ERTRAC WG
“Connectivity and Automated Driving”

Working Group workshop on Roadmap update
04 May 2021

Online meeting rules:

Indicate your full name and the organisation you represent

Please keep your microphone on mute!

Do not use the camera.

To ask a question, provide an input or ask for the floor: please **use the chat box.** Wait for the chair to give you the floor.

Agenda

- Welcome, introduction to CCAM and new roadmap “Connected, Cooperative and Automated Driving”
- Proposal of new Roadmap structure
- Discussion on main messages and Use cases
- Info on CCAM Association
- Conclusion and next steps

Increase safety in road transport

Reduce negative impacts from road transport on environment

Strengthen competitiveness of European industries

Ensuring inclusive mobility and goods access for all

CCAM

CONNECTED, COOPERATIVE & AUTOMATED MOBILITY

European leadership in safe and sustainable road transport through automation

CAD Roadmap version 9.0 – for ITS World Congress

- Focus on **Enablers and Domains** of **Connected Cooperative Automated Driving**.
- Deeper dive into five domains and their use cases for people and goods mobility:
  - **Corridors → Highway Automation**
  - **Confined Areas/Parking → Urban Mobility**
  - **Rural Automation steps**
- Connect to the CCAM Partnership Strategic Research and Innovation Agenda and provide **an EU wide overview** (and beyond).
- Stronger **cooperation model** needed between Vehicle Industry, Communication Industry and Road Operators.

Key messages - structure of roadmap

(1) Vision 2050:
Specific automation domains have linked/combined, transport modes are synchronized

a. All modes have their role (individual/shared/rail/ship/air) -> make clear: no competition between public and private transport!
b. All vehicles have automation but in different levels (assisted, automated, autonomous)
c. Key challenges: AI (Ethics, Data), validation methods (Scenario Databases), infrastructure support (tbd.)
d. Societal Goals are all addressed by CCAD in the context of the EC vision

Key messages - structure of roadmap

(2) Agenda 2030 – key topic for today (working structure):
Separate domains develop and offer a large variety of use cases (Decade of co-creation research and technology)

a. **Confined Autonomy** - will show more and more mastering complexity, main use cases are parking, separate lanes, hub-internal mobility, highway construction sites with strong infra support
b. **Assisted Corridors** - will enable hub2hub truck operation and cooperative assistance with strong infra support
c. **Highway Automation** - will show more and more mastering speed with selected infra support to enrich the ODD for cars and trucks including platooning
d. **Urban Autonomy** - will master complexity with growing speeds and so enable wider ODDs in unrestricted mixed traffic
e. **Rural Assistance** with first Autonomy approaches - will realize safety benefits to all and enable autonomous shuttles in sparsely populated areas on specific tracks and first autonomous municipal and delivery services

Key messages - structure of roadmap

(3) Outlook 2040:
Use cases widen up and grow together (Decade of maturity)

a. Corridors and Highway grow together
b. Confined areas grow and merge into full Urban Autonomy shuttles and delivery
c. Rural Autonomy will expand on specific tracks and within the settlements

(4) Enablers: Strong interaction between Technologies, Infrastructure and Transport / Traffic / Fleet Management, link to CCAM clusters 2-5

a. Details on enablers (Vehicle/Infrastructure/Validation Enablers)
b. Key Enabling Technologies (Digital HD maps, functional safety, …)

Key messages - structure of roadmap

(5) International comparison: update since 2019

(6) Projects: update since 2019

(7) Technical standardization: ISO vs. regional standards (USA, China)

