MAP

TRAFFIC MANAGEMENT

TRAFFIC MANAGEMENT FOR CONNECTED & AUTOMATED VEHICLES

SIP-ADUS WORKSHOP IMPACT ASSESSMENT

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CCAM POTENTIAL

CCAM has the potential to make transport:

- **Safer**: bring down the number of road fatalities and accidents
- **Greener**: help to reduce harmful emissions from transport by smoothening traffic flow and avoiding unnecessary trips
- **More accessible**: ensure inclusive mobility access for all

If it's done "right"!

CCAM DEPLOYMENT CHALLENGES

However, a number of challenges have to be addressed:

- Key technologies still being developed (need to be safe, tested, validated)
- The right legal framework has to be set up (adopted at MS and EU-level)
- CAVs will have to be integrated into the broader transport system and interact with other forms of mobility
- Acceptance and trust in CCAM technology and services, by users and society, has to be nurtured every step of the way

TM4CAD

Traffic Management for Connected & Automated Driving

Consortium

- MAP traffic management (the Netherlands)
- Traficon (Finland)
- Transport & Mobility Leuven (Belgium)
- WMG, University of Warwick (UK)
- Steve Shladover (US – independent)
- Hironao Kawashima (Japan – Keio University)

CEDR Call 2020: Impact of CAD on Safe Smart Roads

https://tm4cad.project.cedr.eu/

CEDR Call 2020: Impact of CAD on Safe Smart Roads

TM4CAD EXPECTED RESULTS

- Project is funded by CEDR Call 2020 Impact of CAD on Safe Smart Roads
- Start: 13 September 2021 | End: 12 March 2023 (18 months)
- 7 workshops and 4 deliverables

- Identify the full range of **ODD attributes** for consideration, based on experience from working on ODD issues in standardization activities and in other related research projects;
- Integrate the very different perspectives of the CAD vehicle system developers and the road authorities and operators to **focus on the areas of intersection** between them;
- Introduce the concept of **ODD attribute awareness** and the role of infrastructure in it;
- Develop recommendations based on understanding the technical constraints on the ODD-relevant **information that can be perceived and exchanged in real time** by the NRAs and the sensing systems on the CAD-equipped vehicles;
- Provide insights on how to support CAD operation and ODD management, and **how ISAD should be refined** for traffic management use, and
- Detail how traffic management systems and CAD vehicles can **best interact** to improve traffic operations.

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TRAFFIC MANAGEMENT FOR CAVS

- To what extent is Traffic Management different for CAVs?
- Sending information to humans driving vehicles or vehicles being driven by software requires a different approach
- How is information being interpreted? What level of context awareness?
- Mixed traffic conditions add complexity
- Define appropriate driving behaviour and response of CAVs
- Related to specific Operational Design Domains (ODD)
- There's a difference between automating vehicles and automating traffic

4CAD TRAFFIC MANAGEMENT

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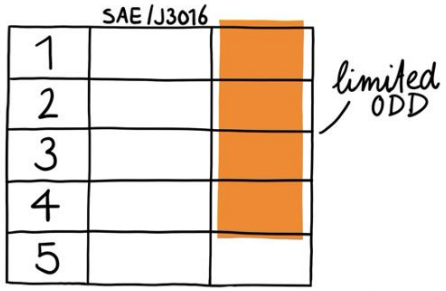
OPERATIONAL DESIGN DOMAIN (ODD) FRAMEWORK

