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# LIVRABLE L2.2 -2

# ODD : Définition & Canevas de description

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| 0.4 | 06-07-2021 | Dernière version après validation par le COPIL |

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## Acronymes

| | |
|---|---|
| STRA | Systèmes de Transport Routiers Automatisés |
| ODD | Domaine de Conception Fonctionnelle (de l'anglais Operational Design Domain) |
| PFA | Plateforme de la Filière Automobile |
| SAM | Sécurité et Acceptibilité de la Mobilité autonome |
| ADS | Automated Driving System |
| ALKS | Automated Lane Keeping System |

# Introduction

Dans le cadre de la tâche 2.2 « déclinaison des objectifs de sécurité sur une architecture fonctionnelle générique », Il a été décidé par les partenaires de décrire et de définir de manière commune et harmonisée le domaine de conception fonctionnelle (en anglais, **O**perational **D**esign **D**omain, d'où l'acronyme ODD), que présenteront les industriels au service en charge de la réception ou de l'homologation des systèmes de conduite automatisés ou d'autorisation de mise en service des systèmes de transport routiers automatisés (STRA). Pour faire simple avant d'en donner une définition plus précise, l'ODD, regroupe l'ensemble des éléments à détecter par le système automatisé pour identifier qu'il est dans le Domaine pour lequel il a été Conçu pour Fonctionner en toute sécurité, ou qu'il va sortir de ce domaine.

La description de l'ODD est une tâche à réaliser dans le cadre de la spécification du système de conduite automatisé ou du système de transport routier automatisé, comme l'indique la figure ci-dessous a titre d'illustration.

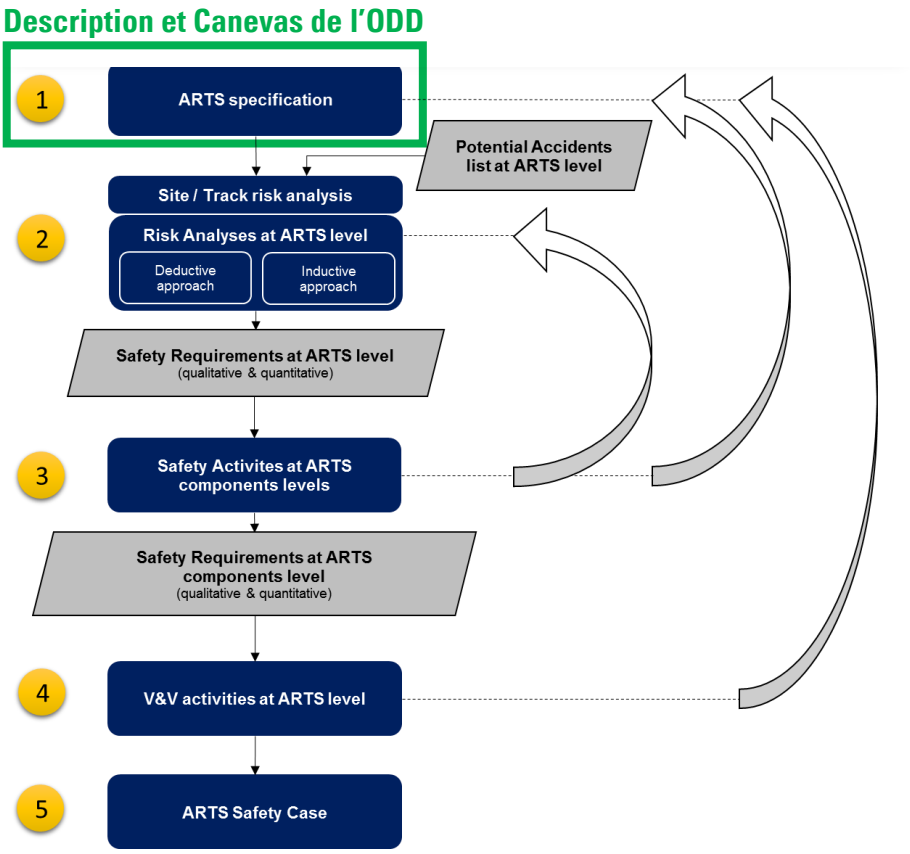


***Figure 1*** *- Représentation simplifiée du processus de démonstration de la sécurité SAM pour un STRA*

Le domaine de conception fonctionnelle (ODD) du système doit être défini et décrit. Quel que soit l'ODD, il doit être décrit d'une manière commune et partagée. Les systèmes automatisés de niveau 3 et plus doivent être conçus pour ne fonctionner qu'à l'intérieur de l'ODD et détecter l'atteinte proche des frontières de l'ODD.

Cette description de l'ODD sera intégrée au dossier d'information sur la conception du système remis aux autorités qui vérifieront lors de l'homologation ou la certification « si le système […] a été conçu et élaboré pour fonctionner de manière à être exempt de risques déraisonnables pour le conducteur, les passagers et les autres usagers de la route à l'intérieur du domaine de conception fonctionnelle et des limites déclarées » (cf. Réglementation R157 [5] dite « ALKS »).

Ce livrable se fonde sur une position technique PFA [17], initialement proposée par les industriels de l'automobile pour répondre à la réglementation R157 «dite, ALKS » autorisant à partir de 2021 la circulation des véhicules munis de systèmes de conduite automatisée ( de niveau 2+ ou de niveau 3 ) en bouchons sur voie à chaussées séparées.

Cette position PFA a notamment été présentée dans le cadre de l'écriture de la norme ISO 34503, qui vise à normaliser la description de l'ODD. Cette première proposition a permis dans le cadre du projet SAM d'obtenir un consensus entre les partenaires, et de proposer pour ce livrable une position commune. Ce sera désormais la version présentée dans le cadre des groupes de travail de l'administration (comme précisé dans le livrable [18] ) et dans le cadre de la normalisation ISO.

Ce livrable comprend : un état de l'art concernant l'ODD, la définition retenue de l'ODD, sa structuration ainsi que la définition des catégories et attributs de l'ODD. Enfin, ce document propose un canevas de description de l'ODD dans l'outil Excel, présenté en annexe, et joint à ce livrable.

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La suite du document sera principalement en anglais afin qu'il puisse servir directement dans le cadre de discussions internationales au niveau réglementaire, normatif, ou bilatéral, mais aussi pour éviter des ambiguïtés liées au fait d'avoir deux définitions en deux langues différentes avec les interminables écarts de sens des mots. Veuillez-nous en excuser.

