measuring lateral acceleration, vehicle rotation and individual road wheel speeds.*

3.1.33 emergency lane keeping (ELK)

vehicle (**3.1.96**) system that attempts to prevent the vehicle from crossing a lane marking into a lane where there is an obstruction or risk of collision, irrespective of whether the human driver has operated the direction indicator

NOTE *Also known as lane departure prevention (LDP).*

3.1.34 entity for remote driving operation (ERDO)

licensed organisation that operates remotely driven vehicles without authorised no-user-in-charge (NUIC) features (**3.1.55**)

NOTE 1 *This definition is adapted from Remote Driving Advice to Government, Law Commission (2023)[8].*

NOTE 2 *The Law Commission highlights that this term exists to differentiate an entity that uses remote driving (**3.1.71**) without any element of self-driving (**3.1.80**).*

3.1.35 fallback

process by which the full function of the dynamic driving task is delivered when a driving automation system or systems (**3.1.27**) cease to operate

NOTE 1 *Fallback may be required due to mechanical breakdown, driving automation system (**3.1.27**) failure, departure from the operational design domain (**3.1.60**) for the driving automation system (**3.1.27**) or failure of the human driver to respond to a request to resume the dynamic driving task (**3.1.28**).*

NOTE 2 *Fallback performance in automated vehicles is delivered by the automated driving system (**3.1.9**); for vehicles with less capable driving automation systems, the human driver delivers some or all of the fallback process.*

NOTE 3 *If a trip cannot be completed, fallback requires a minimal risk manoeuvre (**3.1.54**) to achieve a minimal risk condition (**3.1.53**). These may be delivered by the human driver or automated driving systems, depending on the capabilities of the vehicle and extent of any system failure.*

3.1.36 fallback user

user able to operate the vehicle (**3.1.96**) and capable of intervening to perform the fallback (**3.1.35**) as required and within a time span appropriate for the defined non-driving related activities

NOTE *A fallback user of an automated vehicle (**3.1.11**) on UK roads will be a user-in-charge (**3.1.94**).*

3.1.37 fault injection testing

method to evaluate the effect of a fault within an element by the deliberate insertion of faults, errors or failures in order to observe the safety driver (**3.1.76**) and/or automated driving system (**3.1.9**) response

3.1.38 forward collision warning (FCW)

vehicle (**3.1.96**) system that uses sensors and computer processing to detect when the vehicle might collide with an object in its path and provides warnings for the human driver to prompt avoiding action

3.1.39 full-trip feature

automated driving system (**3.1.9**) features that operate a vehicle (**3.1.96**) throughout complete trips (**3.1.93**)

[SOURCE: SAE J3016 APR2021, **3.7.3**][9]

3.1.40 fully automated vehicle

vehicle (**3.1.96**) equipped with an automated driving system (**3.1.9**) that operates without any operational design domain (**3.1.60**) limitations for some or all of the journey, without the need for human intervention as a fallback (**3.1.35**)

[SOURCE: UNECE/TRANS/WP.1/165, 2018][11]

3.1.41 global navigation satellite system (GNSS)

entity consisting of interdependent components that use time signals transmitted from a constellation of Earth orbiting satellites to determine latitude, longitude and elevation

NOTE 1 *Examples of global navigation satellite systems include the United States' Global Positioning System (GPS), Russia's Global Navigation Satellite System (GLONASS), China's BeiDou Navigation Satellite System and the European Union's Galileo system.*

NOTE 2 *Estimates of position using global navigation satellite systems can be used to derive speed and acceleration of a vehicle to which the system is mounted.*

3.1.42 green light optimized speed advisory (GLOSA)

vehicle (**3.1.96**) system that receives upcoming traffic signal cycle information over V2X communication channels and uses relative vehicle position to compute and display a speed recommendation that, if adopted by the driver, would allow the vehicle to pass the upcoming traffic lights during a green interval, thereby reducing stops at red lights