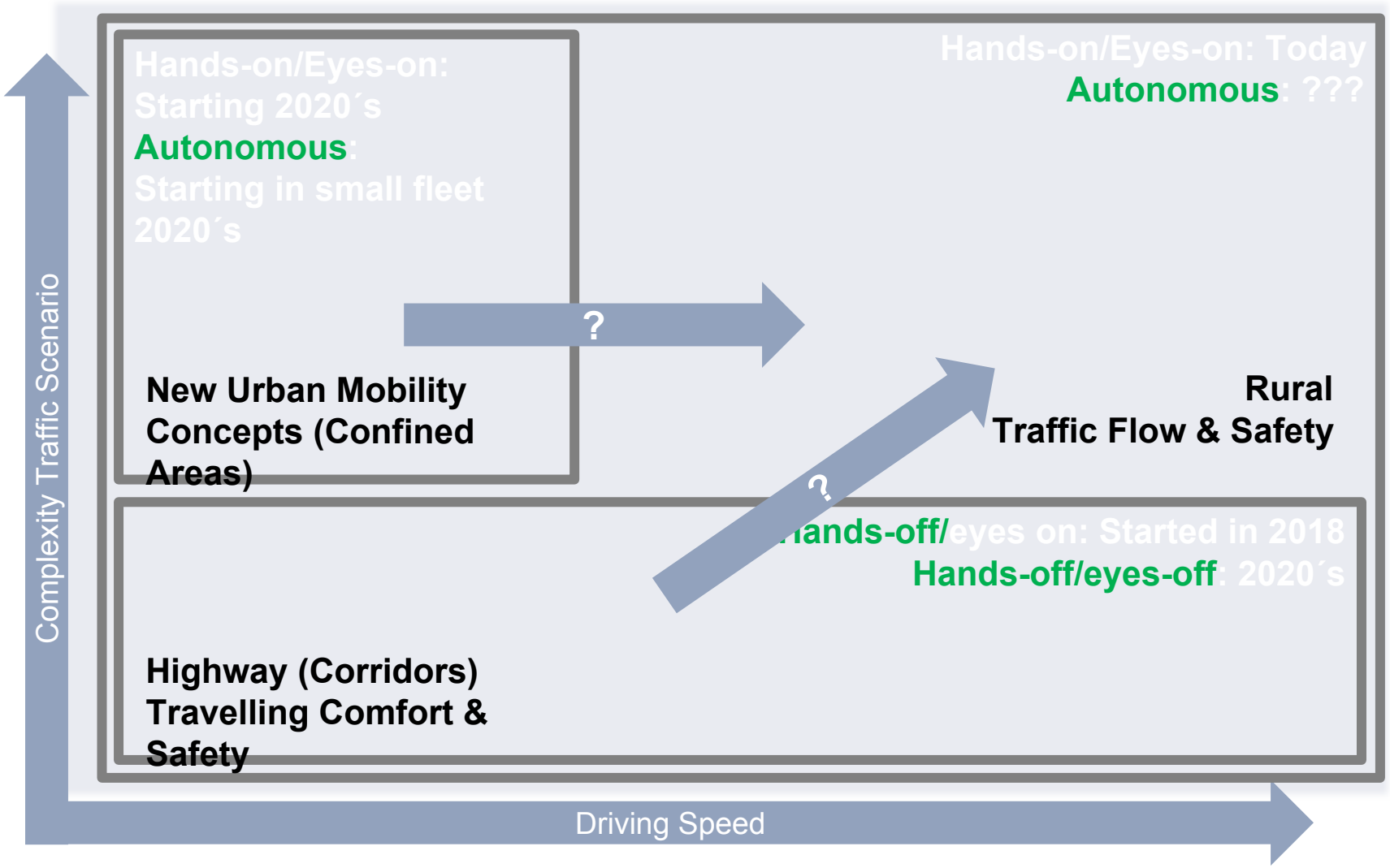
(8) Regulation: deeper overview, as many initiatives under way

(9) Annex: new and relevant definitions to understand the document

a. BASt defines:
   assisted = L0-2
   automated = L3+4 with driver /
   autonomous (but still connected, high communication needs) = l4+5 driverless
b. …

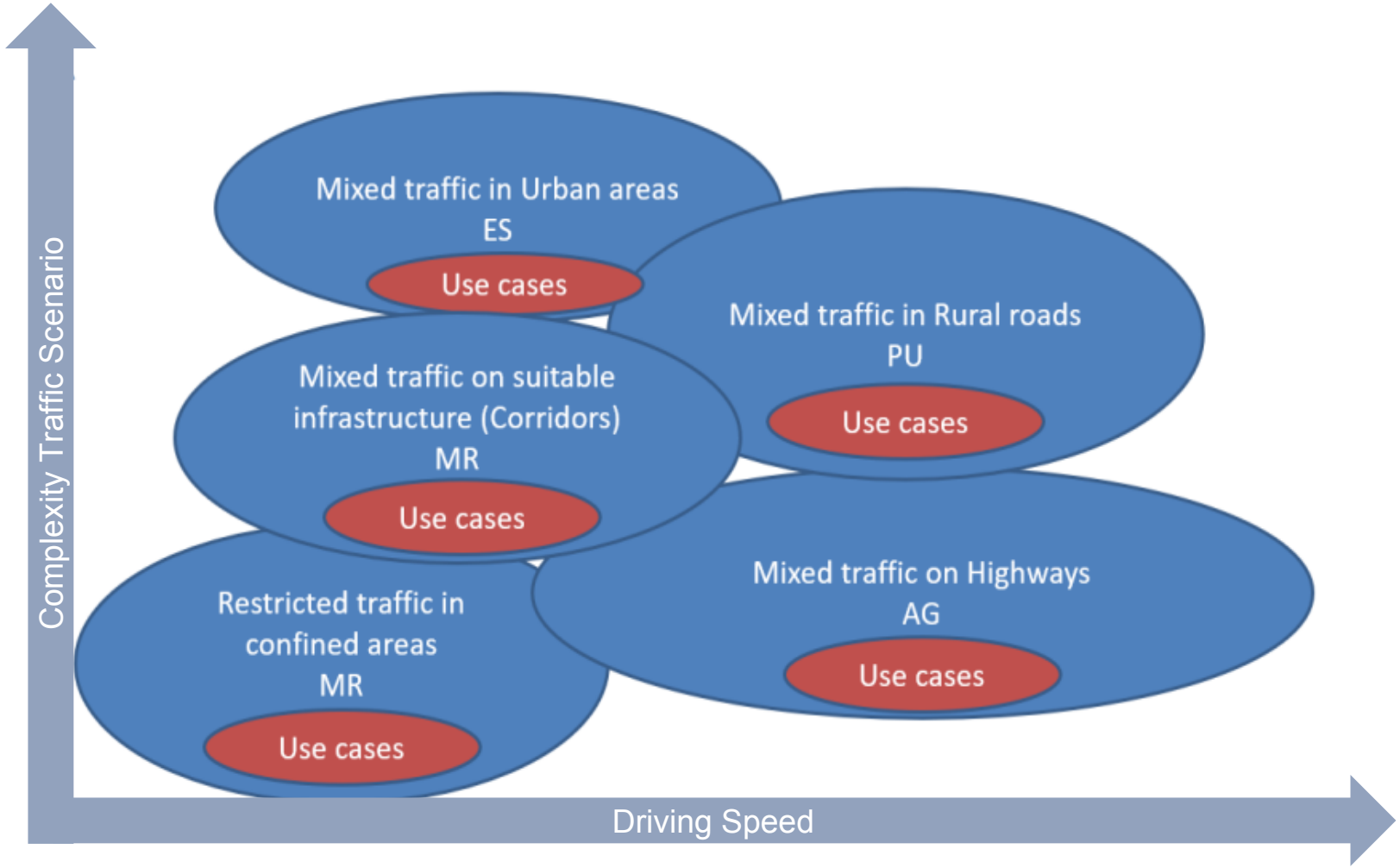
(2) AGENDA 2030: In decades 2020-2050, separate domains develop and grow together