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*The ODD shall be defined. Whatever the ODD, it has to be described with a common hierarchy and taxonomy. A system SAE L3 or higher shall be designed to be only used inside the ODD – by considering to avoid unreasonable risks. These systems must be designed to consider situations that can be expected, address possible risks and detect its ODD limits.*

*This document gives the positions of ADS Safety & Validation working group of SAM project. After setting the state of the art concerning ODD, and giving the definition of an ODD, the ODD structuration is described, and categories and attributes are defined and named. The position also proposes a template document in excel in order to describe the ODD.*

# 1. Etat de l'art - State of the art

*Several definitions from Operational (Design) Domain were given in regulation, SAE, or NHTSA documents. After presenting this state of the art, we will choose our position. At the beginning of this document please note that Operation Domain (OD) or Operational Design Domain (ODD) are both used in a very similar way. At first sight, ODD seems more US native and OD European native.*

| ***Source*** | ***ODD relative items*** |
|---|---|
| ***CAMP March 2016*** *[11]* | *The specific operating conditions (e.g., geographic, weather, time of day, road type) under which a given driving automation system, or feature thereof, is designed to function.* |
| ***US DOT September 2016*** *[10]* | *Description of the specific Operating Domain(s) in which an automated function or system is designed to properly operate, including but not limited to roadway types, speed range, environmental conditions (weather, daytime/nighttime, etc.) and other domain constraints.*<br>*The manufacturer or other entity should define and document the Operational Design Domain (ODD) for each HAV system available on their vehicle as tested or deployed for use on public roadways.32 The ODD should describe the specific operating domain(s) in which the HAV system is designed to properly operate. The defined ODD should include the following information to define HAV systems' capabilities:*<br>- *Roadway types on which the HAV system is intended to operate safely;*<br>- *Geographic area;*<br>- *Speed range;*<br>- *Environmental conditions in which the HAV will operate (weather, daytime/nighttime, etc.); and*<br>- *Other domain constraints.*<br>*Manufacturers and other entities should develop tests and verification methods to assess their HAV systems' capabilities to ensure a high level of safety. In the future, as DOT develops more experience and expertise with HAV systems, NHTSA may promulgate specific performance tests and standards. Presently, manufacturers and other entities should develop and apply tests and standards to establish the safe ODD for each HAV system. An HAV should be able to operate safely within the ODD for which it is designed. In situations where the HAV is outside of its defined ODD or in which conditions dynamically change to fall outside of the HAV's ODD, the vehicle should transition to a minimal risk condition. The vehicle should give a clear indication of the type outlined in the HMI section to the occupants that it is switching to a minimal risk condition and that the HAV system is not available.*<br>*To better inform human drivers and vehicle operators, the ODD should also be described in summary form and in plain language in the vehicle owner's manual, including a clear description of the conditions in which the vehicle's HAV system(s) is and is not intended to operate. These instructions should aid the human driver or operator of the vehicle to easily understand the capabilities and limitations of each HAV system.* |
| ***NHTSA Sept 2017*** *[7]* | *Entities are encouraged to define and document the Operational Design Domain (ODD) for each ADS available on their vehicle(s) as tested or deployed for use on public roadways, as well as document the process and procedure for assessment, testing, and validation of ADS functionality with the prescribed ODD. The ODD should describe the specific conditions under which a given ADS or feature is intended to function. The ODD is the definition of **where** (such as what roadway types and speeds) and **when** (under what conditions, such as day/night, weather limits, etc.) an ADS is designed to operate.*<br>*The ODD would include the following information at a minimum to define each ADS's capability limits/boundaries:*<br>• *Roadway types (interstate, local, etc.) on which the ADS is intended to operate safely;*<br>• *Geographic area (city, mountain, desert, etc.);* |

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| | • *Speed range;*<br>• *Environmental conditions in which the ADS will operate (weather, daytime/nighttime, etc.); and*<br>• *Other domain constraints.*<br>*An ADS should be able to operate safely within the ODD for which it is designed. In situations where the ADS is outside of its defined ODD or in which conditions dynamically change to fall outside of the ADS's ODD, the vehicle should transition to a minimal risk condition.*<br>*For a Level 3 ADS, transitioning to a minimal risk condition could entail transitioning control to a receptive, fallback-ready user.*<br>*In cases the ADS does not have indications that the user is receptive and fallback-ready, the system should continue to mitigate manageable risks, which may include slowing the vehicle down or bringing the vehicle to a safe stop. To support the safe introduction of ADSs on public roadways and to speed deployment, the ODD concept provides the flexibility for entities to initially limit the complexity of broader driving challenges in a confined ODD.* |
| ***ISO 22736***<br>***SAE J3016***<br>*2018, June*<br>*[8]* | *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.*<br>*The ODD information shall include at least data on:*<br>• *roadway types,*<br>• *geographic area,*<br>• *vehicle speed range,*<br>• *environmental conditions, and*<br>• *other restrictions*<br>*NOTE: Section 6 discusses the significance of ODDs in the context of the Levels of driving automation.*<br>*EXAMPLE 1: An ADS feature is designed to operate a vehicle only on fully access-controlled freeways in low-speed traffic, under fair weather conditions and optimal road maintenance conditions (e.g., good lane markings and not under construction).*<br>*EXAMPLE 2: An ADS-dedicated vehicle is designed to operate only within a geographically defined military base, and only during daylight at speeds not to exceed 25 mph.*<br>*EXAMPLE 3: An ADS-dedicated commercial truck is designed to pick up parts from a geo-fenced seaport and deliver them via a specific route to a distribution center located 30 miles away. The vehicle's ODD is limited to day- time operation within the specified seaport and the specific roads that constitute the prescribed route between the seaport and the distribution center.* |
| ***WP.29***<br>***June 2019***<br>***[4]*** | *For the assessment of the vehicle safety, the vehicle manufacturers should document the [ODD/OD] available on their vehicles and the functionality of the vehicle within the prescribed [ODD/OD].*<br>*The [ODD/OD] should describe the specific conditions under which the automated vehicle is intended to drive in the automated mode.*<br>*The [ODD/OD] should include the following information at a minimum: roadway types; geographic area; speed range; environmental conditions (weather as well as day/nighttime); and other domain constraints.* |
| ***BMW***<br>***2019, June***<br>***[12]*** | *Another driving force behind the requirements on the system for higher levels of automation originate in the definition of the operational design domain (ODD). As previously mentioned, the ODD as defined by SAE J3016 is the collection of conditions where the system is designed to operate. Examples can be geographic as in the country or state, environmental as from sunshine to snow, or a collection of roadway characteristics such as a divided highway. As the function is designed to operate safely in this domain, sensors shall confirm at all times that the vehicle is still in that domain.*<br>***ODD recognition***<br>*As soon as system limits, which restrict the safe functionality of the automation system, are recognized, the system must react to compensate, or request a take-over from the driver with adequate time reserve.* |

