

Considerations on the categorization of Automated Vehicles

Motivation for reviewing the existing vehicle categories

Check if :

- Existing categories are working for Automated Vehicles
- It is ensured that the different ADS use-cases are covered
- The application of regulations to the specific use cases fits well
- A logical structuring of the use cases under the existing vehicle categories is possible

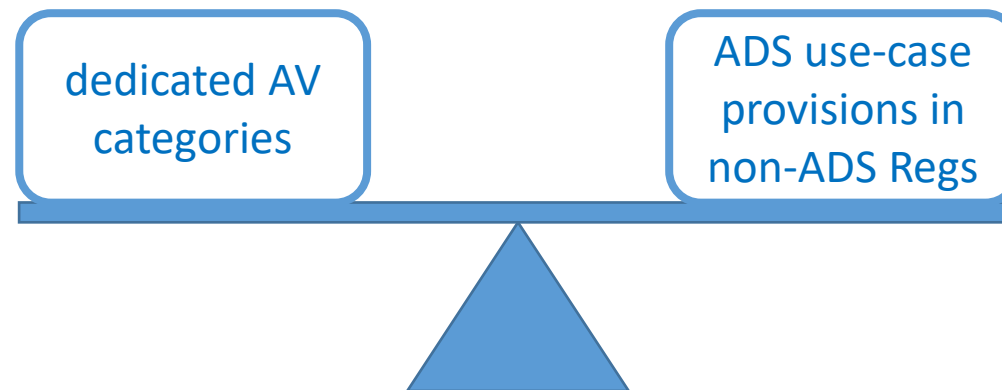


Outcome:

- Existing categories cannot be used as they are currently defined, without modification
- New approach has to be defined to address different ADS vehicle use cases

Prerequisites for the new categorization concept for AV's

- Balanced approach between number of AV categories vs. ADS use-case specific requirements in each individual Regulation
- Keep current logic for basic vehicle categorization
- Resolve existing issues for categories, e.g. issue of small shuttles with standing passengers
- Easy application in existing WVTA frameworks



Vehicle categorization under R.E.3

New sub categories for Automated Vehicles (AV's)

Subcategory A „Driverless Vehicles with ADS“

Designed primarily for the carriage of people

Designed primarily for the carriage of goods

Subcategory D „Dual Mode vehicles“

Designed primarily for the carriage of people

Designed primarily for the carriage of goods

Subcategories X & Y „Low speed driverless AV's“

M1
Driver seat + max. 8 add. seats, no limitation of GVM

M2
Driver seat + more than 8 add. seats, GVM max. 5 t

M3
Driver seat + more than 8 add. seats, GVM exceeding 5 t

N1
GVM \leq 3.5t

N2
3.5t < GVM \leq 12t

N3
GVM > 12t

Examples:

M1D
e.g. Robotaxi

N3D
e.g. Hub-2-Hub truck

M1Z
e.g. AVP equipped vehicle

M1A
seated only, max. 9 seats

M2A
More than 9 seats or standing passengers, GVM Max. 5t

M3A
More than 9 seats or standing passengers, GVM exceeding. 5t

With or w/o passengers

N1A
GVM \leq 3.5t

N2A
3.5t < GVM \leq 12t

N3A
GVM > 12t

Examples:

M2X
< [25] km/h
e.g. Campus shuttle

M2Y
[25] km/h \leq v \leq [50]
e.g. Urban shuttle

*Class I, II, III and Class A, B can be carried over

Vehicles which can be driven manually under nominal conditions

AV's which do not require a driver/fallback-ready user

Categories according to Consolidated Resolution R.E.3

Required amendments to existing Definitions:

