Highlights on Operational Design Domains
EU EIP 4.2 Torino Workshop
Torino, 1st October 2019

Luisa Andreone, FCA-CRF
L3Pilot Piloting Leader
Highlights on Operational Design Domains
Automated Driving Vehicle Functions

Automated Driving Vehicle Functions have different deployment timeframes:

1. PARKING CHAUFFEUR
2. TRAFFIC JAM CHAUFFEUR
3. MOTORWAY CHAUFFEUR
4. URBAN CHAUFFEUR

“Parking” and “Traffic jam” will enter the market first and then the others.
“Motorway” follows “Traffic jam” and “Urban” will come later for its variety of dynamic situations.
Highlights on Operational Design Domains
Automated Driving Vehicle Scenarios
Highlights on Operational Design Domains
L3Pilot Automated Driving Vehicle Functions

1,000 drivers  100 cars  10 European countries
Highlights on Operational Design Domains
L3Pilot Automated Driving Vehicle Functions: parking chauffeur
Highlights on Operational Design Domains
L3Pilot Automated Driving Vehicle Functions: traffic jam chauffeur

On motorways and circular roads the car takes over the driving in traffic jams up to 60 km/h. When the detection of slow driving vehicles in front indicates a traffic jam, the function will be activated. In some instances, the car changes lanes to react to a slower vehicle ahead or infrastructural reasons like exit lanes.

The L3Pilot Traffic Jam Chauffeur relieves you from exhausting manual driving during traffic jams.

10 HOURS A WEEK
Again, stuck in a traffic jam, like every day.
I AM SO TIRED OF IT.

RELAX AND USE INFOTAINMENT FUNCTIONALITIES

On motorways and circular roads the car takes over the driving in traffic jams up to 60 km/h. When the detection of slow driving vehicles in front indicates a traffic jam, the function will be activated. In some instances, the car changes lanes to react to a slower vehicle ahead or infrastructural reasons like exit lanes.

L3PILOT APPLICATION
TRAFFIC JAM CHAUFFEUR

1.10.2019
EU EIP 4.2 Torino Workshop
Highlights on Operational Design Domains
L3Pilot Automated Driving Vehicle Functions: motorway chauffeur
Highlights on Operational Design Domains
L3Pilot Automated Driving Vehicle Functions: urban chauffeur
Highlights on Operational Design Domains
Automated Driving Vehicle SAE Level 3
Highlights on Operational Design Domains
Automated Driving Vehicle SAE Level 4

SAE Level 4: High Automation
The driving mode specific performance by an automated driving system of all aspects of the dynamic driving task, even if a human driver does not respond appropriately to a request to intervene.
Highlights on Operational Design Domains

ODD contextualization

Operational Design Domain

• Describes the specific conditions under which a given Automated Driving System (ADS) 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.

Highlights on Operational Design Domains
Automated Driving Vehicle sensing, connecting, positioning
Operational Design Domains: what’s next?
open a dialogue among “Vehicles and Roads”

INTERACTIVE SESSION

Per each **ODD characteristic** let’s open a dialogue:

Shall the vehicle, the road operator, or other actor deal with it?

Shall it be a cooperation among different actors?
Operational Design Domains: what’s next?
Which are the ODDs elements?

1. **Operational terrain, and associated location-dependent characteristics** (e.g., slope, camber, curvature, banking, coefficient of friction, road roughness): dramatic changes can occur in relatively short distances.

2. **Environmental and weather conditions** such as surface temperature, air temperature, wind, visibility, precipitation, icing, lighting, glare, electromagnetic interference, clutter, vibration, and other types of sensor noise.

3. **Operational infrastructure** such as availability and placement of operational surfacing, navigation aids (e.g., beacons, lane markings, augmented signage), traffic management devices (e.g., traffic lights, right of way signage, vehicle running lights), keep-out zones, special road use rules (e.g., time-dependent lane direction changes) and vehicle-to-infrastructure availability.

[Philip Koopman, Frank Fratrik Carnegie Mellon University, Edge Case Research, Jan 19]
Operational Design Domains: what’s next?
Which are the ODDs elements?

4. **Rules of engagement** and expectations for interaction with the environment and other aspects of the operational state space, including traffic laws, social norms, and customary signaling and negotiation procedures with other agents (both autonomous and human, including explicit signaling as well as implicit signaling via vehicle motion control).

5. **Considerations for deployment to multiple regions/countries** (e.g., blue stop signs, “right turn keep moving” stop sign modifiers, horizontal vs. vertical traffic signal orientation, side-of-road changes).

6. **Communication modes** bandwidth, latency, stability, availability, reliability, including both machine-to-machine communications and human interaction.

[Philip Koopman, Frank Fratrik Carnegie Mellon University, Edge Case Research, Jan 19]
Operational Design Domains: what’s next?
Which are the ODDs elements?

7. **Availability and freshness of infrastructure characterization** data such as level of mapping detail and identification of temporary deviations from baseline data. (e.g., construction zones, traffic jams, temporary traffic rules such as for hurricane evacuation).

8. **Expected distributions of operational state space elements** including which elements are considered rare but in-scope (e.g. toll booths, police traffic stops), and which are considered outside the region of the state space in which the system is intended to operate.

[Philip Koopman, Frank Fratrik Carnegie Mellon University, Edge Case Research, Jan 19]
Large-scale, cross-border demonstration of connected and highly automated driving functions for passenger cars
Thank you for your kind attention.

Luisa Andreone

FCA-CRF Global Innovation
Networking, collaborative research

phone: +39 011 9083 071
mobile: +39 335 7755243
email: luisa.andreone@crf.it

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 723051.