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| | *Since the automated driving system is limited to an ODD and while activated in this domain, it is responsible for vehicle control until it requests the fallback ready user to intervene. While this may sound trivial, in lower levels of automation, it is ultimately the driver's responsibility to recognize when the limits are reached. The system may provide assistance to that effect, but only higher levels of automation need to definitively register the limits as a reaction is necessary.*<br><br>***Manage typical situations***<br><br>*The automated driving system must take situations into account, which can typically be expected to be encountered in the ODD and address the risks that may result.*<br><br>*The sensor arrays of vehicles equipped with automated driving systems need to register and classify much more than only the most common objects and the situations they are associated with. Even when they only make up a small percentage of the time spent on the road, there are a multitude of events such as an unexpected lane change, which happen often enough that they cannot be considered unusual. The system shall therefore be able to deal with all situations that are foreseeable to occur within the ODD which have an inherent risk of relevant magnitude.* |
| ***SaFAD***<br>*2019, July*<br>*[6]* | ***ODD DETERMINATION***<br>*As soon as system limits that restrict the safe functionality of the automated system are recognized, the system shall react to compensate or shall issue a driver takeover request with a sufficient time frame for the takeover.*<br>***MANAGE TYPICAL SITUATIONS***<br>*The automated driving system shall take into account situations that can typically be expected in the ODD and address possible risks.*<br>***[SAE J3016]:*** *The ODD refers to the operating conditions under which a given automated driving system or feature thereof is specifically designed to function. "These limitations reflect the technological capability of the automated driving system."* |
| ***Thatcham Research***<br>*Sept 2019*<br>*[13]* | ***ODD:*** *which a given ADS 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.*<br><br>***Driving Domain:*** *A high level set of four categories of ODD, representing the classes of driving situation the ADS is intended to function: Parking, City, Inter Urban or Highway.*<br><br>***Location Specific: Operational Design Domain (ODD)***<br><br>➢ ***Technical requirements:***<br>*The manufacturer of an ADS shall publish a detailed definition of the ODD in which the ADS will function safely. Road type is one of the main criteria that must be defined. Any ADS that operates in the 'Highway' driving domain shall be subject to the requirements in this document.*<br><br>*The ODD requirements shall be a combination of static (fixed, such as Highway) and dynamic features (changing, such as Traffic conditions).*<br><br>*As a minimum, manufacturers shall include specific information on whether or not there are any further restrictions in the ODD in terms of:*<br>• *Junctions*<br>• *Geography*<br>• *Speed range*<br>• *Road conditions*<br>• *Traffic conditions*<br>• *Environmental conditions.*<br>➢ ***Test and Assessment***<br>*The manufacturer shall demonstrate through virtual testing how the ADS will identify that it is within the ODD, and how it will reliably predict when it will leave the ODD with sufficient notice to allow managed handback. The type approval authority will check the results of the virtual testing during the on-road trial* |

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| | *by placing the vehicle in a range of situations both outside, entering, within and exiting the ODD to assess whether the system reliably indicates its availability.* |
| ***UL 4600***<br>*2019, December*<br>*[16]* | *The set of environments and situations the item is intended to operate within. This includes not only direct environmental conditions and geographic restrictions, but also a characterization of the set of objects, events, and other conditions that will occur within that environment.*<br>*NOTE: A system has a single ODD by definition. Assessment is made with regard to the entire ODD.*<br>*See also: ODD Subset*<br><br>***ODD Subset:***<br>*A managed portion of an item's ODD.*<br>*EXAMPLE: An all-weather ODD is broken up into subsets for fair weather, rain, and snow/ice.*<br>*NOTE: An ODD subset might be defined to partition the operational space to ease design tasks, support phased deployment by adding additional subsets over time, or otherwise manage the complexity of a potentially large and varied ODD. The safety case might argue each ODD subset independently for some aspects* |
| ***PFA/DGITM***<br>*Jan. 2020*<br>*[15]* | ***ODD description:***<br>*ODD description could take into account the following parameters:*<br>• *Type of infrastructure*<br>• *Hours / period*<br>• *Visibility conditions*<br>• *Surface conditions*<br>• *Contextual speed and traffic conditions*<br>• *Eligible lanes (position, min-max width, lane merges, incoming ramps, exits)*<br>• *Eligibility of specific sections or zones under autonomous mode*<br><br>***High Level Rule (ODD):***<br>*The vehicle shall not be in AD mode out of its ODD.* |
| ***GRVA(ALKS)***<br>*March 2020*<br>*[5]* | ***Operational Design Domain (ODD)*** *of the automated lane keeping system defines the specific operating conditions (e.g. environmental, geographic, time-of-day, traffic, infrastructure, speed range, weather and other conditions) within the boundaries fixed by this regulation under which the automated lane keeping system is designed to operate without any intervention by the driver.*<br>- *The System is designed and was developed to operate in such a way that it is free from unreasonable risks for the driver, passengers and other road users within the declared ODD and boundaries;*<br>- *Interaction concept with the driver when ODD limits are reached shall be explained including the list of types of situations in which the system will generate a transition demand to the driver.*<br>- *Model of the information provided to users (including expected driver's tasks within the ODD and when going out of the ODD.* |
| ***Ongoing work at ISO*** | |
| ***ISO/TS 14812***<br>***2019 (CD Stage)***<br>*2019*<br>*[9]* | *Set of operating conditions under which a given driving automation system or feature thereof is specifically designed to function*<br>*EXAMPLE 1ADS feature designed to operate a vehicle only on fully access-controlled freeways in low-speed traffic, under fair weather conditions and optimal road maintenance conditions (e.g., good lane markings and not under construction).*<br>*EXAMPLE 2ADS-dedicated vehicle designed to operate only within a geographically defined area, and only during daylight at speeds not to exceed 25 mph.* |

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| | *Note 1 to entry: The conditions might include environmental, geographical, time-of-day, and/or other restrictions.*<br><br>*Note 2 to entry: The conditions might require the presence or absence of certain traffic or roadway characteristics.* |
| ***ISO 22734***<br><br>***TC204/WG 14***<br><br>*[14]* | *Every LSAD system shall have its ODD defined by the manufacturer. The operational design domain limits for LSAD system shall specify at least the following attributes:*<br><br>➢ *Low speed – speed of LSAD system shall be equal to or less than 8.89 m/s or 32 km/h.*<br>➢ *Areas of application – e.g. either restricted access or dedicated roadways (public or private), or pedestrian / bicycle pathways, or areas from which all or some specific categories of motor vehicles are restricted. Restricted access roadways may be specified by lane markings or speed restriction or physical demarcation.*<br>➢ *Pre-defined routes – Routes defined within the LSAD system before operation of the LSAD system.*<br>*LSAD system shall only operate on the pre-defined routes. Pre-defined routes shall be defined by relevant stakeholders in conjunction with each other (e.g. local authorities, service providers, manufacturers etc.). Any deviation from pre-defined routes shall be confirmed by remote dispatcher (if applicable).*<br><br>• *Lighting condition in the area of application*<br>• *Weather conditions*<br>• *Road conditions*<br>• *Presence or Absence of Vulnerable Road Users (VRUs)*<br>• *Connectivity requirements*<br>*Either the LSAD systems or the dispatcher should select LSAD system equipped vehicle operating values for the ODD attributes based on current ODD conditions (e.g. foggy weather conditions, nighttime lighting condition).*<br><br>*NOTE: For example, a dispatcher or LSAD system may decide to restrict the maximum allowable speed on a rainy day to a lower speed as compared to a clear sunny day.* |

*Now that state of the art of the definition of the ODD is explored and set, let's now define SAM partners position.*

## 2. Définition de l'ODD definition

*We consider as a reference, ISO / SAE J3016 [8] definition of the ODD, because of the largest consensus, and largest usage (not only level 3 and more automated driving systems like in Regulation document):*

***OPERATIONAL DESIGN DOMAIN**, hereafter ODD, is first defined as: "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."*

*NOTE : **For system, ALKS** regulation [5] proposes the following specific version: "Operational Design Domain (ODD) of the automated lane keeping system defines the specific operating conditions (e.g. environmental, geographic, time-of-day, traffic, infrastructure, speed range, weather and other conditions) within the boundaries fixed by this regulation under which the automated lane keeping system is designed to operate without any intervention by the driver."*

Nous proposons par convention de retenir l'acronyme ODD, pour Domaine de Conception Fonctionnelle, terme retenu par la traduction en français de la réglementation ALKS [5] et dans la loi française dite LOM.