ERTRAC 2019: WHAT DRIVES TECHNOLOGY? ROLLOUT LIMITED BY SCENARIO COMPLEXITY AND DRIVING SPEED.



(2) AGENDA 2030: In decades 2020-2050, separate domains develop and grow together

MORE CONCRETE DOMAINS TO EXPLAIN BETTER THE ROLLOUT STEPS.



(2) Agenda 2030: domains develop and grow together on the basis of common enablers → (4) Strong interaction Technologies, Infrastructure and Traffic management

AG

Corridors → Highway

→ mastering speed

Technological enablers	Highway		Corridor	
	Vehicle	Infrastr.	Vehicle	Infrastr.
2020-2030	Perception Interaction with traffic	ISAD B/C	Perception Cooperative driving	ISAD A Realtime digit twin
2030-2040	Costs/uptake Extended ODD	ISAD A (relevant areas) ISAD B/C (other areas)	Costs/uptake Extended ODD	ISAD A
2040-2050	See Rural	See Rural	See Rural	See Rural

Rural

→ mastering high speed in high complexity traffic

Technological enablers	Vehicle	Infrastr.
2020-2030	Costs/uptake/performance	ISAD D/E (HD map + RTTI)
	Perception on a higher level	

Parking / Confined Areas → Urban

→ mastering traffic complexity

Technological enablers	Confined		Urban	
	Vehicle	Infrastr.	Vehicle	Infrastr.
2020-2030	C2X com-munication	Perception Safety	Perception Interaction with traffic First small ODD	ISAD C/D
2030-2040	Uptake Extended ODD	Uptake Extended ODD	Costs/uptake ODD	Realtime digital twin
2040-2050	See Rural		See Rural	

Corridors will enable more and more use cases on highways to master speed challenges

Corridors → Highway

→ mastering speed

Technological enablers	Highway		Corridor	
	Vehicle	Infrastr.	Vehicle	Infrastr.
2020-2030	Perception Interaction with traffic	ISAD B/C	Perception Cooperative driving	ISAD A Realtime digital twin
2030-2040	Costs/uptake Extended ODD	ISAD A (relevant areas) ISAD B/C (other areas)	Costs/uptake Extended ODD	ISAD A
2040-2050	See Rural	See Rural	See Rural	See Rural

(2) Agenda 2030: Domain canvasses 2030 - Example: domain highway

MR

Description
- Highway with L3-4 in mixed traffic, with limited ODD
- Start with small market up-take and ODD, which can then be extended

Motivation
- Use case traffic jam on highway is important in metropolitan regions
- Important enabler for L3 and higher automation levels in future

Use Cases
- Traffic Jam Chauffeur:
  - L3 in traffic jam up to 60km/h, following vehicle in front, optionally with lane change
  - System can bring veh. to safe stop in lane, if driver does not take over on request
- Highway Chauffeur:
  - L3 on highway up to 130km/h, incl. lane ch.
  - System can bring veh. to safe stop on emergency lane
- Highway Pilot Platooning:
  - L4 on highway up to 130km/h
  - No driver intervention needed

Standardisation
- *Test methodology*
- Standardization of interfaces, components and tooling

Regulation
- ALKS extension nearly finished
- UN ECE (VMAD, FRAV), NHTSA (ANPRM), CATARC (GB/T) on-going