3.1.43 handover

process by which the sustained dynamic driving task (**3.1.28**) function transitions either from a human driver to an automated driving system (**3.1.9**) or from an automated driving system to a human driver

3.1.44 highly automated vehicle

vehicle equipped with an automated driving system (**3.1.9**) that operates within a specific operational design domain (**3.1.60**) for some or all of the journey, without the need for human intervention as a fallback (**3.1.35**)

[SOURCE: UNECE/TRANS/WP.1/165, 2018][11]

3.1.45 intelligent speed assistance (ISA)

vehicle (**3.1.96**) system that supports drivers in complying with legally enforced speed limits

NOTE 1 *Systems can use satellite-based tracking of vehicle position against a database of speed limits and/or cameras to detect speed limits shown on road signs (including electronic signs and signals); speed limits may also be broadcast from infrastructure to vehicles to communicate relevant speed limits to the ISA system. Some systems provide a human driver with warnings of excessive speed while others actively moderate vehicle speed to comply with limits.*

NOTE 2 *This term was referred to as intelligent speed adaptation in previous versions of this vocabulary.*

3.1.46 intervention

action or set of actions initiated by the safety driver (**3.1.76**) to override automated operation of the subject vehicle (**3.1.83**)

[SOURCE: PAS 1884: 2021, **3.1.15**]

3.1.47 ITS-G5

communications standard for supporting vehicle-to-vehicle (**3.1.100**) and vehicle-to-infrastructure (**3.1.99**) communications in an ad hoc network based on IEEE 802.11-2012 and ANSI/IEEE Std 802.2

NOTE *ITS stands for intelligent transport systems; G5 is derived from the frequency band (5.9GHz) upon which it was designed to operate.*

3.1.48 lane centring

vehicle (**3.1.96**) system that uses cameras or other inputs and systematic controls to help the vehicle stay in the centre of the driven lane

NOTE *Unlike lane-keeping assist, this system operates continuously, applying steering controls to keep the vehicle in the centre of the lane whilst in operation. Current systems rely on lane markings of sufficient quality and visibility to support the function. The system can be cancelled by use of the turn signals.*

3.1.49 lane departure prevention (LDP)

vehicle (**3.1.96**) system that uses cameras or other inputs to detect impending lane exceedances by the vehicle and provide visual, auditory or haptic feedback to the human driver

NOTE *Unlike lane centring and lane-keeping assist, this system does not actively apply any control inputs to the vehicle. Current systems rely on lane markings of sufficient quality and visibility to support the function. The system can be cancelled by use of the turn signals.*

3.1.50 lane departure warning (LDW)

vehicle (**3.1.96**) system that uses cameras or other inputs to detect impending lane exceedances by the vehicle and provide visual, auditory or haptic feedback to the human driver

NOTE Unlike lane centring and lane-keeping assist, this system does not actively apply any control inputs to the vehicle. Current systems rely on lane markings of sufficient quality and visibility to support the function. The system can be cancelled by use of the turn signals.

3.1.51 lane-keeping assist (LKA)

vehicle (**3.1.96**) system that uses cameras or other inputs and systematic controls to direct the vehicle away from the edges of the driven lane

NOTE Unlike lane-centring, this system operates exceptionally when it detects that the vehicle is about to depart from the driven lane. Some systems allow a degree of line crossing before directing the vehicle back into the lane from which it is departing. Current systems rely on lane markings of sufficient quality and visibility to support the function. The system can be cancelled by use of the turn signals.

