MANTRA

TransAID Final Event:
Operational Design Domain & Road Classification

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- MANTRA = Making full use of Automation for National Transport and Road Authorities

- MANTRA responds to the question posed in CEDR Automation Call 2017 Topic A: How will automation change the core business of NRA's

- Duration: 1 Sep 2018 – 31 August 2020
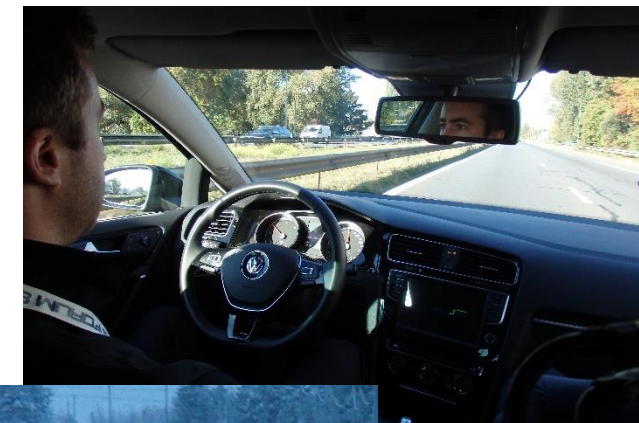
Road operator related ODD attributes

ODD attribute	Physical / Digital infrastructure	Static / Dynamic
Road	Physical	Static
Speed range	Physical	Static
Shoulder or kerb	Physical	Static
Road markings	Physical	Static
Traffic signs	Physical	Static
Road equipment	Physical	Static
Traffic	-	Dynamic
Time incl. light conditions	-	Dynamic
Weather conditions	-	Dynamic

ODD attribute	Physical / Digital infrastructure	Static / Dynamic
HD map	Digital	Static/ Dynamic
Satellite positioning	Digital	Static
Communication	Digital	Static
Information system	Digital	Static
Traffic management	Digital	Dynamic
Infrastructure maintenance*	Physical/Digital	Dynamic
Fleet supervision*	Digital	Dynamic
Digital twin of road network*	Digital	Dynamic

* Added by MANTRA on the basis of input from EU EIP and CEDR workshops

Results on unit costs:

Costs can be quite high esp. For phy- sical infra

ODD attribute	Detailed feature	Unit cost range estimate (deployment)	O&M annually
Shoulder or kerb	Safe "harbours"	40-100 k€/km where needed	8 %
	Passenger pick-up/drop-off point	2-5 k€/point where needed	10 %
Markings and signs	Enhanced maintenance of markings, signs & signals	0.1-0.2 k€/km/a	included
Road furniture	Landmarks for positioning enhancement	4-6 k€/km where needed	10 %
	Signs and/or barriers for access control	15-90 k€/km where needed	8 %
	Game fences	20-30 k€/km where needed	2 %
Traffic management	Standardized marking & efficient management of road works zones, incident/event sites, toll plazas	3-5 k€/km/a	included
	Adaptation of traffic centres, systems and services	10-90 k€/km	8 %
Maintenance	Enhanced snow-removal	2-2.5 k€/km /a (2-lane roads) 3-4 k€/km/a (motorways)	included
HD map non-LIDAR	HD Maps or road areas, infra, equipment	3-4 k€/km	8 %
	HD Maps of road structures for maintenance purposes	5-7 k€/km	8 %
	Road areas & environment	1-3 k€/km/a	included
HD map LIDAR	Road areas & environment with LIDAR point clouds	3-6 k€/km/a	included
GNSS land stations	Satellite positioning enhancement with land stations	0.4-2 k€/km	8 %
Longer range V2I	Base station (micro or macro)	35-40 k€/station/a (macro) 8-10 k€/station/a (micro)	included
Short range V2I	Roadside station	15 k€/km	8%
	Connecting to trunk communication network and servers	fibre optics 20 - 100 k€/km	8 %
Problem and regulation information	High quality real-time situational picture & rules and regulations	Interurban 0.4-0.8 k€/km/a urban 0.1-0.2 k€/km	included
Road works information	VMS/C-ITS warnings	0.5-0.9 k€/km/a	included

- ODDs are crucial for the road operators
  - » Where the benefits of highly automated driving can be achieved
  - » Alterations in physical infrastructure can be very costly
- We need constructive dialogue between stakeholders
  - » **Safe minimum risk manoeuvre specification considering also cases of very large AV fleets OR Additional emergency bays, wide shoulders and safe harbours to accommodate minimum risk manoeuvres for AVs**
  - » **Uniform wear of pavement enabled by wheel path alteration in cross-section implemented by OEMs and ADS providers OR Pavement design and maintenance standards review and adaption to mitigate increased roughing and rutting**
  - » …
- Key issue: continuous evolution of ODD due the advances in sensor, software, AI etc. technologies while road operators build in 2020 roads to last until 2050 or 2070

D2.1	Vehicle fleet penetrations and ODD coverage of NRA-relevant automation functions up to 2040
D3.1	Intermediate report of the state of the art on the impact of automated and connected vehicles
D4.1	Intermediate report on infrastructural consequences
D3.2	Impacts of automation functions on NRA policy targets
D4.2	Infrastructural consequences of connectivity and automation, and recommendations for their implementation
D5.1	Draft road map - road operator core business affected by connectivity and automation
D5.2	Road map for developing road operator core business utilising connectivity and automation

Project web site: www.mantra-research.eu