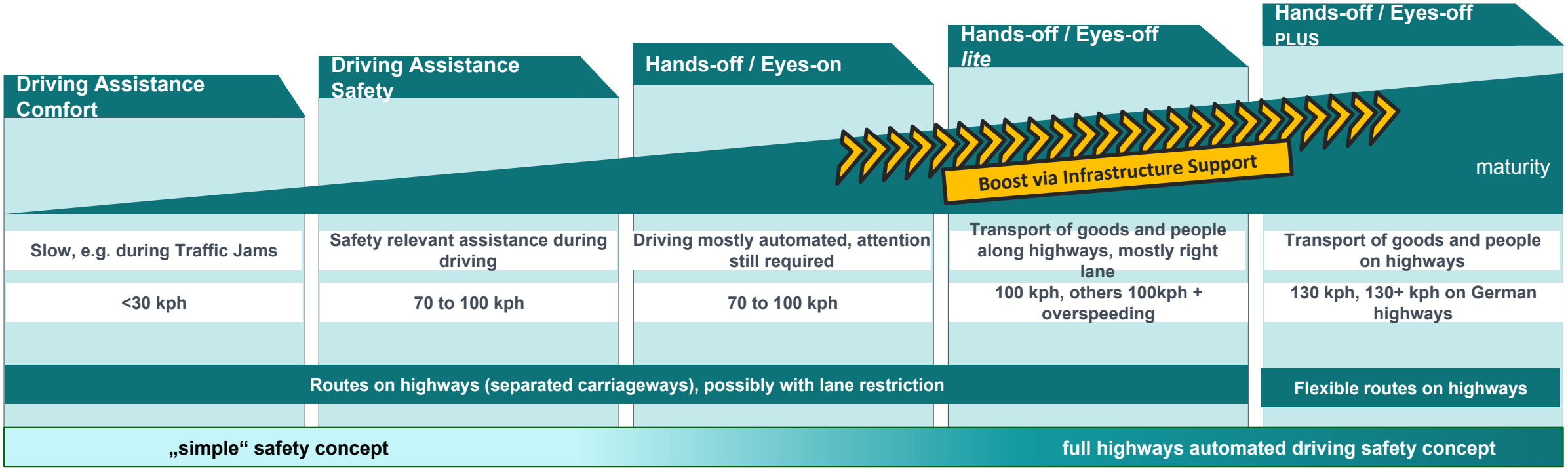
Vehicle Enablers
- Sense: first use of laser scanner and multi-sensor fusion (>=3 sensors)
- Plan: safe&fast interaction with other traffic participants in dynamic sit., reinforcement learning techn. for driving strat.

Infrastructure Enablers
- HD map and RTTI for all use cases (ISAD B-C)
- Additionally, C2X for platooning (ISAD A)

Validation Enablers
- Common test methodology, based on data base of crit. scenarios (edge cases)
- Scaling and mapping of test results to validation targets

Societal benefits, Demonstrations
- Acceptance of positive risk balance (vs. human model)
- Transparency on safety-relevant incidents (near-misses)
- FOT for impact analysis (safety, customer time, energy efficiency)

(2) Agenda 2030 & (3) Outlook 2040: corridors first enabled for better highway use cases



Low Speed use cases will evolve and combine to master traffic complexity challenges

Parking / Confined Areas → Urban

→ mastering traffic complexity

Technological enablers	Confined		Urban	
	Vehicle	Infrastr.	Vehicle	Infrastr.
2020-2030	C2X com-munication	Perception Safety	Perception Interaction with traffic First small ODD	ISAD C/D
2030-2040	Uptake Extended ODD	Uptake Extended ODD	Costs/uptake ODD	Realtime digital twin
2040-2050	See Rural		See Rural	

(2) Agenda 2030: Domain canvasses 2030 - Example: domain confined area

Description
Confined areas have surrounding under control, no or controlled mixed traffic, specific use cases depending on area

Use Cases
- AVP Type 2 (Infrabased) L4
- automated vehicle transport in production plants to trucks and trains or in harbors for shipment

Standardisation
Connectivity Interfaces
Functional Safety of Infrastructure
Common evaluation of perception performance (vehicles and infra)

Motivation
Much quicker introduction of L4 possible, due to reducing risks by other traffic participants

Regulation
Operation in confined area but under traffic rules

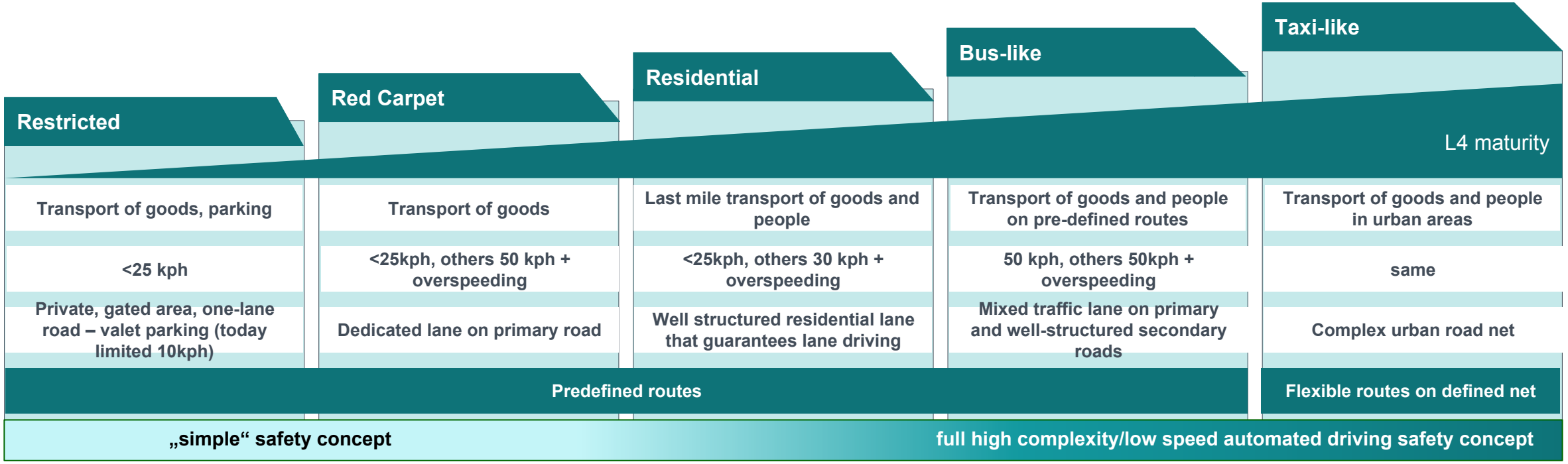
Vehicle Enablers
Realtime reaction on connected safety functions

Infrastructure Enablers
Realtime Traffic control

Validation Enablers
Functional Safety of the whole traffic system
Efficient validation toolchain

Societal benefits, Demonstrations
High early acceptance

(2) Agenda 2030 & (3) Outlook 2040: various use cases from confined to urban



Speed and complexity combine on rural roads.