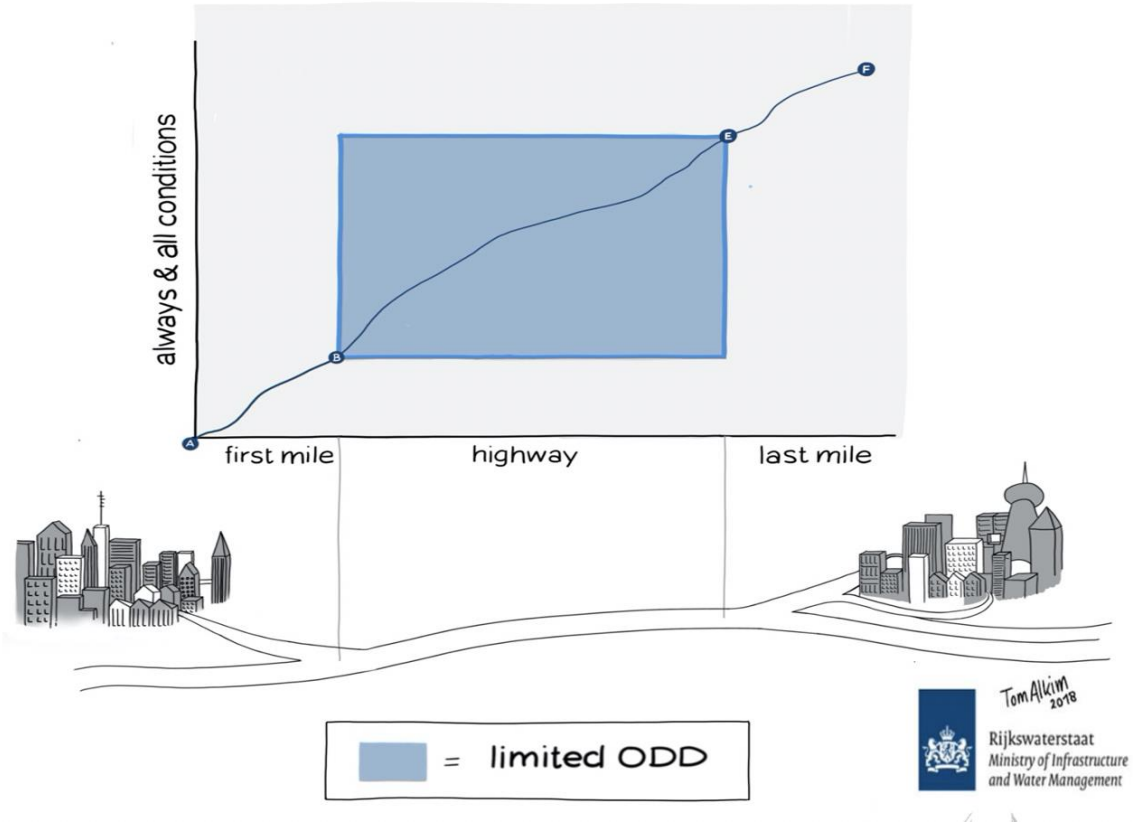
STORYLINE ODD FRAMEWORK

A
Driver leaves home to drive to work. First mile is driven manually.

B
... gives control to vehicle (ToC) and continues the trip in automated mode. Does something else with the freed up time, like reading email, posting on instagram or drinking coffee.

E
Vehicle approaches the exit and driver prepares to take back control (ToC) and drives last mile manually to destination.





ODD FRAMEWORK

infrastructure – traffic - weather

STORYLINE ODD FRAMEWORK

A
Driver leaves home to drive to work. First mile is driven manually.