La traduction de la définition générique donnée par l'ISO / SAE J3016 [8] **quel que soit le niveau de délégation de conduite** devient :

**Domaine de conception fonctionnelle (ODD)** : conditions d'opération dans lesquelles un système de conduite automatisée donné ou une fonction de celui-ci est spécifiquement conçu pour fonctionner. Elles comprennent au-minimum les conditions environnementales et géographiques, des restrictions temporelles, et la présence ou l'absence de certaines caractéristiques routière ou du trafic.

L'application de cette définition au système de délégation de conduite en embouteillage sur voies à chaussées séparées (de niveau 2+ ou 3) définit par la Réglementation ALKS [5] est :

**Domaine de conception fonctionnelle (ODD)** du système automatisé de maintien dans la voie, les conditions de fonctionnement spécifiques (par exemple, les conditions environnementales, géographiques ou météorologiques, l'heure, la circulation, l'infrastructure, la plage de vitesses, et autres) dans les limites fixées par le présent Règlement, dans lesquelles le système automatisé de maintien dans la voie est conçu pour fonctionner sans aucune intervention du conducteur ; (cf. R157 [5] – Annexe 4 - § 2.9)

Enfin, une troisième définition a été retenue dans le cadre de l'écriture de la Loi d'Orientation des Mobilités, dite loi LOM. Elle couvre aussi bien les systèmes de délégation de conduite de niveau 3 ou de niveau 4 intégrés à des systèmes de transport routier automatisés, et définit une liste minimale et non exhaustive des attributs du domaine :

**Domaine De conception fonctionnelle (ODD)** : Conditions notamment géographiques, météorologiques, horaires, de circulation, de trafic et d'infrastructure dans lesquelles un système de conduite automatisé est spécifiquement conçu pour exercer le contrôle dynamique du véhicule et en informer le conducteur.
(cf. LOM – Article 31 -Projet de Décret - Volet relatif aux définitions version du 02-12-2020 )

# 3. Attributs de l'ODD attributes

The 3 main documents on the topic are from NHTSA [1], GRVA [4], and SAE [8]. SAM project considers as the reference for a minimum description, the Regulation [5] version, with only five items:

The ODD shall include the following information at a minimum to comply with ALKS Regulation:
- Road types,
- Speed range,
- Geographic area,
- Environmental condition (weather as well as day/night-time),
- And other domain constraints

Moreover, SAM project considers, as proposed by NHTSA [1], it is necessary to give more details about the Operational Design Domain of the System.

SAM project proposes, in order to simplify the understanding of ODD description, to always organize ODD description with the same high-level **architecture**, and **taxonomy**, to produce more information (regulatory information is in bold/grey). An ODD consists in items. Each item is called an **Attribute**. Attributes are gathered in 6 high-level **categories**.

For each of the 6 categories, we give an explanation directly extracted from NHTSA [1]:

## 1. Physical infrastructure

"Physical infrastructure is typically characterized by technical structures, such as roads, bridges, tunnels, etc. ADS features may depend on such infrastructure elements, which are a critical part of the ODD environment." (NB: it includes: Roadway types (Necessary to comply with regulation)

## 2. Operational constraints

Several operational constraints "*need to be considered when designing and testing ADS applications. These include elements such as dynamic changes in speed limits, traffic characteristics, construction, etc. For example, an ADS entering a school zone is subjected to lower speed limits and must respond appropriately to ensure the safety of its* passengers and other road users". (NB: it includes: Speed limit = **Speed range,** necessary to comply with regulation)

## 3. Objects

"*For an ADS to properly navigate within an ODD, it must detect and respond to certain objects, which is referred to as OEDR.*" OEDR is another topic "*but is discussed here in the context of identifying objects that can reasonably be expected to exist within the ODD. For example, a pedestrian may be expected at an intersection but rarely on a freeway."*

### 4. Connectivity

*"Connectivity is an enabling technology that may define where an ADS feature can operate. For example, low-speed shuttles may depend on traffic light signal phase and timing messages to reduce the dependence on sensors alone to detect the signal. […] Connectivity constitutes a communications link between other vehicles, road users, remote fleet management operators, and physical and digital infrastructure elements."*

### 5. Environmental conditions

(Necessary to comply with regulation) : *"Environmental conditions play a crucial role in the safe operation of a variety of ADS applications, and pose one of the biggest challenges to deployment, particularly early deployment. The environment can impact visibility, sensor fidelity, vehicle maneuverability, and communications systems. […] It is thus important to consider a variety of environmental conditions as part of the ODD."*

### 6. Zones

(= **Geographic area**, Necessary to comply with regulation) : *"ADS features may be limited spatially by zones. The boundaries of these zones may be fixed or dynamic, and conditions that define a boundary may be based on complexity, operating procedures, or other factors. One example is work zones, which can confuse ADS as the road configuration (pavement markings and new lane alignments) differs from typical conditions. In a work zone, cones may replace double yellow lines, and construction worker hand signals may overrule traffic lights."*

The next part of this chapter gives more detail information on each of the previous six categories and associated sub-categories. **This list of ODD elements is not exhaustive, but it gives a structure of description of the ODD, and the associated taxonomy.** You should use it to describe in your ODD all the necessary items to define what is within and what is outside an ODD and what it should detect. The following hierarchy, is the more detail one, given in NHTSA [1] (for more information please refer to this reference document), and this is considered as the reference on the topic. All items are not mandatory to be defined, but as said before, this hierarchy allows to define and organize the different items an gives the taxonomy to be used.

## 1. Physical infrastructure

1.1. Roadway types
*For example: divided highway, undivided highway, Arterial, urban, rural, parking, …*

1.2. Roadway surfaces
*For example: asphalt, concrete, mixed, grating, brick, dirt, gravel, scraped road, speed bumps, potholes, grass, …*

1.3. Roadway Edges
*For example: line markers, temporary line markers, shoulder (paved, gravel or grass), concrete barriers, grating, rails, curb, cones, …*

1.4. Lane markings
*For example: lane markings, temporary lane markings, zebra, …*

1.5. Roadway Geometry
*For example: straightaways, curves, hills, lateral crests, corners (regular, blind corners), negative obstacles, lane width, …*

## 2. Operational constraints

2.1. Speed limit
*For example: Minimum and maximum speed limit, speed limit depending on environmental conditions, …*
2.2. Traffic Conditions
*For example: minimal traffic, normal traffic, aumper-to-bumper/rush-hour traffic, altered (accident, emergency vehicle, construction, closed road, special event), …*
2.3. Operational conditions
*For example: Max passenger capacity, max payload, maximum number of vehicle per site, …*
2.4. Driver and operator conditions
*For example: present in seat, attentive, …*

## 3. Objects

3.1. Passive vertical signage
*For example: signs (e.g., stop, yield, pedestrian, railroad, school zone, etc.), traffic signals (flashing, school zone, fire department zone, etc.), …*
3.2. Dynamic signage
*For example: dynamic speed limit, dynamic traffic signs, …*
**3.3.** Roadway users
*For example: vehicle types (cars, light trucks, large trucks, buses, motorcycles, wide-load, emergency vehicles, construction equipment, horse-drawn carriages/buggies), …*
**3.4.** Non roadway users & obstacles
*For example: animals (e.g., dogs, deer, etc.), shopping carts, debris (e.g., pieces of tire, trash, ladders), …*
3.5. Human signs
*For example: human directed traffic, human injunction, …*