Rural

→ mastering high speed in high complexity traffic

Technological enablers	Vehicle	Infrastr.
2020-2030	Costs/uptake/performance	ISAD D/E (HD map + RTTI)
2030-2040	Perception on a higher level First small ODD	ISAD B/C on high level roads
2040-2050	Full ODD for defined road network	ISAD A in relevant areas ISAD B/C in all areas Realtime digital twin

(2) Agenda 2030: Domain canvasses 2030 - Example: domain rural roads (L0-2)

Description
- Focus on L0-2 for increased safety in a large variety of situations (no ODD limitation)
- Technology and regulation are mature, focus is on increasing market up-take and extending functionalities

Motivation
- L0-2 can have substantial contribution to improving road safety (54% of EU road fatalities on rural roads) based on low-cost systems (cost-benefit optimization)
- L3-5 not yet in focus, due to high complexity of situations (enabling first in other domains)

Use Cases (examples)
- Automatic Emergency braking
- Lane Departure Warning System
- Adaptive Cruise Control
- Steering and Lane Control Assistant

Standardisation
- Standardization of test procedures / rankings
- Standardization of interfaces, components and tooling

Regulation
- Worldwide alignment of existing regulation
- Incentives for increased market-up take (safety benefit)

Vehicle Enablers
- Constantly improving environment perception
- Reducing costs for increased marked up-take

Infrastructure Enablers
- Digital map with information on road signs, weather, incidents, …

Validation Enablers
- Increased virtual testing for cost reduction
- Field monitoring
- Human factors (mode awareness)

Societal benefits
- High potential in improving safety
- Reduction of accident-related costs (e.g. insurance policy)

Demonstrations
- Impact assessment of L0-2 systems on market (safety, human factors)

(2) Agenda 2030: Domain canvasses 2030 - Example: domain rural roads (L3-4)

Description
Rural roads have mixed traffic (incl. wildlife, agricultural machinery etc.),
relatively high speeds (v ≤ 110 km/h),
typically oncoming traffic,
large variation in road infrastructure types and conditions as well as in quality of digital map data and connectivity

Motivation
- Improving road safety (54% of EU road fatalities on rural roads)
- Ensuring inclusive mobility for all
- Reducing congestion on access roads to cities
- Reducing labour costs
  → more cost-efficient service provision

Use Cases (examples)
- Automated shuttles in sparsely populated areas

- Automated municipal + delivery services in rural areas

Standardisation
- PDI requirements for rural road network

Regulation
Almost completely missing

Societal benefits
- Highest potential in improving safety and inclusivity
- Counteracting rural depopulation

Demonstrations
- Early deployment in public transport / municipal services extending from urban into rural areas

Vehicle Enablers
- Constantly improving environment perception
- Ability to cope with limited PDI support incl. bad road surface conditions

Infrastructure Enablers
- Availability of up-to-date HD maps of rural road network
- Reliable connectivity
- Provision of non-stationary infrastructure support

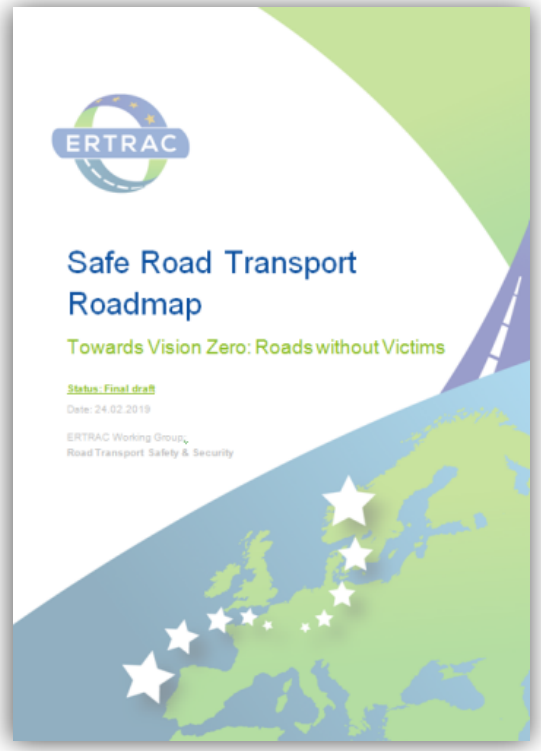
Validation Enablers
- Integration of safety-critical scenarios specific to rural roads in EU wide database (incl. diverse lighting / road conditions + edge cases)

Update of ERTRAC Safe Road Transport Roadmap

PU

Current ERTRAC "Safe Road Transport Roadmap"

- Published at ERTRAC Conference on 4 April 2019
- Very well received by the EC
- Good reflection of contents in Horizon Europe Cluster 5 WP 2021-2022



Update 2021

- Targeting WP 2023-2024 and 2025-2027
- Updating process kicked off in WG meeting on March 24th with 40 participants from a broad range of stakeholders

Safety Research Needs within the Thematic Scope of the CCAM Partnership (I)

PU

Assessment of road user capabilities in future scenarios of road transport

- How to avoid degradation of driving skills with an increased use of level 4 systems? How much skill is required by future drivers?
- How can humans be trained to cooperate with highly or fully automated vehicles?