2.2. Category M - Power-driven vehicles having at least four wheels and used for the carriage of passengers

- 2.2.1. "Category M1": Vehicles used for the carriage of passengers and comprising not more than ~~eight~~ **nine** seats ~~in addition to the driver's seat.~~
- 2.2.2. "Category M2": Vehicles used for the carriage of passengers, comprising more than ~~eight~~ **nine** seats ~~in addition to the driver's seat or designed to carry standing passengers,~~ and having a maximum mass not exceeding 5 tonnes.
- 2.2.3. "Category M3": Vehicles used for the carriage of passengers, comprising more than ~~eight~~ **nine** seats ~~in addition to the driver's seat or designed to carry standing passengers,~~ and having a maximum mass exceeding 5 tonnes.
- 2.2.4. Vehicles of categories M2 and M3 belong to:
 - 2.2.4.1. For vehicles having a capacity exceeding ~~[22] occupants 22 passengers in addition to the driver,~~ there are three classes of vehicles:
 - 2.2.4.1.1. "Class I": Vehicles constructed with areas for standing passengers, to allow frequent passenger movement.
 - 2.2.4.1.2. "Class II": Vehicles constructed principally for the carriage of seated passengers, and designed to allow the carriage of standing passengers in the gangway and/or in an area which does not exceed the space provided for two double seats.
 - 2.2.4.1.3. "Class III": Vehicles constructed exclusively for the carriage of seated passengers.
 - 2.2.4.1.4. A vehicle may be regarded as belonging in more than one class. In such a case it may be approved for each class to which it corresponds.
 - 2.2.4.2. For vehicles having a capacity not exceeding ~~[22] occupants 22 passengers in addition to the driver,~~ there are two classes of vehicles:
 - 2.2.4.2.1. "Class A": Vehicles designed to carry standing passengers; a vehicle of this class has seats and shall have provisions for standing passengers.
 - 2.2.4.2.2. "Class B": Vehicles not designed to carry standing passengers; a vehicle of this class has no provision for standing passengers.

Categories according to Consolidated Resolution R.E.3

New categories:

New “Dual-mode” sub category:

2.x. Dual-mode vehicles with Automated Driving Systems

2.x.1. Definition.

Dual-mode vehicles are vehicles of category M or N which can be driven manually and which are equipped with an Automated Driving System allowing the vehicle to be driven in an automated mode not issuing a Transition Demand, requiring an interaction by a driver to take back manual control (e.g. a fallback-ready user).

2.x.2. Categorization

Dual-mode vehicles are categorized into two categories, based on the maximum operational design speed of the Automated Driving System. In cases where the Automated Driving System consists of multiple features, e.g. low-speed and high-speed ADS features, the feature with the highest maximum design speed is defining the maximum design speed of the Automated Driving System and therefore considered for the dual-mode categorization.

2.x.2.1. Category D are dual mode vehicles having a maximum operational speed of the Automated Driving System exceeding [25] km/h.

2.x.2.2. Category Z are dual mode vehicles having a maximum operational speed of the Automated Driving System not exceeding [25] km/h.

2.x.3. Combined designation

Symbols M and N may be combined with symbol D or Z. For example, a vehicle of category M1 which is suited for dual-mode use having a maximum operational speed of the Automated Driving System exceeding [25] km/h may be designated as M1D.

Categories according to Consolidated Resolution R.E.3

New categories (continued):

New “Driverless Vehicles” sub category:

2.y. Category A – Driverless vehicles with Automated Driving Systems

2.y.1. Definition.

Driverless vehicles are vehicles of category M or N which are equipped with an Automated Driving System allowing the vehicle to be driven in an automated mode not issuing a Transition Demand, requiring an interaction by a driver to take back manual control (e.g. a fallback-ready user) and which [cannot be driven manually under nominal conditions/are not falling under the definition of dual mode vehicles].

2.y.2. Combined designation

Symbols M and N may be combined with symbol A. For example, a vehicle of category M1 which is considered an driverless vehicle shall be designated as M1A.

New “Low speed driverless vehicles” sub categories:

2.z. Low-speed driverless vehicles with Automated Driving Systems

2.z.1. Definition

2.z.1.1. Category X are vehicles belonging to category A, but having a maximum design speed not exceeding [25] km/h.

2.z.1.2. Category Y are vehicles belonging to category A, having a maximum design speed exceeding [25] km/h but not exceeding [50] km/h