## 4. Connectivity

4.1. Vehicles
*For example: V2V communications (e.g., DSRC, Wi-Fi), emergency vehicles, …*
4.2. Remote Fleet Management System
*For example: a vehicle may be supported by an operations center that can perform remote operation, …*
4.3. Infrastructure sensors
*For example: VRU detection, work zone alerts, routing and incident management, …*
**4.4.** Digital infrastructure
*For example: Map, GNSS, traffic density information, …*

## 5. Environmental conditions

**5.1.** Weather
*For example: wind, rain, snow, sleet, temperature, …*
**5.2.** Weather induced roadway conditions
*Standing water, flooded roadways, icy roads, snow on road, …*

**5.3.** Particulate matter
*For example: fog, smoke, smog, dust/dirt, mud, water projection, …*

**5.4.** Illumination
*For example: day (sun: overhead, back-lighting, and front-lighting), …*

**5.5.** Time of the day
*For example: available from 9 Am until 10 Pm, …*

## 6. Zones

6.1. Geofence area,
*For example: central business districts, school campuses, and retirement communities, …*

6.2. Region/states
*For example: any legal, regulatory, enforcement, tort, or other considerations (e.g., following distance, licensing, etc.), …*

6.3. Interference zones
*For example: tunnel, parking garages, Bridge, buildings, dense foliage, atmospheric conditions, …*

**These two first levels of ODD hierarchy and associated taxonomy is under standardization at ISO in the frame of ISO 34503 working group (TC22 SC33 WG9).**

# 4. Exigences sur l' ODD relative requirements

From the basis of the state of the art produced in Part 1, SAM project opinion is to consider the following requirements to be satisfied.

## 1. Exigences de la réglementation ALKS

From ALKS regulation [5] the requirements considered are:

1. "The ODD should describe the specific conditions under which the automated vehicle is intended to drive in the automated mode."
2. "The vehicle manufactures should document the ODD available"
3. "The ODD should include the following information at a minimum: roadway types; geographic area; speed range; environmental conditions (weather as well as day/nighttime); and other domain constraints."
4. "The System is designed and was developed to operate in such a way that it is free from unreasonable risks for the driver, passengers and other road users within the declared ODD and boundaries;"
5. "The interaction concept with the driver when ODD limits are reached shall be explained including the list of types of situations in which the system will generate a transition demand to the driver."
6. "Model of the information provided to users (including expected driver's tasks within the ODD and when going out of the ODD."

## 2. Exigences issus d'autres standards

From other kinds of documents, we only consider the following requirements coming from PFA Safety position paper [3] and NHTSA documents [1]:

a) ODD01 – The vehicle shall not be in AD mode out of its ODD.
b) ODD02 – Manufacturers and other entities [like Mobility services providers] should develop and apply tests and standards to establish the safe ODD.
c) ODD03 – In situations where the ADS is outside of its defined ODD or in which conditions dynamically change to fall outside of the ADS's ODD, the vehicle should transition to a minimal risk condition. (For a Level 3 ADS, transitioning to a minimal risk condition could entail transitioning control to a receptive, fallback-ready user.)
d) ODD04 – The manufacturer shall demonstrate through virtual testing how the ADS will identify that it is within the ODD, and how it will reliably predict when it will leave the ODD.
e) ODD05 – To better inform human drivers and vehicle operators, the ODD should also be described in summary form and in plain language in the vehicle owner's manual, including a clear description of the conditions in which the vehicle's AD system(s) is and is not intended to operate.
f) ODD06 – The driver/operator shall be informed about when the system will reach a limit of the ODD, whatever the minimal risk condition (vehicle stop or driver take back control…).

## 3. Exigences de la loi LOM

Le périmètre d'application de la loi LOM étant plus large que le système de conduite automatisée, puisqu'elle s'applique à tout système de transport routier automatisé, des premières définitions issues de cette loi doivent être données :

**Art. R. 3151-1.** – Pour l'application du présent livre, les termes ci-après ont le sens qui leur est donné dans le présent article :

1. « **système technique de transport routier automatisé** » : ensemble de véhicules hautement et totalement automatisés tels que définis au 8.2 et au 8.3 de l'article 311-1 du code de la route et d'installations techniques permettant une intervention à distance ou participant à la sécurité;
2. « **système de transport routier automatisé** » : système technique de transport routier automatisé, déployé sur des parcours ou zones de circulation prédéfinis, et complété de règles d'exploitation, d'entretien et de maintenance, aux fins de fournir un service de transport routier public collectif ou particulier de personnes, ou de service privé de transport de personnes, à l'exclusion des transports soumis au décret n° 2017-440 du 30 mars 2017 relatif à la sécurité des transports publics guidés ;
3. « **domaine d'emploi** » : conditions d'emploi d'un système technique de transport routier automatisé associées à des parcours ou zones de circulation particulières et respectant son domaine de conception technique ;
4. « **domaine de conception technique du système** » : conditions d'opération dans lesquelles un système technique de transport routier automatisé est spécifiquement conçu pour fonctionner.

Maintenant que les termes sont bien définis, voici les extraits des articles concernant ces différents domaines :

**Art. R. 319-1. – I.** Pour l'application du premier alinéa de l'article L. 319-1, le système de conduite automatisé est soumis à des conditions d'utilisation qui précisent notamment :
1° Le domaine de conception fonctionnelle et ses limites, notamment concernant les interactions avec les forces de l'ordre et les véhicules d'intérêt général prioritaires ou bénéficiant de facilités de passage;

**Art. R. 3152-2. _ II. -** Tout système de transport routier automatisé doit :
1° Etre conçu pour éviter les accidents pouvant résulter de situations raisonnablement prévisibles dans son domaine d'emploi ;
2° Reconnaître s'il est dans son domaine d'emploi et n'être actif que dans ce domaine d'emploi ;
3° Détecter ses défaillances ainsi que la sortie du domaine d'emploi et en informer l'exploitant, y compris dans le cadre d'une intervention à distance.

**Art. R. 3152-2. _ III.** - Tout système technique de transport routier automatisé doit :
1°Etre conçu pour éviter les accidents pouvant résulter de situations raisonnablement prévisibles dans son domaine de conception technique du système ;
2°Utiliser des véhicules équipés d'un système de conduite automatisé conçu pour exécuter des manœuvres à risque minimal ou d'urgence ;
3°Etre en mesure de détecter ses défaillances ainsi que la sortie du domaine de conception technique du système, et d'en informer l'exploitant y compris dans le cadre d'une intervention à distance.

# Conclusion

Le domaine de conception fonctionnelle, ou l'ODD a été défini dans plusieurs documents normatifs et réglementaires. Nous considérons comme référence valable quelle que soit le niveau de délégation de conduite, la définition issue de l'ISO / SAE J3016 [8], en raison du plus large consensus et de la plus grande utilisation de cette référence.