Specific safety issues of highly and fully automated vehicles

- Reliability and required redundancy level of safety-critical in-vehicle systems
- Passenger safety in the context of new in-vehicle furniture (e.g. tables…)
    - Impact of side effects (like motion sickness) of new seating positions

Safety Research Needs within the Thematic Scope of the CCAM Partnership (II)

PU

Preparing the regulatory framework for safe, secure and inclusive CCAM

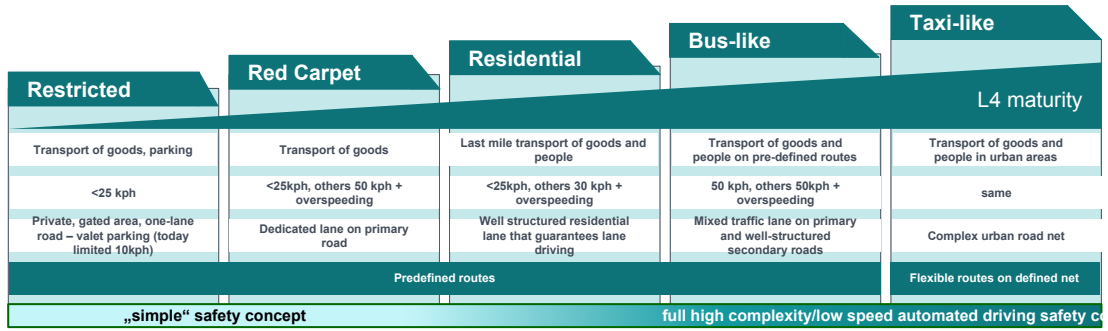
- Identification of traffic rules which need to be adapted for smooth and safe inclusion of highly automated vehicles in the road transport system
- Identification and assessment of criminal threat scenarios in future shared automated vehicles → Need for protection solutions?

Traffic management in automated public mobility services

- New roles and tasks in control rooms
- Remote operations, remote interaction with passengers and remote maintenance

\+ Approaches to develop “automation-ready” infra-structures in low- and middle-income countries

(2) Agenda 2030: Core use cases of domains 2030 in detail & (3) Outlook 2040: large variety of use cases

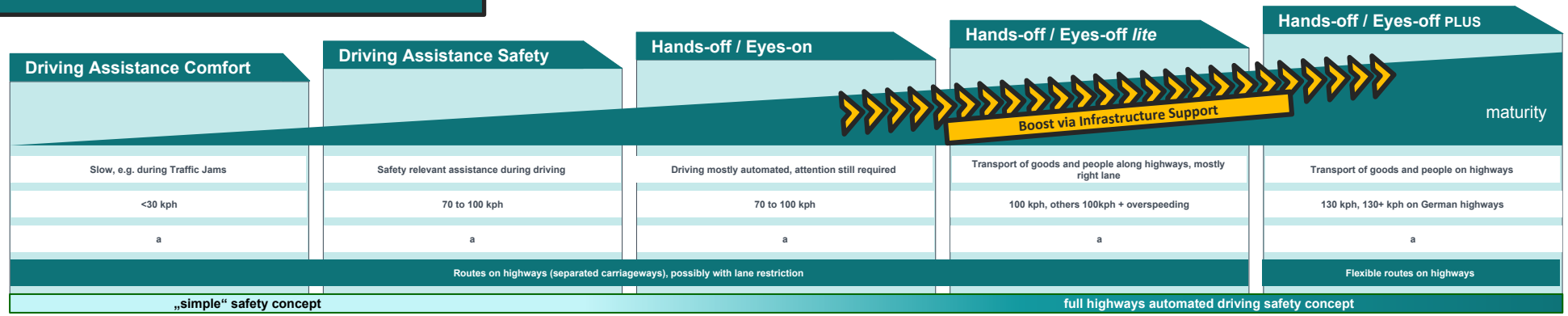


Maintenance vehicles & highway safety trailers

Most complex scenario: high speed on rural roads

How to implement all this to work on rural roads? Results of technology implementation from urban and highway automation can fuse to enable safe automation for rural roads also including oncoming traffic

Maintenance vehicles w/o traffic at all?



Complexity of Traffic Scenario

Driving Speed

Automated Driving Matrix

Further Increase scope to better cover Connected Automated Driving, including cooperative and connected vehicles

- New research programs starting 2021 (CEF2, CEDR R&D2020, etc.)
  - ⇨ Role of non-EC funding programs?
- Emphasis on Connectivity:
  - Engage with DG CNCT, TelCos/Mobile Network Operators (MNOs), etc.
- Statement on requirements for a joint deployment roadmap:
  - Stronger cooperation model needed with Communication Industry and Vehicle Industry (TelCos, MNOs, OEMs, Technology Providers for vehicles and infrastructure, etc.) and ROs
  - Hybrid Communication Model for ***C***-ITS-G5 and 3G/4G/5G
  - **Common use case definition needed to define starting use cases**
    - *Without a roadmap here, **connected** automated vehicles won't happen*
- ERTRAC Roadmap can be this roadmap!