3.1.52 localization

determination of position and orientation relative to a specific frame of reference

*NOTE Localization is often achieved using global navigation satellite systems (**3.1.41**) but can also use visual information, beacons, stored maps etc.*

3.1.53 minimal risk condition (MRC)

stable, stopped condition to which a human driver or automated driving system (**3.1.9**) brings a vehicle after performing a minimal risk manoeuvre (**3.1.54**) in order to reduce the risk of a collision or other loss when a given trip cannot be continued

*NOTE 1 Examples of reasons for which a trip cannot be completed include mechanical breakdown, automated driving system (**2.1.9**) failure, departure from the operational design domain for an automated driving system or failure of the human driver to respond to a request to resume the full function of the dynamic driving task.*

*NOTE 2 The form of the MRC will be highly dependent on the operational design domain (**2.1.60**) of the automated vehicle (**2.1.11**) and the reason for which the MRC was required. For example, the MRC for an automated vehicle on a highway with a minor sensor fault may be to manoeuvre to the hard shoulder, decelerate gently to a stop and activate the hazard warning lights; the MRC for a low speed automated shuttle operating in an urban environment with a damaged forward lidar system might be to come to an immediate halt.*

*NOTE 3 This definition includes a remotely operated vehicle in a stable, stopped condition after the minimal risk manoeuvre (**3.1.54**).*

3.1.54 minimal risk manoeuvre (MRM)

tactical or operational manoeuvre triggered and executed by the driving automation system (**3.1.27**) or the human driver to achieve the minimal risk condition (**3.1.53**)

NOTE 1 Michon (1985)[10] defines operational driving functions as those delivered over a time constant of milliseconds and include tasks such as steering inputs to keep within a lane or braking to avoid an ermgering hazard; tactical driving functions are those delivered over a time constant of seconds and include tasks such as lane choice, gap acceptance and overtaking.

*NOTE 2 The form of the MRM will be highly dependent on (and must be within) the operational design domain (**3.1.60**) of the automated vehicle (**3.1.11**); for example, the MRM performed by a vehicle performing automated driving (**3.1.8**) at freeflow speed on a highway may be very different to that performed by a low speed automated shuttle operating in an urban environment. A remotely operated vehicle dependent on external communication will trigger the MRM if the communication link degrades below a minimum acceptable level of performance.*

*NOTE 3 This definition includes actions taken by a remote driver (**3.1.70**) to bring a vehicle to the minimal risk condition (**3.1.53**).*

3.1.55 no-user-in-charge (NUIC) feature

function of a vehicle (**3.1.96**) which is authorized for use without a user-in-charge (**3.1.94**) with the oversight of a NUIC operator (**3.1.56**)

3.1.56 no-user-in-charge operator (NUICO)

licensed organisation that oversees vehicles that operate without a user-in-charge (**3.1.94**)

This term and definition is adapted from the Law Commissions' report (2022): Automated Vehicles: joint report.[3]

3.1.57 no-user-in-charge (NUIC) vehicle

vehicle equipped with one or more automated driving system (**3.1.9**) features designed to perform the dynamic driving task (**3.1.28**) without a user-in-charge (**3.1.94**)

NOTE This term and definition is adapted from the Law Commissions' report (2022): Automated Vehicles: joint report.[3]

3.1.58 object and event detection and response (OEDR)

subtasks of the dynamic driving task (**2.1.28**) that include monitoring the driving environment and executing an appropriate response

NOTE 1 This definition is adapted from SAE J3016 (2021).[9]

NOTE 2 The definition includes detecting, recognizing, and classifying objects and events and preparing and exceuting responses as needed.

3.1.59 on-board diagnostics (OBD)

vehicle (**3.1.96**) system for checking and reporting specific faults

NOTE The OBD-II / EOBD (European on-board diagnostics) regulations have standardized connections, format and messaging for this capability for M1 category cars since 2001 (petrol) and 2004 (diesel).

3.1.60 operational design domain (ODD)

operating conditions under which a given driving automation system (**3.1.27**) or feature thereof is specifically designed to function

[SOURCE: SAE J3016 JUN2018, **3.22**]

NOTE 1 Including, but not limited to, environmental, geographical, and time-of-day restrictions, and/or the requisite presence or absence of certain traffic or road characteristics.

NOTE 2 For further information refer to PAS 1883 – Specification for Operational Design Domains.