Cette définition et cette description de l'ODD s'appuient sur les documents de l'état de l'art (NHTSA et ISO 34503). Les éléments à vocation de standard sont les 6 catégories de premier niveau, les attributs de second niveau, ainsi que les noms associés. Le document ISO 34503 qui vise à normaliser l'ensemble des éléments de l'ODD est en cours de rédaction. Il faudra prévoir une mise à jour de ce livrable pour le mettre en cohérence avec la version finale du document ISO prévue en 2022.

Lors de la phase de validation par les partenaires de la conformité des livrables à leurs attentes, les représentants de l'UTAC ont confirmé que cette description de l'ODD correspondait à leurs attentes dans le cadre de la réglementation R157 (ALKS).

# ANNEXE : Canevas de description de l'ODD

Le projet SAM propose de décrire sous la forme d'un tableau Excel l'ODD du système. L'organisation avec les 6 catégories et les sous-catégories est fixe et normée.

Les attributs dans les sous-catégories sont donnés à titre illustratif. Il est de la responsabilité du concepteur du système d'en établir une liste exhaustive. L'essentiel est que cette description de l'ODD comporte tous les éléments à percevoir par le système ADS, soit :

- pour identifier et confirmer qu'il est dans son ODD (e.g : le système est opérationnel sur autoroute),
- pour indentifier que le véhicule va franchir une limite de l'ODD (e.g: le système est opérationnel et approche de la fin de l'autoroute),
- ou bien pour confirmer que le véhicule est hors de l'ODD (e.g : le véhicule n'est pas sur autoroute).

Pour chaque attribut, il faut qualifier s'il est dans l'ODD ou pas ; d'où la dernière colonne de la table de l'ODD à remplir avec :

| | |
|---|---|
| **Oui et/ou Valeur** | Élément dans l'ODD, nécessaire à percevoir, soit pour identifier que l'on est bien à l'intérieur des limites de l'ODD, soit parce qu'il pourrait nous conduire à une situation dangereuse. |
| **Non** | Élément en dehors de l'ODD, nécessaire à percevoir, car pouvant conduire à une sortie imminente de l'ODD et donc une situation dangereuse. |
| **/** | Élément de la liste du canevas, dont il faudra biffer le texte ou supprimer la ligne, lors d'une application sur un projet donné, car elle ne sert à rien. |

Nota Bene : Il est possible de décomposer la dernière catégorie « / » en deux sous-catégories :

- « / » : attribut sans effet sur la sécurité du système. Attribut qu'il n'est pas nécessaire de percevoir pour assurer la sécurité d'utilisation.
- « N/A » : attribut de la liste du canevas, mais non pertinent pour le système étudié (ex. autoroute pour un STRA avec navettes urbaines en centre-ville)

Dans la suite de cette annexe, vous trouverez une copie de la description de l'ODD retenue par les partenaires du projet SAM. Nous proposons le formalisme ci-dessous dans Word ou Excel (document joint). La référence est le document Excel, mais dans l'objectif que ce document soit autoporteur nous l'y avons inclus à la demande des partenaires.

Pour être aussi autoporteur que possible la description de l'ODD commence par une section introductive rappelant des informations très générales sur le système automatisé considéré.

# Introduction

| *Transportation Usage* - Moyen de Transport | | |
|---|---|---|
| *Public People Transpotation*<br>Transport Public de personne | *Shared use of the vhc*<br>Véhicles à usage partagé | Yes |
| | *Collective public transport*<br>Transport Public Collectif | Yes |
| | *Individual public transport*<br>Transport Public Individuel | Yes |
| *Private People Transpotation*<br>Transport Privé de personne | *Private transport services*<br>Service de transport privé | No |
| | *Car sharing*<br>Véhicule en auto-partage | No |
| | *Other* | No |
| *Goods transportation*<br>Transport de Biens | | No |
| etc… | | … |

## *Physical infrastructure* - Infrastructure Physique

| *Roadway Types* - Types de route | | |
|---|---|---|
| Segregated lane - With strong/massive separators (guard rails, etc.) / beside a dangerous area (river, oncoming lane, pedestrian sidewalk, cyclist lane, etc.)<br>Voie de circulation séparée - Avec des séparateurs solides/massifs (e.g. barrière de sécurité)/à côté des zones dangereuses (rivières, voie de circulation en sens inverse, trottoir pour piéton, voie cycliste, etc. ) | | Yes |
| Segregated lane - with light separators (studs, light barrier, etc.) / beside a dangerous area (river, oncoming lane, pedestrian sidewalk, cyclist lane, etc.)<br>Voie de circulation séparée - Avec des séparateurs légers (e.g. clous ? )/à côté des zones dangereuses (rivières, voie de circulation en sens inverse, trottoir pour piéton, voie cycliste, etc. ) | | Yes |
| Not segregated lane / beside a dangerous area (river, oncoming lane, pedestrian sidewalk, cyclist lane, etc.)<br>Voie non séparée / des zones de dangers | | Yes |
| Single Lane<br>Chaussée à voie unique | | Yes, if other Vh Speed < 50km/h |
| Multiple-lanes undivided with same driving directions - without Lane Change<br>Chaussée à voies multiples dans le même sens de circulation | | Yes, if other Vh Speed < 50km/h |
| *Multiple-lanes undivided with same driving directions - with Lane Change* | | Yes, if other Vh Speed < 30km/h |
| *Multiple-lanes undivided with opposite driving directions*<br>Chaussée à voies multiples avec circulation en sens opposé | | Yes, if other Vh Speed <30Km/h |
| *Intersections with priority to AV*<br>Intersection avec priorité au véhicule autonome | | Yes, if other Vh Speed <50Km/h |
| *Intersections with give-way or stop*<br>Intersection avec céder le passage ou stop | | Yes, if other Vh Speed <50Km/h |
| *Intersections with traffic light (not connected)*<br>Intersection avec feux de circulation non connectés | | No , if other Vh Speed <50Km/h |
| *Intersections with traffic light (connected)*<br>Intersection avec feux de circulation connectés | | Yes, if other Vh Speed <50Km/h |
| *Intersections with blind corners / blind spots*<br>Intersection avec obstruction / Angles morts | | Yes , if other Vh Speed <50Km/h |