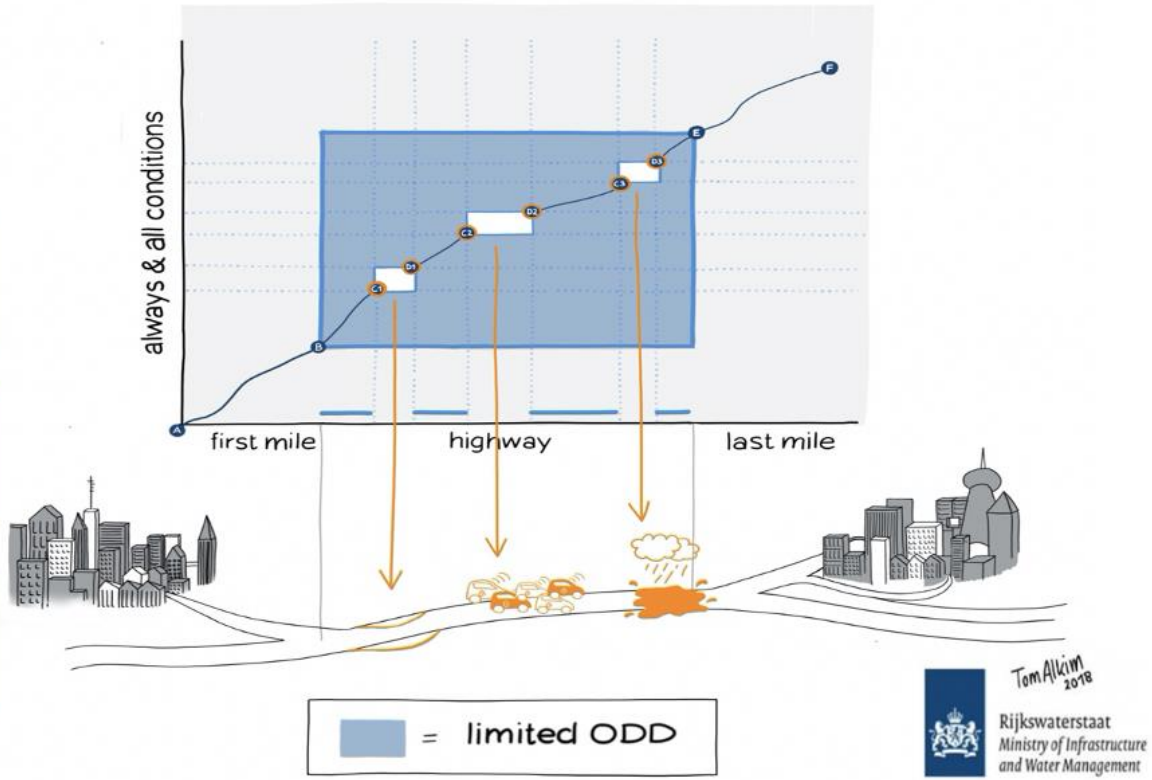
B
... gives control to vehicle (ToC) and continues the trip in automated mode. Does something else with the freed up time, like reading email, posting on instagram or drinking coffee.

C1
During the trip vehicle encounters temporary lane markings, vehicle is confused and ODD ends. Driver needs to take over control (ToC).
D1
Conditions back to normal, ODD is available again, driver gives back control (ToC).

C2
During the trip vehicle has to merge in heavy mixed traffic, vehicle can't handle the situation and ODD ends. Driver needs to take over control (ToC).
D2
Conditions back to normal, ODD is available again, driver gives back control (ToC).