3.1.61 operational domain

real-world conditions that an automated driving system (**3.1.9**) may experience

[SOURCE: BS ISO 34503 Road vehicles. Taxonomy for operational design domain, 2023]

3.1.62 over-the-air (OTA)

wireless transmission of information often used to deliver software, firmware or configuration updates

3.1.63 path planning

determining a route from origin to destination that is optimized across a range of possible criteria

NOTE Optimization may be across one or more criteria, for example, the shortest route, the quickest route, the route with the fewest hazards and may account for the characteristics of the vehicle

3.1.64 passenger

user in a vehicle (**3.1.96**) who has no role in the operation of that vehicle

NOTE 1 This definition is adapted from SAE J3016 (2021)[9]*.*

*NOTE 2 A passenger can be an occupant of a no-user-in-charge vehicle (**3.1.57**) or an additional occupant of a vehicle where another occupant is either the user-in-charge (**3.1.94**) in an automated vehicle (**3.1.11**) or at the controls of a conventional vehicle (**3.1.21**).*

3.1.65 pedestrian detection

vehicle (**3.1.96**) system that uses sensors and computer processing to identify the presence of pedestrians

*NOTE 1 The scope of pedestrian detection systems is increasing to cover a wider range of vulnerable road users (**3.1.103**) beyond pedestrians.*

NOTE 2 Most pedestrian detection systems are associated with other vehicle systems that take action directly or indirectly to help avoid or mitigate collisions.

3.1.66 place of relative safety

location that puts an effective safety clearance between the subject vehicle (**3.1.83**), in-vehicle occupants or freight and the risks presented by hazards in the surrounding environment

[SOURCE: PAS 1884: 2021, **3.1.24**]

NOTE 1 Places of relative safety might include a side road, rest or service area, lay-by, hard shoulder or emergency refuge area. The relative safety of a location, or locations, will vary depending on the test or trial environment and hazards presented by the road and road traffic. Dynamic risk assessment can be used to determine the safest location at a given point in time.

*NOTE 2 A minimal risk manoeuvre (**3.1.54**) should aim for the vehicle to achieve a minimal risk condition (**3.1.53**) in a place of relative safety if possible.*

3.1.67 platooning

linking of two or more vehicles (**3.1.96**) in a convoy using connectivity technology and driving automation systems which allow the vehicles to maintain automatically a set, close distance between each other when connected for certain parts of a journey and to adapt to changes in the movement of the lead vehicle with little to no action from the drivers

NOTE This definition is adapted from Regulation (EU) 2019/2144 Of The European Parliament And Of The Council of 27 November 2019 on type-approval requirements for motor vehicles and their trailers, and systems, components and separate technical units intended for such vehicles, as regards their general safety and the protection of vehicle occupants and vulnerable road users.[1]

3.1.68 positioning, navigation and timing (PNT)

determination of location according to a standard reference system, guide movements to follow a route from origin to destination and acquire an accurate measure of time according to a standard reference system

*NOTE Positioning, navigation and timing are often achieved using a global navigation satellite system (**3.1.41**) that use accurate timing information to enable estimation of location and thereby support routing to the desired destination.*

3.1.69 remote assistance

provision of information or advice from beyond line-of-sight (**3.1.15**) to a vehicle (**3.1.96**), its occupants or other road users

*NOTE 1 Remote assistance does not include the dynamic driving task (**3.1.28**), fallback (**3.1.35**) or any immediate safety critical interventions.*

*NOTE 2 Remote assistance supports trip continuation, safety and comfort and may include providing an automated driving system (**3.1.9**) with revised goals and/or tasks and support/information for vehicle occupants or other road users.*

NOTE 3 The distinction between remote assistance and remote driving is described in Remote Driving Advice to Government, Law Commission (2023)[8].

3.1.70 remote driver

individual who performs all or any one of steering; braking; removing a brake; accelerating; or monitoring the driving environment with a view to immediate and safety-critical intervention in the way the subject vehicle (**3.1.83**) drives from beyond line-of-sight (**3.1.14**).