| | | |
|---|---|---|
| *Roundabouts*<br>Rond-point | | Yes , if other Vh Speed <50Km/h |
| *Merging Lane : Transition from 2 lanes to 1 lane (ego vehicle on this lane)*<br>Fusion de voie(ego vehicule sur la voie qui disparaît) | | Yes, if other Vh Speed <50Km/h |
| *Merging Lane : Transition from 2 lanes to 1 lane (ego vehicle NOT on this lane)*<br>Fusion de voie (ego vehicule pas sur la voie qui disparaît) | | Yes , if other Vh Speed <50Km/h |
| *Merging in*<br>Fusion de 2 voies | | Yes, if other Vh Speed <50Km/h |
| *Branching / Exit / merging out (City)*<br>Ramification / Voie de sortie / Création de voie | | Yes, if other Vh Speed <50Km/h |
| *Passengers Stations / Notched*<br>Station (Arrêt) / Arrêt déporté en dehors de la voie | *Other vhc speed ≤ 30 km/h* | Yes, if other Vh Speed <50Km/h |
| *Passengers Stations / In Lane*<br>Station (Arrêt) / sur la voie de circulation | | Yes |
| *Bridges / **Gap**, ditch*<br>Pont / Fossé | | Yes |
| *Crosswalk*<br>Passage Piéton | | Yes |
| *Tunnel, underpass*<br>Tunnel, passage souterrain | | Yes |
| *Railway crossing*<br>Passage à niveau | *Without barriers* | No |
| | *With Signals - Not connected* | No |
| | *With Signals - Connected* | Yes Cf. Connected signage |
| *Construction area*<br>*Zone de construction* | | Yes |
| *Parking (surface lots, structures, private/public)*<br>*Zone de Parking* | | Yes |
| *Loading and Unloading Zones*<br>Zones de chargement / déchargement | | Yes |
| *etc.* | | / |
| ***Highway-specific Roadway Types*** | | |
| *Divided Highway*<br>Autoroute, Voie rapide (à chaussées séparées par une barrière physique) | | No |
| *Undivided Highway*<br>Autoroute, Voie rapide sans barrière physique entre les sens de ciculation | | No |
| *Road with regulated access*<br>Routes à accès limité | | No |
| *Tollgate*<br>Barrière de Péage | | No |
| *Border office*<br>Douane | | No |
| *Interchange*<br>Echangeur | | No |

| | |
|---|---|
| *Slip Road ( ego vehicle on this road )*<br>Bretelles d' Entrée & Sortie (ego véhicule sur cette voie) | No |
| *Slip Road ( ego vehicle not on this road )*<br>Bretelles d' Entrée & Sortie (ego véhicule sur la voie adjacente) | No |
| *etc.* | / |
| ***Roadway Surfaces*** **- Surface de la route** | |
| *Asphalt*<br>Asphalte | Yes |
| *Concrete*<br>Béton | Yes |
| Mixed (Asphalt + concrete) | Yes |
| *Grating*<br>Grille (*e.g.* grille d'égoût) | No |
| Cobblestones | No |
| *Brick*<br>Pavés | No |
| *Dirt*<br>Poussières, Saletés sur la route | No |
| *Gravel*<br>Graviers | No |
| *Scraped road*<br>Route grattée | No |
| *Speed bumps*<br>Ralentisseurs | Yes |
| *Potholes*<br>Trous / Nids de Poule | No |
| *Grass*<br>Herbe | No |
| *etc.* | / |
| ***Roadway Edges*** **- Bords de route** | |
| Sidewalks<br>Trottoirs | Yes |
| Parking areas<br>Places de parking | Yes |
| Cyclist lane<br>Voie Cycliste | Yes |
| Gap / Ditch alongside the lane<br>Fossé le long de la voie | Yes |
| Dock, Ravin, River alongside the lane<br>Eau le long de la voie | Yes |
| *Shoulder (paved, gravel, grass)*<br>Accotement | / |
| *Lane barriers, Segregation components*<br>Barrière de sécurité | *Cf. Roadway Types* |
| *Emergency Lane*<br>Bande d'Arrêt d'Urgence | / |
| *etc.* | / |

| Lane markings - Signalisation horizontale | |
|---|---|
| *Lane markings*<br>Signalisation horizontale | Yes = Clear markers<br>Oui = marquages détectables |
| *Temporary lane markings*<br>Signalisation horizontale temporaire | No |
| *Zebras* | No |
| *etc.* | / |
| ***Roadway Geometry*** - Géométrie de la route | |
| *Straightaways*<br>Ligne droite | Yes |
| *Curves*<br>Courbes | Yes if Radius ≥ XXX m |
| *Hills - uphill - [%]*<br>Pentes ascendantes | Yes if gradient ≤ XXX |
| *Hills - downhill - [%]*<br>Pentes descendantes | Yes if gradient ≤ YYY |
| *Lane width - [m]*<br>Largeur de voie [m] | ≥ XXX |
| *etc.* | / |

| ***Operational Constraints*** - Contraintes Opérationnelles | | |
|---|---|---|
| ***Speed Limits*** - Limites de vitesses | | |
| Minimum - [km/h] | | 0 |
| Maximum - [km/h] | | ≤ XXX |
| *Speed of Surrounding Traffic*<br>Relative au trafic environnant | | Cf. Roadway Types |
| *etc …*<br>etc … | | / |
| ***Traffic Conditions*** - Conditions liées au trafic | | |
| *Average Traffic density - [/h]*<br>Densité de trafic | *≤ XXX* | / |
| | *] XXX ; YYY ]]* | / |
| | *> YYY* | / |
| *etc …*<br>etc … | | / |
| ***Operational Conditions*** | | |
| *Max passenger capacity per vhc - [passengers]* | | ≤ XXX (seated passengers)<br>≤ XXX (standing passengers)<br>≤ XXX (overall passengers) |
| *Max payload per vhc - [kg]* | | ≤ XXX |
| *Max number of vhc per site - [vhc]* | | ≤ XXX |
| *etc …*<br>etc … | | / |
| ***Driver and Operator Conditions*** - Conditions liées au conducteur ou à l'opérateur | | |
| *Present in seat*<br>Présence dans le siège | | *Yes* |

| | | |
|---|---|---|
| *Attentive*<br>Attentif | | *Yes* |
| *On board Safety Operator*<br>Opérateur de sécurité à bord | *Always required onboard*<br>Toujours à bord | No |
| | *Always attentive*<br>Toujours attentif | No |
| *etc …*<br>etc … | | / |

| ***Objects*** **-** **Objets** | |
|---|---|
| ***Passive Vertical Signage*** **-** **Signalisation Verticale passive** | |
| *Signs (e.g., stop, yield, speed limit, school zone, etc.)*<br>Panneau de signalisation | / |
| *Tunnel traffic light*<br>Feux de signalisation en Tunnel | / |
| *Crosswalk sign*<br>Panneau de passage Piéton | / |
| *Railroad crossing*<br>Panneau de passage à niveau | / |
| *Stopped buses*<br>Arrêt de Bus | / |
| *Construction signs*<br>Panneaux temporaires de travaux | Yes |
| Construction cones<br>cônes de signalisation de travaux | Yes |
| *Temporary Closures*<br>Fermeture temporaire de voie/route | Yes |
| *etc.* | / |
| ***Dynamic Signage*** **-** **Signalisation variable** | |
| *Traffic Signals (e.g. regular, flashing, school zone, fire dept. zone)*<br>Feux de signalisation | / |
| *Dynamic speed limit* | No |
| *Dynamic Traffic Signs*<br>Panneaux à message variable | No |
| *Variable Speed Limits*<br>Limitation de vitesses variables | No |
| *etc.* | / |
| ***Human signs*** **-** **Trafic dirigé par un humain** | |
| *Human-Directed Traffic*<br>Trafic dirigé par un être humain *(agent de police, ouvriers de chantier, etc.)* | No |
| *Human injunctions*<br>Injonction faites par un humain (ralentir, se déporter vers la gauche, etc.) | No |
| *etc.* | / |
| ***Roadway Users*** **-** **Usagers de la route** | |
| *Road Vehicles*<br>Véhicules routiers | Yes for cars, light trucks, large trucks, buses, motorcycles, wide-load, emergency vehicles<br>No for Bicycle , horse-drawn carriages/buggies, scooter, Moped |