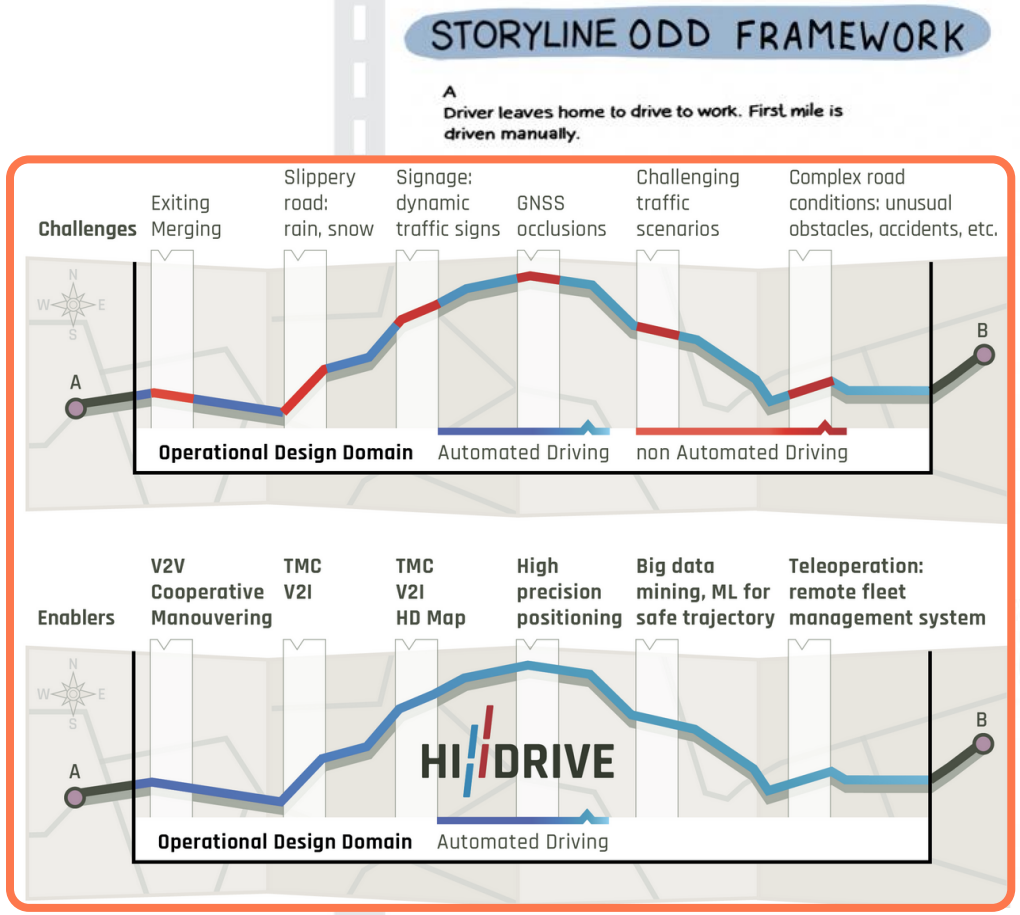
C3
During the trip a heavy rain shower occurs, vehicle can't handle the situation and ODD ends. Driver needs to take over control (ToC).
D3
Conditions back to normal, ODD is available again, driver gives back control (ToC).

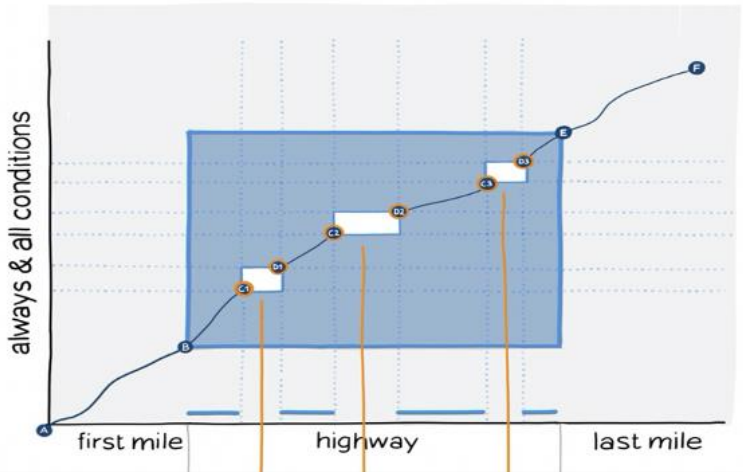
E
Vehicle approaches the exit and driver prepares to take back control (ToC) and drives last mile manually to destination.