NOTE This definition is adapted from Remote Driving Advice to Government, Law Commission (2023)[8].

3.1.71 remote driving

performance of all or any one of steering; braking; removing a brake; accelerating; or monitoring the driving environment with a view to immediate and safety-critical intervention in the way the subject vehicle (**3.1.83**) drives from beyond line-of-sight (**3.1.14**).

NOTE This definition is adapted from Remote Driving Advice to Government, Law Commission (2023)[8].

3.1.72 remote monitoring

continual oversight of vehicle (**3.1.96**) operation from beyond line-of-sight (**3.1.14**)

NOTE Remote monitoring may encompass one or more vehicles.

3.1.73 remote operations

monitoring, assistance and/or driving of vehicles using remote technology

*NOTE The term 'remote' indicates beyond line-of-sight (**3.1.14**) of the subject vehicle (**3.1.83**).*

3.1.74 remote operations centre

building or facility from which people oversee, assist and/or drive vehicles using remote technology

NOTE 1 This definition is adapted from Remote Driving Advice to Government, Law Commission (2023)[8].

*NOTE 2 The term 'remote' indicates beyond line-of-sight (**3.1.14**) of the subject vehicle (**3.1.83**).*

3.1.75 safety case

structured argument, supported by evidence, intended to justify that a system and activity is acceptably safe for a specific application in a specific operating environment

NOTE For further information refer to PAS 1881:2020 Assuring the safety of automated vehicle trials and testing. Specification.

3.1.76 safety driver

person at the controls within an automated vehicle (**3.1.11**), observing the driving environment, enforcing the operational design domain (**3.1.60**), recognising challenging situations, detecting deviations from expected behaviour and ready and able to deliver the dynamic driving task (**3.1.28**) when needed in order to preserve safety during development, testing or trial activities, in accordance with the safety case (**3.1.75**)

3.1.77 safety of the intended functionality (SOTIF)

absence of unreasonable risk due to hazards resulting from functional insufficiencies of the intended functionality or from reasonably foreseeable misuse by persons

[SOURCE: PD ISO/PAS 21448:2019, **3.10**]

3.1.78 scenario

description of a driving situation that includes the pertinent actors, environment, objectives and sequences of events

3.1.79 scene

snapshot of all entities including but not limited to the automated driving system (**3.1.9**), subject vehicle (**3.1.83**), static entities (**3.1.82**), dynamic entities (**3.1.29**) and actors (**3.1.3**) and observer's self-representations and the relationships between those entities.

NOTE 1 *Definition adapted from BS ISO 34501:2022.*

NOTE 2 *A scene is a snapshot of a scenario (**3.1.78**).*

3.1.80 self-driving

see automated driving (**3.1.8**)

NOTE *Although this term is deprecated within SAE J3016 (2021)*[7] *it is included here because this is the term best understood by the public to mean the definition as stated (which is the same as that for automated driving (**3.1.8**).*

3.1.81 simulation

computer generated environments used to test or develop components, systems or human behaviours

NOTE *Simulation in the CAM domain can refer to a wide range of virtual test environments from microsimulation of traffic to simulation of CAV sensors and components to human-in-the-loop simulations of CAVs.*

3.1.82 static entity

entity that does not experience state change(s) during a scenario (**3.1.78**)

[SOURCE: BS ISO 34501:2022]

NOTE *Examples of static entities might include a bench, parked car or lighting column.*

3.1.83 subject vehicle

connected and/or automated vehicle, the behaviour which is of primary interest in testing, trialling or operational scenarios (**3.1.78**)

[SOURCE: PAS 1884: 2021, **3.1.32**]

NOTE *Subject vehicle is used interchangeably with ego vehicle (**3.1.31**) and vehicle under test (VUT) (**3.1.101**).*

3.1.84 sub-trip feature

driving automation system feature equipped on a conventional vehicle (**3.1.21**) that requires a human driver to perform the complete dynamic driving task (**3.1.28**) for at least part of every trip (**3.1.93**)

