EU EIP 4.2 Consortium Workshop
1 – 2 October 2019

SIAS | Società Iniziative Autostradali e Servizi S.p.A.
Via Giuseppe Maria Bonzanigo 22, 10144 Torino (Italy)

Proceedings

This multi-stakeholder workshop took place in Torino, Italy on 1-2 October 2019. The workshop put the focus on ODD, costs and benefits of highly automated driving. On Day 1 the workshop discussed the Operational Design Domains, their evolution path and the role they can play in type approval and certification. On Day 2 the workshop examined and discussed the costs and benefits of highly automated driving based upon existing research and projects.
The workshop welcomed everyone involved in shaping innovation in the automated driving. Overall, the Workshop attracted in all 37 participants with 15 from industry and the private sector, 17 from public sector and road operators, and 5 representing academia and research.

Day 1 October 1, 2019

4. Parallel Sessions

There were three parallel sessions for three Use Case groups based on the Use Cases of the ERTRAC Road Map.

Use case group	Moderator	Rapporteur
Automated Passenger Cars	Maarten	Vish
Automated Freight Vehicles	Magnus	Johnny
Urban Mobility Vehicles	Merja	Ian

Each moderator presented a short summary reporting on the discussions on the ODD attributes for each Use Case (see the resulting Excel tables):

- Automated Passenger Cars (Maarten Amelink)
- Automated Freight Vehicles (Magnus Hjälmdahl)
- Urban Mobility Vehicles (Merja Penttinen)

a. Notes from Automated Passenger Cars Breakout Group

The outcome of the breakout session is described in the table below. Some general comments:

- ODD attributes have interrelations, lower visibility would be acceptable with lower speed at the same time;
- Definition of ERTRAC use cases is not always clear;
- Possible new ODD attributes were mentioned: presence of regulations & of TMC/operations centre
- The group discussion lacked an OEM representative, so their input is not included.

		Automated Passenger Cars		
general: what is the hierarchy of information on road & conditions when sources are contradicting?	ODD attributes	**Highway Autopilot (Level 4)**	**Urban and Suburban Pilot (Level 4)**	Traffic Jam Chauffeur (Level 3)
toll roads, presence of toll plazas *road construction material, wear conditions, pavement state* *road category* *no of lanes, curvature, width* *transversal, longitudional, slope skid resistance*	**Road**	Enough space left for fail safe parking? How can we monitor that? And what are their locations? Hard lane division needed.		
applicable minimum/maxium speeds, specific one for AD? *Variable speed range for AD depeding on other circumstances?*	**Speed range**			
activation of hard shoulder running *how to warn other cars when fail safe manoeuvre is done* *presence of emergency lane, width of it*	**Shoulder or kerb**			
contrast, reflection *quality, repaint frequency* *design in general, consistency, harmonisation*	**Road markings**	Good quality needed		visible/detectable (including traffic lights), since cars are close together?
dynamic or static *digital availability* *visibility of them, reflection characteristics* *uniform location of traffic signs, consistent with digital information* *how is digital message translated to road user?*	**Traffic signs**			
lighting of the road *fences to keep e.g. animals away*	**Road furniture**			
behaviour of traffic, mixed character, vulnerable road users, level of congestion *authorisation for certain roads*	**Traffic**			
day or night *rush hour* *regulations that are time dependant*	**Time**			
	Weather conditions	winter maintenance is a challenge		
general: the attributes below could be complementing the attributes above, lower quality there may be solved by high quality info here.	**HD map**			
presence of high rise buildings or other disturbing elements	**Satellite positioning**			information on traffic situation
certificates *cellular coverage* *V2V, V2I*	**Communication**			
sharing of information to non automated drivers *broadcasting of information*	**Information system**			V2I needed?
	environmental conditions (pollution etc)			
	irregularities (accidents, animals crossing etc)			
	cross border roads, open bridge			
	regulations			
	traffic management system, operations centre			
	not discussed:	**Highway Chauffeur (Level 3)**	**Highway Convoy (Level 4)**	**Autonomous private vehicles on public roads (Level 5)**

Figure 1 ODDs for the automated passenger car use cases

b. Notes from Automated Freight Vehicles Breakout Group

There were ten participants in the group and the discussion started with identifying factors that could be relevant to consider when discussing the ODD. Factors relevant to consider where:

- Traffic: Volume, mix
- Weather: Visibility, snow
- HD Map: Special features
- Satelite positioning: Accuracy, tunnels
- Communication: 3,4,5G, digital infra, profiles, coverage, standards, profiles
- Governance: legal issues, authorization

The discussion then continued with the three Use cases linked to Automated freight vehicles.

UC no 1. Automated Freight Vehicles in a confined area:
Discussion on the definition of confined area was difficult. If it is confined, then many of the ODD issues can be handled. It was discussed that in a confined area the self-driving vehicles do not interact with other vehicles at all, but the group did not entirely agree that that had to be the case.