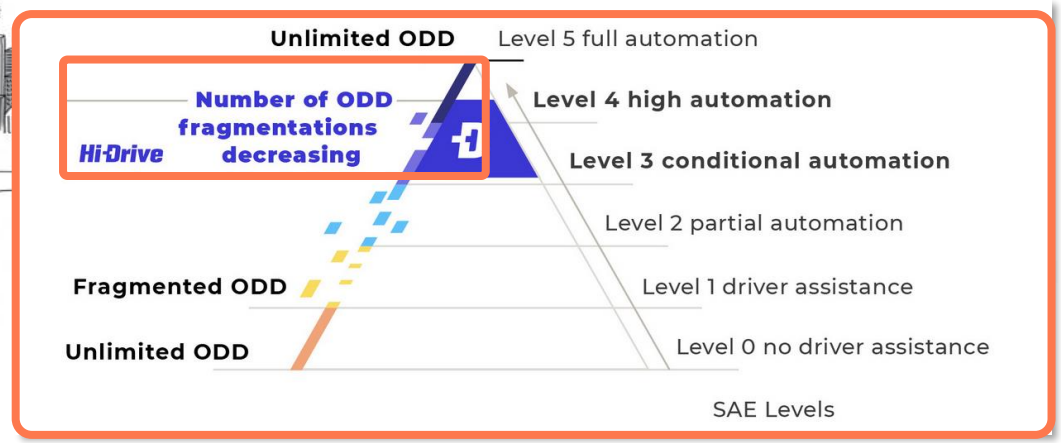


ODD FRAMEWORK

infrastructure – traffic - weather

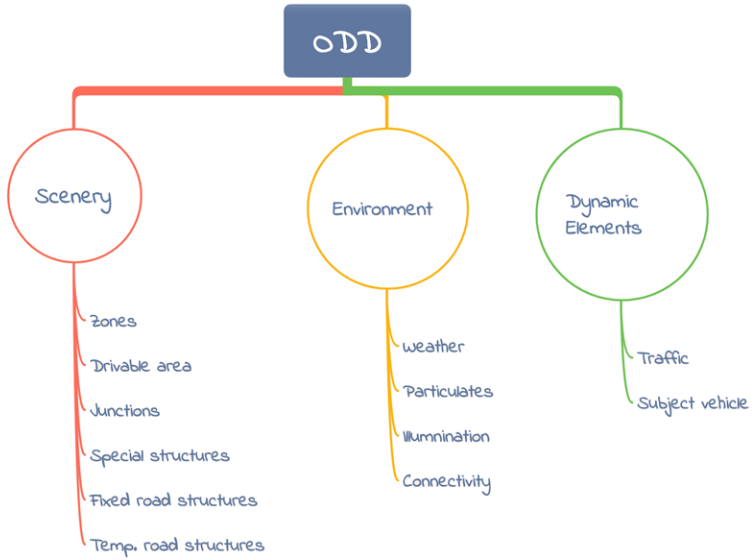






DISTRIBUTED ODD AWARENESS

- Any ODD attribute can be measured via off-board sensing
- Every ODD attribute doesn't need to be measured via off-board sensing
- Off-board measurements will require infrastructure investment
- Connectivity implicitly becomes a requirement



TRAFFIC MANAGEMENT 4CAD

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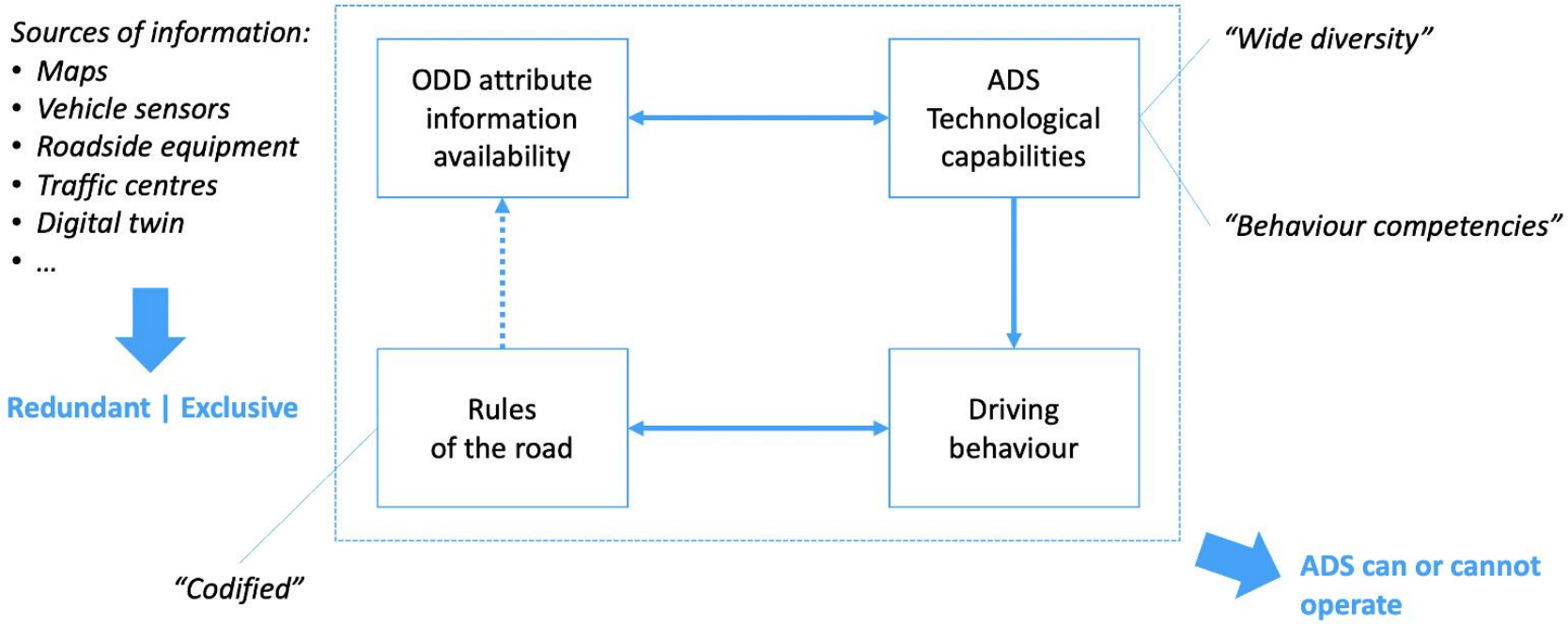
DISTRIBUTED ODD AWARENESS