NOTE 1 *This definition is adapted from SAE J3016 (2021).*[9]

NOTE 2 *Sub-trip features require a human driver to operate the vehicle between the point-of-origin and the boundary of the feature's operational design domain (**3.1.60**) and/or after leaving the feature's operational design domain until the destination is reached.*

3.1.85 takeover

see handover (**3.1.43**)

3.1.86 takeover request

vehicle generated notification to indicate an imminent requirement for the human driver to perform some or all of the dynamic driving task (**3.1.28**)

3.1.87 takeover time

time between initiation of the takeover request (**3.1.86**) and significant intentional intervention (**3.1.46**) by the human driver

NOTE *Interventions resulting in a human driver taking responsibility for parts or all of the dynamic driving task (**3.1.28**) will vary depending on the design of the interface but usually include interactions by the human driver with the primary vehicle controls (accelerator, brake, steering) or automation override/ deactivation switches.*

3.1.88 target operational domain (TOD)

real-world conditions that an automated driving system (**3.1.9**) may experience during its deployment

NOTE *While operational design domain (**3.1.60**) constitutes the operating conditions in which an automated driving system (**3.1.9**) is designed to operate, the target operational domain is the area where the automated driving system will be deployed and may have conditions outside of the operational design domain of the automated driving system.*

[SOURCE: BS ISO 34503 Road vehicles. Taxonomy for operational design domain, 2023]

3.1.89 telematics

collection and communication of vehicle (**3.1.96**) operational and status data

3.1.90 teleoperation

see remote driving (**3.1.71**)

3.1.91 teleoperator

see remote driver (**3.1.70**)

3.1.92 transition demand

logical, intuitive procedure to transfer the dynamic driving task (**3.1.28**) from the system (automated control) to the human driver (manual control) following a request from the system to the human driver

[SOURCE: Safe Use of Automated Lane Keeping System (ALKS) Summary of Responses and Next Steps, CCAV, 2021][12]

3.1.93 trip

complete journey by a vehicle (**3.1.96**) from the point of origin to a destination

NOTE 1 This definition is adapted from SAE J3016 (2021)[9].

*NOTE 2 Performance of the dynamic driving task (**3.1.28**) during a given trip may be accomplished in whole or in part by a driver, driving automation system, or both.*

3.1.94 user-in-charge

human in the vehicle (**3.1.96**) who is qualified to drive it and in a position to operate the controls of the vehicle while a relevant automated driving system (**3.1.9**) feature is engaged

*NOTE 1 The role of user-in-charge is not intended for use in reference to human occupants of automated vehicles during development, testing or trials, which may be safety drivers (**3.1.76**).*

*NOTE 2 The main role of the user-in-charge (**3.1.94**) is to take over in planned circumstances as a conscious choice, in response to a transition demand (**3.1.92**) or after the vehicle has come to a safe stop. They would also have obligations to maintain and insure the vehicle and report collisions. An automated vehicle would require a* user-in-charge *(**3.1.94**) unless it is authorized to operate without one, in which case it would be a no-user-in-charge (NUIC) vehicle (**3.1.57**). The user-in-charge (**3.1.94**) must be in the vehicle (**3.1.96**).*

NOTE 3 Being qualified to drive means the user-in-charge holds a current and valid driving licence to drive the relevant vehicle in the jurisdiction in which it is being operated.

NOTE 4 This term and definition is adapted from the Law Commissions' joint consultation paper 3 (2020)[2].