| | |
|---|---|
| *VRU / Pedestrians*<br>Piétons | Yes |
| *VRU / Cyclists*<br>Cyclistes | Yes |
| Emergency Vehicles<br>Véhicules d'urgence | No : Audio signalisation devices<br>No : Visual signalisation devices<br>Yes : V2V Messages<br>Cf. Connectivity |
| Specific / peculiar vehicles<br>Véhicule spéciaux / spécifiques | No |
| *etc.* | / |
| ***Non-Roadway Users & Obstacles*** **-** Non usagers de la route et Obstacles | |
| Negative obstacles (holes, missing mancover, potholes, etc.)<br>Obstacles négatifs (Trou, nid de poule, etc.) | No |
| *Animals (e.g., dogs, deer, etc.)*<br>Animaux | Yes if ≤ XXX mm<br>No if > XXX mm height |
| *Debris, lost cargos, etc. (e.g., pieces of tire, trash, ladders)*<br>Debris (e.g. pneu, déchets) | Yes if ≤ XXX mm<br>No if > XXX mm height |
| Wind-blown objects (leaves, debris, dust/dirt, sand)<br>Objets emportés par le vent (feuilles, débris, poussière, sables) | No |
| *etc.* | / |

| | |
|---|---|
| ***Environmental conditions*** **-** Conditions environnementales | |
| ***Weather*** **-** Climat | |
| *Wind - km/h*<br>Vent | ≤ XXX km/h stabilized<br>≤ YYY km/h peak |
| *Rain - mm/h*<br>Pluie | ≤ XXX mm/h |
| *Snow*<br>Neige | No |
| *Sleet*<br>Grésil, Neige fondue | No |
| Operating Temperature - °C<br>Température d'Opération | Min :<br>Max : ≥ XXX |
| Storage Temperature - °C<br>Température de stockage | [ XXX , YYY ] |
| *Humidity Rate - %*<br>Taux d'humidité | ≤ XXX |
| *etc.* | / |
| **Weather-Induced Roadway Conditions** | |
| *Standing Water - mm*<br>Accumulations d'eau | ≤ XXX mm |
| *Flooded Roadways*<br>Route innondée | No |
| *Icy Road*<br>Route verglacée | No |
| *Snowy Road - mm*<br>Route enneigée | ≤ XXX mm |
| Mud<br>Boue | No |

| | | | |
|---|---|---|---|
| | *etc.* | | / |
| | **Particulate Matter - Particules** | | |
| | Adverse Visibility (Fog, smoke, smog, dust/dirt, etc.)<br>Visibilité dégradée (Brouillard, Pollution, Fumée, poussière, etc.) | | No if Visibility ≤ 100 m<br>Yes if Visibility > 100 m |
| | *etc.* | | / |
| | **Illumination** | | |
| | Day (sun: Overhead, Back-lighting and Front-lighting) | | Yes |
| | Dawn, Dusk<br>Aube, Crépuscule | | Yes |
| | *Night*<br>Nuit | *With Street lights*<br>Eclairage public | Yes |
| | | *Without Street lights*<br>Sans éclairage public | Yes |
| | *Headlights (Regular & High-Beam)*<br>Lumière des autres véhicules | | Yes |
| | Oncoming vehicle lights (Overhead Lighting, Back-lighting & Front-lighting)<br>Eclairaige des véhicules venant en sens inverse | | Yes |
| | *etc.* | | / |
| | **Time of the day - Période de la journée** | | |
| | Availability<br>Disponibilité | | From - 09:00 AM<br>To - 10:00 PM |
| | *etc.* | | / |
| | | | |
| | **Connectivity - Connectivité** | | |
| | **Vehicles - Véhicules** | | |
| | V2I communications required<br>Communication V2I (Unités de Bord de Route en courte portée (ITS-G5/C-V2X)) | | Yes for some roadway types<br>Cf. Roadway Types |
| | V2V communications required<br>Communication V2V | | No |
| | Emergency vehicles V2V C-ITS required<br>Véhicules prioritaires | | Yes |
| | V2Device - V2Network<br>Véhicules Vers Device - Réseaux | | No |
| | etc. | | / |
| | **Remote Fleet Management System - Supervision** | | |
| | Does the system require an operations center ?<br>Nécessité d'un Poste de Contrôle Centralisé (PCC) ? | | Yes |
| | Remote operation<br>Intervention à distance | | No |
| | *Remote operator required*<br>Télé-opérateur | *Always on duty* | Yes |
| | | *Always attentive* | No |
| | etc. | | / |
| | **Infrastructure Sensors - Capteurs de l'infrastructure** | | |
| | Work zone alerts by Connectivity<br>Alerte de zone de Travaux | | Not required |
| | Vulnerable road user by Connectivity<br>Usagers vulnérables de la route | | Yes, C-ITS required for crosswalks with occlusions |

| | |
|---|---|
| Routing and incident management by Connectivity<br>Management du trafic et des incidents de la route | Not required |
| etc. | / |
| **Digital Infrastructure - Infrastructure numérique** | |
| 3G / 4G | Yes, required. |
| GPS / GNSS<br>GPS | Yes, required. |
| Reference Maps ( e.g. 3D HDMAP)<br>Carte Haute Définition | Yes, required. |
| Pothole Locations<br>Positon des nids de poule | Not required |
| Weather Data<br>Informations Météorologiques | Yes, required. |
| Connected Signals (traffic lights, railway crossing, etc.)<br>Signalisations connectées (feux de circulation, passages à niveau, etc.) | Yes, required for some roadway types<br>Cf. Roadway Types |
| etc. | / |

| **ZONES** | | |
|---|---|---|
| **Geofence area - Zones particulières** | | |
| *Fixed Route*<br>Parcours prédéfinis | | Yes |
| *Private Site Area* | *Ungated / Roads accessible to public traffic* | Yes |
| | *Gated / Roads NOT accessible to public traffic* | Yes |
| *Urban Area (downtown, Central Business Districts, School campuses, etc.)*<br>Zone Urbaine : Centre-ville, Quartier d'affaires, Campus Scolaire, etc.) | *Roads accessible to public traffic* | Yes |
| | *Roads NOT accessible to public traffic* | Yes |
| *etc.* | | / |
| ***Regions/States - Régions & états*** | | |
| *Legal/Regulatory*<br>Législation/Règlementation | | UN-ECE member states |
| *Enforcement Considerations* | | No |
| *Tort*<br>*Délit - Infraction au code de la route* | | No |
| *etc.* | | / |
| **Interferences zones** | | |
| Tunnels<br>Tunnel | | Yes |
| Area clear of infrastructures and buildings<br>Zone sans aucune infrastructure ou immeuble | | Yes |
| Urban canyon<br>Canyon urbain | | Yes |
| Multiple reflectivity<br>Réflexion multiples | | Yes |
| Parking Garage<br>Zone de stationnement | | / |
| Dense Foliage<br>Feuillage dense | | Yes |

| | | |
|---|---|---|
| | Limited 3G / 4G<br>Perturbations 3G / 4G | Yes |
| | Limited GPS / GNSS<br>Perturbations GPS / GNSS | Yes |
| | *etc.* | / |

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