Set a framework on PDI for CCAD

- How can we establish common ground?
- What do infrastructure providers need from vehicle/mobility providers, and vice versa?
- How to incorporate the role of ISAD here? ⇨ cover all automation levels on traffic as well as transport
- Both sides: infrastructure requirements regarding:
  - Physical infrastructure
  - Digital infrastructure/connectivity
  - Digital Twin
- ODD & ISAD Framework – link between the two, need for base ODD
- Digital Traffic Regulations (DTR)
- Edge Services on the road (results of CEDR R&D2017, living labs, etc.)

Functional Safety

MH

Challenge

Reaching out towards different SAE levels (with and without human driver fallback scenarios), there are situations which cannot be handled by the AD vehicle autonomously. These situations are mostly time critical.

It is paramount to reach a common framework that guarantees overall functional safety. In these situations, the perception system of the AD vehicle requires additional sensor information from the road infrastructure, i.e. the perception system has to be extended to infrastructure sensors. Consequently, the concept of **functional safety has to be applied to the overall system of vehicle and infrastructure.**

Use Cases

- Tunnel entrance
- Freeway entry
- Blind intersections

Increase safety in road transport

Reduce negative impacts from road transport on environment

Strengthen competitiveness of European industries

Ensuring inclusive mobility and goods access for all

CCAM

CONNECTED, COOPERATIVE & AUTOMATED MOBILITY

European leadership in safe and sustainable road transport through automation

New CCAM Association to support the Partnership

Open to all types of research stakeholders:

- **Industry**
  - Automotive manufacturers
  - Automotive supply chain
  - Physical and digital infrastructure (including ITS, telecom, connectivity)
- **Research**
  - Universities
  - Research institutes, R&D providers
- **Services**
  - Public transport operators
  - Mobility providers for the transport of passengers (MaaS, vehicle sharing, rental, …)
  - Freight and logistics services and users
  - Other services: insurance, maintenance, repair, etc.
- **Public authority**
  - National Ministry
  - National transport authority, road authority, road operator
  - Local and regional authorities and transport authorities
- **Association**
  - Stakeholder representation association at European level
  - Platform or cluster at national or regional level
  - Civil society representation

New CCAM Association: membership status

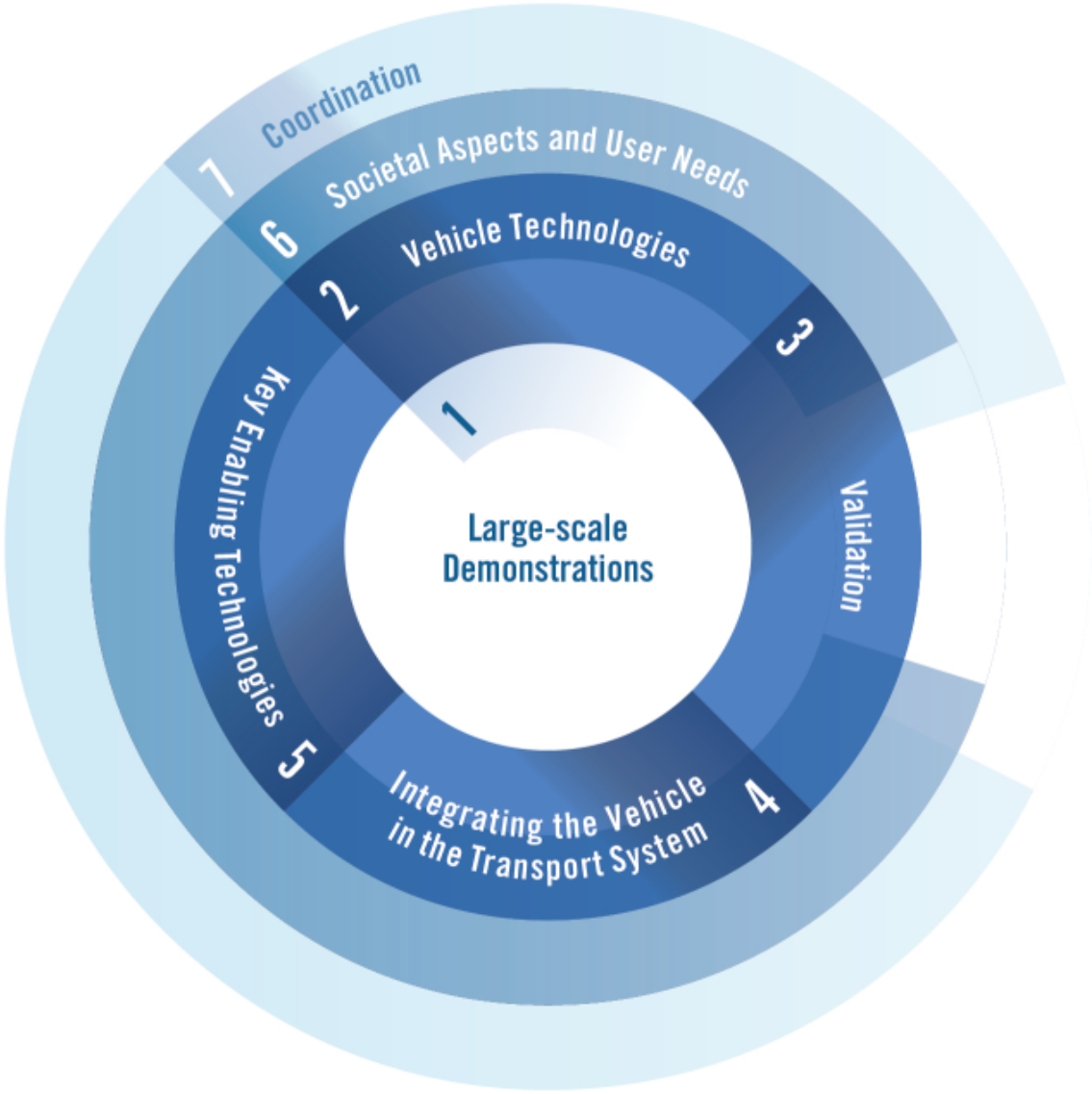
- **144 Members** were endorsed at the first General Assembly on 14 April.
- We will continue to gather members. No deadline to apply. Some membership categories have no or very few members: we will take actions to promote membership, and welcome your support to do so.
  - Public transport operators
  - Mobility providers for the transport of passengers (MaaS, vehicle sharing, rental, …)
  - Freight and logistics services and users
  - Local and regional authorities and transport authorities