2.z.2. Combined designation

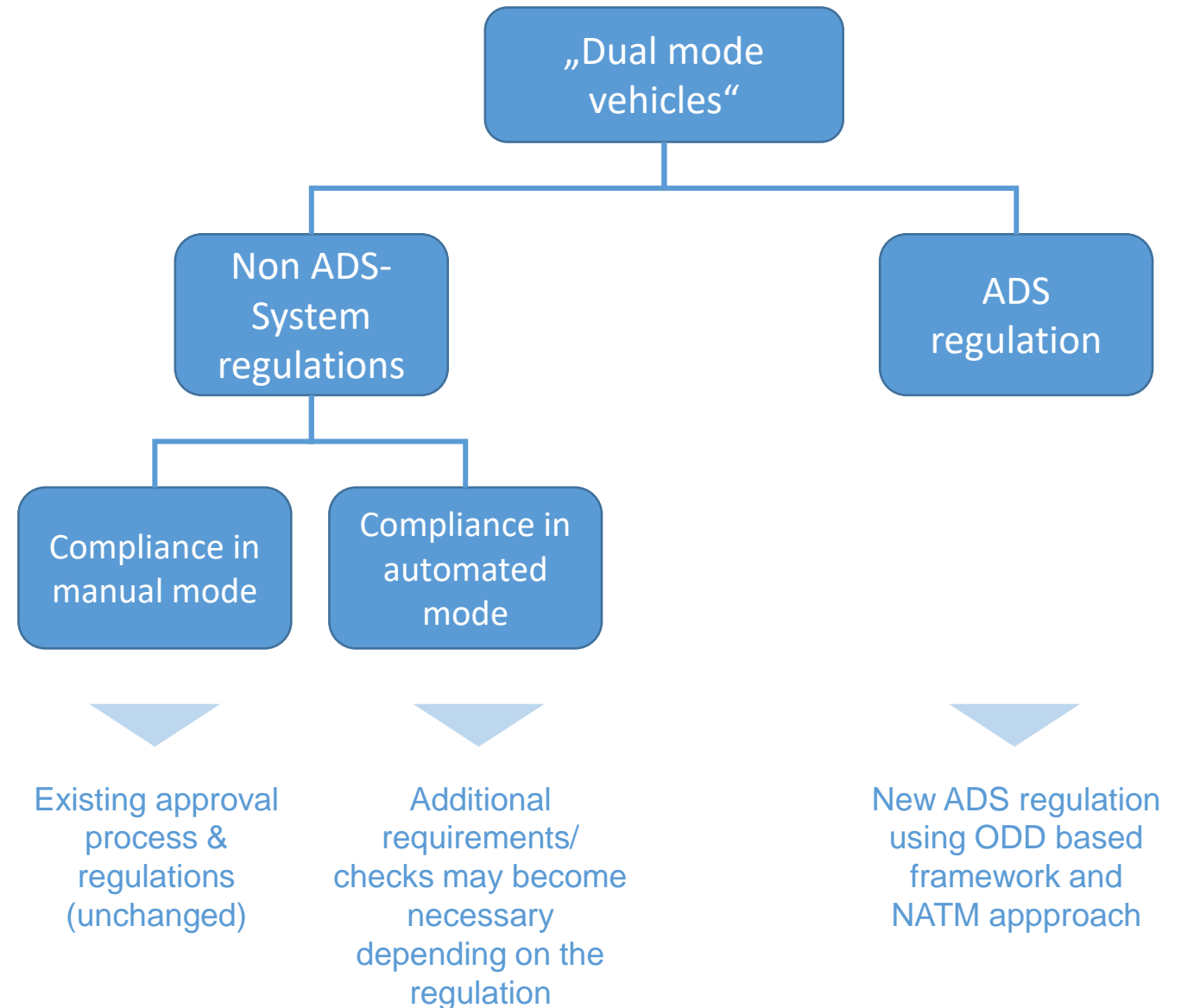
Symbols M and N may be combined with symbol X or Y. For example, a vehicle of category M1 which is considered a low-speed driverless vehicle of Category Y shall be designated as M1Y.

Vehicle categorization: „Dual Mode vehicles“*

Since the main vehicle design from a vehicle category point of view is „driven“ by the manually operated vehicle, it may be appropriate to use existing categories + an addition subclassification comparable to „off road“ => „G“, e.g. „D“ for „dual mode automated vehicles“ => M1D, N1D, ...

Which „specifics“ will have to be considered under automated mode for non-ADS system regulations?

- 1) Replace „driver reference“ adequately
- 2) HMI (incl. warnings) to consider passengers in general (where applicable)
- 3) Amending/supplementing e.g. testing conditions as appropriate (=> testing?, self assessment/ declaration?) Additionally considering ADS performance assessment (performing DDT in the ODD)



* AV's which do not require a driver/fallback-user



Thank you