Distributed ODD Awareness: CAD Safety Assurance



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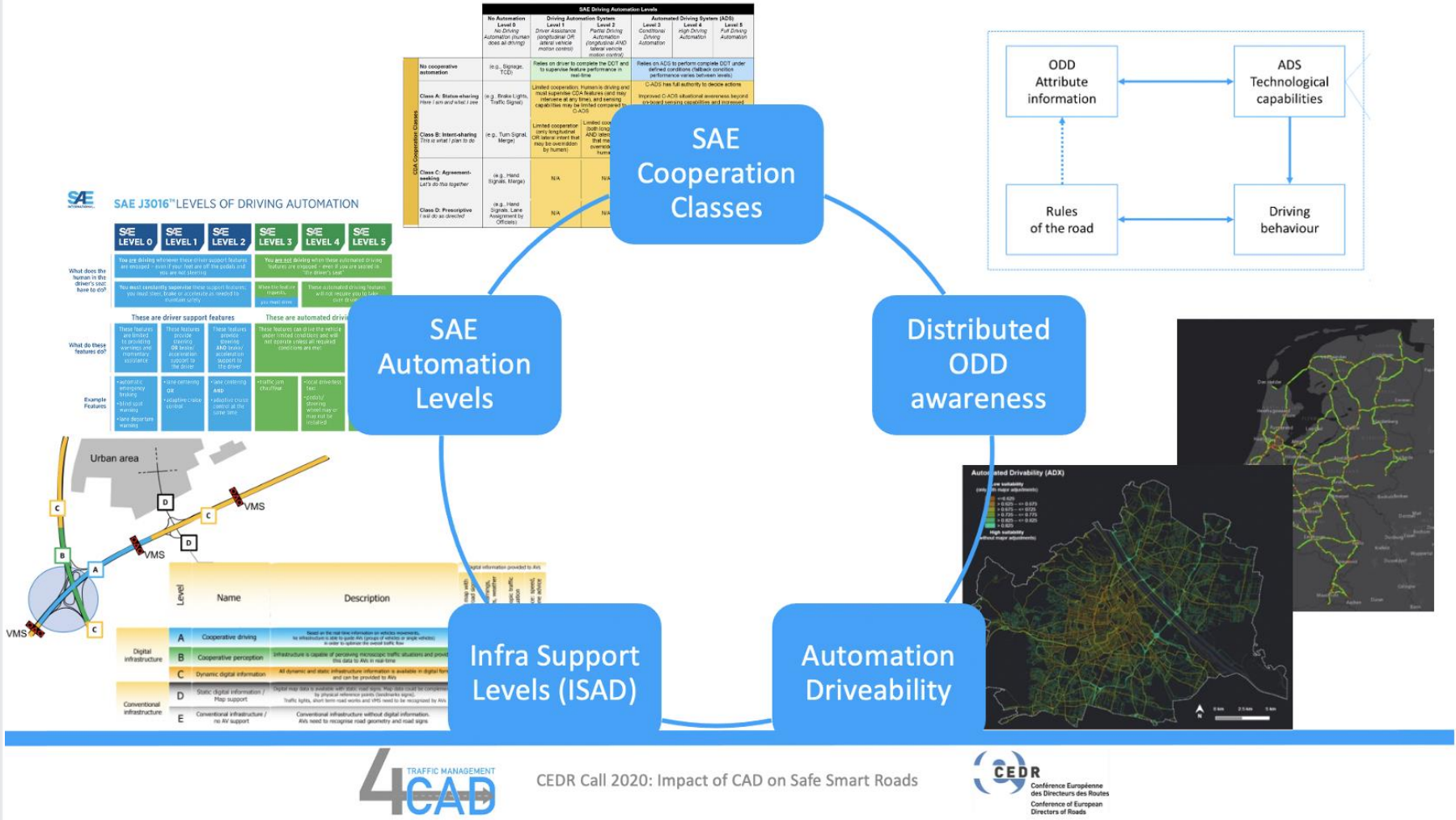
MULTI DISCIPLINARY INTERPLAY DETERMINES AUTOMATION DRIVEABILITY