UC no2. Automated freight vehicles node to node.
Designated roads for these vehicles can be public.
Control Tower needed. Video camera on board the vehicles to assist the CT.
Question: At what volume of AV's does the road in practise become AV only (No other traffic will be able to get access)?
If the difference in speed between AV's and other traffic is too large, dedicated lanes might be needed from a safety point of view.
Lane markings, are they needed or not? Difficult to get a clear answer from OEM's. What are the requirements?
Question for RO: If I want AV do I need to invest?
Must be defined what is nice to have and must have?
In UC 2 costs can (to a high degree) be put on the company benefitting from the UC. Not necessary that the RO takes the cost.
Communication is needed to have the CT work.
Designated corridors, does that mean designated vehicles for that corridor or can a vehicle from one corridor be moved to another?
Can the control tower allow/steer vehicles round disturbances or is the ODD no disturbance?

UC no 3. Automated freight vehicles everywhere.
Not much time to discuss this.
Is UC 2 & 3 the same in terms of ODD? If you limit the UC to all major truck networks (expanded UC 2…). If you include all roads and urban then it's different.

c. Notes from the Urban Mobility Vehicles Breakout Group

Merja introduced the four vehicle use case categories and the ODD attributes to be discussed with respect to Level 4 conditions.

There is a clarification required between group 1 (automated shuttle bus L4 – later just Shuttle) and group 2 (robo-taxi) whether the latter is completely driverless, and whether the service is "door-to-door".

- Shuttles - Roads:
  - Many of the shuttles are not operating in urban environments but in lower traffic volume roadways (e.g. lower complexity).
  - Most of the complexity in urban streets comes from the mix of traffic
  - Local roads could have restricted access such as bus lanes.
  - If the lane is dedicated for the use of AV shuttles, then in many ways the road type is irrelevant
- Shuttles – Speed range
  - Low speed that meets the safety requirements of the environment
  - Setting limits for regulatory or human behavior is unclear as today we have learned to accept that part of the human drivers do not comply to speed limits. However, for dedicated lanes, it is easier to set speed criteria to regulatory criteria
- Shuttles – Shoulder or kerb
  - Must have passenger pick-up, drop-off locations
  - Parking policies must be tailored to the needs of AVs
  - Landscaping and other moveable elements must be maintained to keep the path clear for sensor range
- Shuttles – Road Markings
  - There is a wide combination of many lane marking scenarios that humans are able to interpret.
  - In dedicated lanes, markings may be needed to indicate to non-designated vehicles to stay out of these lanes
- Shuttle – Traffic Signs
  - No other needs if the HD map is up to date
- Shuttle – Road Furniture
  - Landmarks are helpful to the vehicle in its navigation
  - Barriers or other indicators to prevent non-permitted vehicles from entering
- Shuttle – Traffic
  - Cannot allow pedestrians or bicyclists in the dedicated routes (other than crossings)
  - Space may be too scarce to say the lane is exclusively reserved for the shuttle
- Shuttle – Time
  - 24/7 but dependent on sensor capabilities

- Shuttle – Weather
  - Must be considered if the entire fleet stops due to changes in weather (heavy rain, fog, etc.)
  - Each manufacturer's suite of sensors impact the capabilities
  - A clear set of conditions must be defined to know when a particular AV vehicle can operate
  - There is a choice to make here: could the vehicles operate in e.g. a lower speed in adverse conditions or just not operate at all then
- Shuttles – HD Maps
  - Requirements are the same for both shuttles and robo-taxis
- Shuttles – Satellite positioning
  - Urban environments need more support
- Shuttles – Communication
  - Controlled supervision center is needed
- Shuttles – Information systems
  - Needed in this scenario but more important in mixed- traffic
- Robo-taxis – Roads
  - More complicated due to the door-to-door requirements and mixed-traffic
- Robo-taxis – Speed Range
  - Needs to adapt to the speeds and regulations for vehicles in that environment
- Robo-taxis – Shoulder or kerb
  - Must have passenger pick-up, drop-off locations
  - Parking policies must be tailored to the needs of AVs
  - Landscaping and other moveable elements must be maintained to keep the path clear form sensor range
- Robo-taxis – Road Markings
  - There are parts of the network where road markings are required to improve the navigation of both automated and non-automated vehicles
  - Mixed traffic depend on road markings or other indicators due to the presence of human drivers.
  - The technological capabilities of the vehicle control whether or not it can navigate a roadway with non-standard lane markings.
- Robo-taxi – Traffic Signs
  - Still required based on the legal framework
- Robo-taxis – HD Maps
  - Requirements are mostly the same for both shuttles and robo-taxis
  - Frequency of updates may need to be more frequent
- Robo-taxi– Communication
  - Controlled supervision center is needed
  - Prioritization at signals in mixed traffic.

- Robo-taxi – Information System
    - More important in mixed traffic

5. Reporting back

Each moderator presented a short summary reporting on the discussions on the ODD attributes for each use Case (see above and the resulting Excel tables).

6. Conclusion & wrap up

Risto started by saying that this was a valuable workshop, different view points were presented. The OEM presentation pointed out the priority of different use cases, and issues were brought up that we had not discussed before. The participation by OEMs was quite shallow, but there are so many activities going on so we understand this.

We still do not have full definition of ODDs. The parallel sessions today and tomorrow will be valuable in providing data on that – e.g. maybe we need remote supervision centers in order to make automated vehicles work when you run out of ODD, and thereby this should be added as one attribute of the ODD.

Motto: Ask not what ODD can do for you, ask what you can do for ODDs!