3.1.95 validation

means by which it is proven beyond reasonable doubt that an end product meets its design intent and stated performance specification

3.1.96 vehicle

motorized, wheeled conveyance that is mechanically propelled and intended or adapted for use on roads

3.1.97 vehicle control system

the combination of hardware and software responsible for enacting the outputs of the perception and decision-making entities and thereby delivering changes in lateral and / or longitudinal movement of the vehicle (**3.1.96**)

3.1.98 vehicle-to-everything (V2X)

unidirectional or bidirectional sharing of data between vehicles (**3.1.96**) and other vehicles, infrastructure, other road users or any other communications system

*NOTE The definition is not intended to indicate that a vehicle is necessarily connected to everything but reflects that vehicles can be connected to a broad spectrum of systems of which vehicle-to-vehicle (**3.1.100**) and vehicle-to-infrastructure (**3.1.99**) communications are examples.*

3.1.99 vehicle-to-infrastructure (V2I)

unidirectional or bidirectional sharing of data between vehicle (**3.1.96**) and infrastructure

3.1.100 vehicle-to-vehicle (V2V)

vehicle (**3.1.96**) sharing data with other vehicles

3.1.101 vehicle under test

connected and/or automated vehicle, the behaviour which is of primary interest in testing, trialling or operational scenarios (**3.1.78**)

*NOTE Vehicle under test is used interchangeably with ego vehicle (**2.1.31**) and subject vehicle (**2.1.83**)*

3.1.102 verification

evaluation of a system to prove that it meets all its specified requirements at a particular stage of its development

3.1.103 vulnerable road user (VRU)

person at higher risk of being injured or killed in a collision by having less crash protection than occupants of motor vehicles with protective bodywork

NOTE Examples include pedestrians, cyclists, horse riders, motor-cyclists, users of mobility scooters or e-scooters and persons with disabilities or reduced mobility and orientation.

3.1.104 vulnerable road user detection

vehicle (**3.1.96**) system that uses sensors and computer processing to identify the presence of vulnerable road users (**3.1.103**)

NOTE *Vulnerable road user detection systems are evolving from pedestrian detection (**3.1.65**) systems to cover a wider range of road users.*

3.2 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

ACC
adaptive cruise control

ACSF
automatically commanded steering function

ADAS
advanced driver assistance system

ADS
automated driving system

AEBS
advanced emergency braking system

AES
automatic emergency steering

ALKS
automated lane keeping system

ASDE
authorized self-driving entity

AV
automated vehicle

BVLOS
beyond visual line of sight

CAV
connected and automated vehicle

CAM
connected automated mobility

CAM
cooperative awareness message

CASDO
combined authorised self-driving operator

COD
current operational domain

CPU
central processing unit

CTA
cross traffic alert

DDT
dynamic driving task

DEN
decentralized environmental notification

DENM
decentralized environmental notification message

DMS
driver monitoring system

DSC
dynamic stability control

ELK
emergency lane keeping

ERDO
entity for remote driving operation

ESC
electronic stability control

ESP
electronic stability program

FCTA
front cross traffic alert

FCW
forward collision warning

GLOSA
green light optimized speed advisory

GNSS
global navigation satellite system

GPU
graphics processing unit

IOT
internet of things

ISA
intelligent speed adaptation

ITS
intelligent transport systems

LDP
lane departure prevention

LIDAR
light detection and ranging

LKA
lane keep assist

MRC
minimal risk condition

MRM
minimal risk manoeuvre

NUIC
no-user-in-charge

NUICO
no-user-in-charge operator

ODD
operational design domain

OEDR
object and event detection and response

OEM
original equipment manufacturer

OTA
over-the-air

PNT
positioning, navigation and timing

RADAR
radio detection and ranging

RCTA
rear cross traffic alert

RTK
real-time kinematics

SAE
Society of Automotive Engineers

NOTE *SAE is itself an abbreviation of SAE International, the full name for the U.S.-based standards and professional development organization for automotive engineering.*

SDK
software development kit

SOTIF
safety of the intended functionality

TOD
target operational domain

UIC
user-in-charge

V2I
vehicle-to-infrastructure

V2V
vehicle-to-vehicle

V2X
vehicle-to-everything

VLOS
visual line of sight

VRU
vulnerable road user

VUT
vehicle under testing

WLAN
wireless local area network

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