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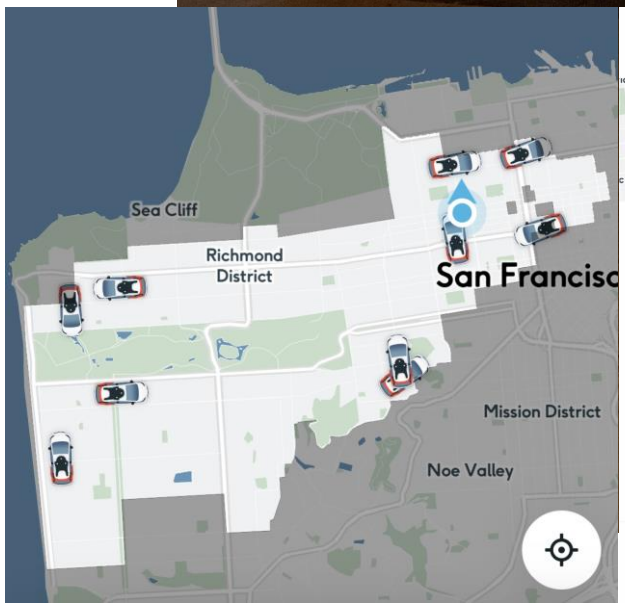
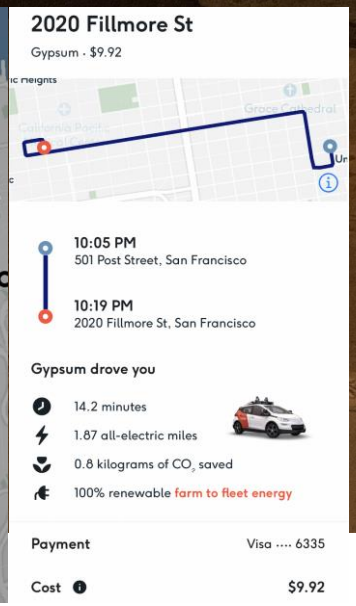
AUTOMATED DRIVING IN PRACTICE, CRUISE IN SF





AUTOMATED DRIVING IN PRACTICE, CRUISE IN SF

ROAD WORKS

DOUBLE PARKED CARS

EDGE CASE

AUTOMATED DRIVING IN PRACTICE CRUISE IN SF

ROAD WORKS

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EDGE CASE

TRAFFIC MANAGEMENT

Thank you for your attention!

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