CCAM Clusters

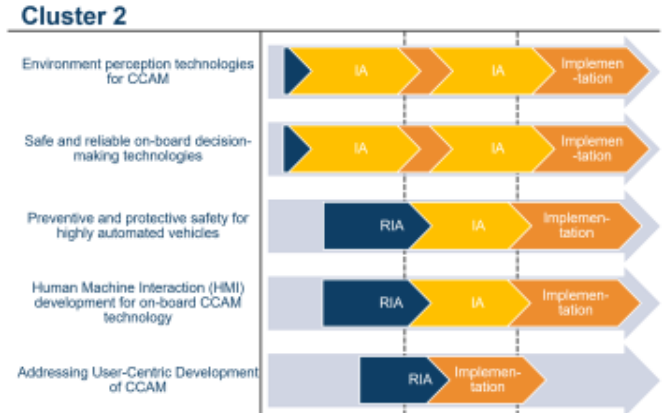
The CCAM Partnership will be organised following the 7 Clusters of the SRIA - Strategic Research and Innovation Agenda.

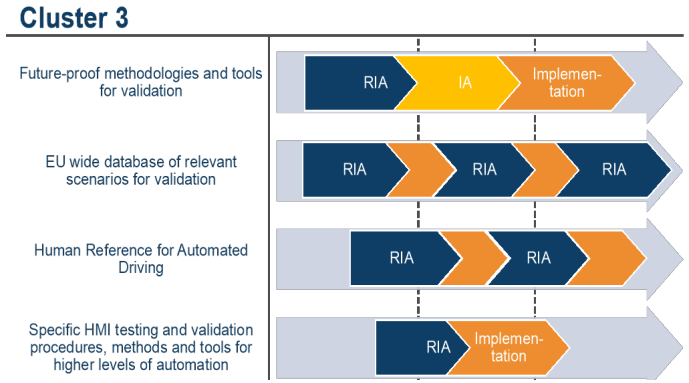
The work of the association will be developed following these 7 Clusters.

We will always refer to the SRIA for guidance on the content and on the objectives to be achieved by the Partnership.

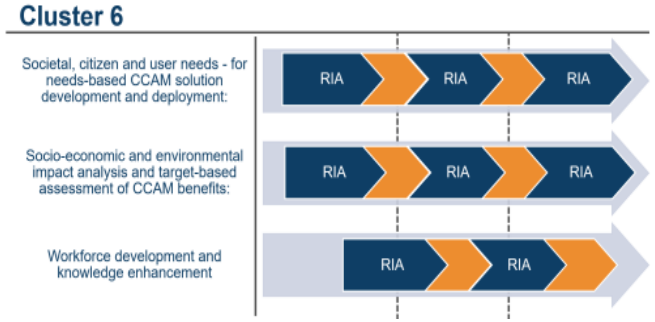


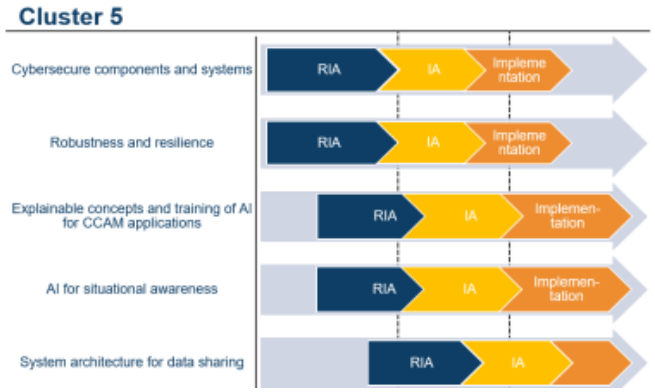
(4) Strong interaction Technologies, Infrastructure and Traffic management

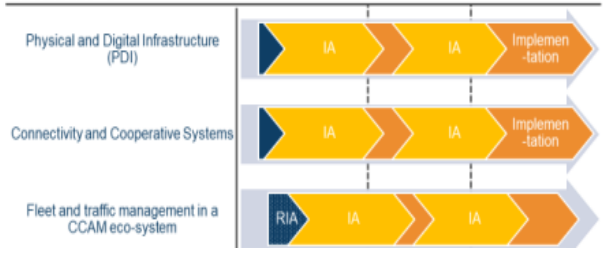


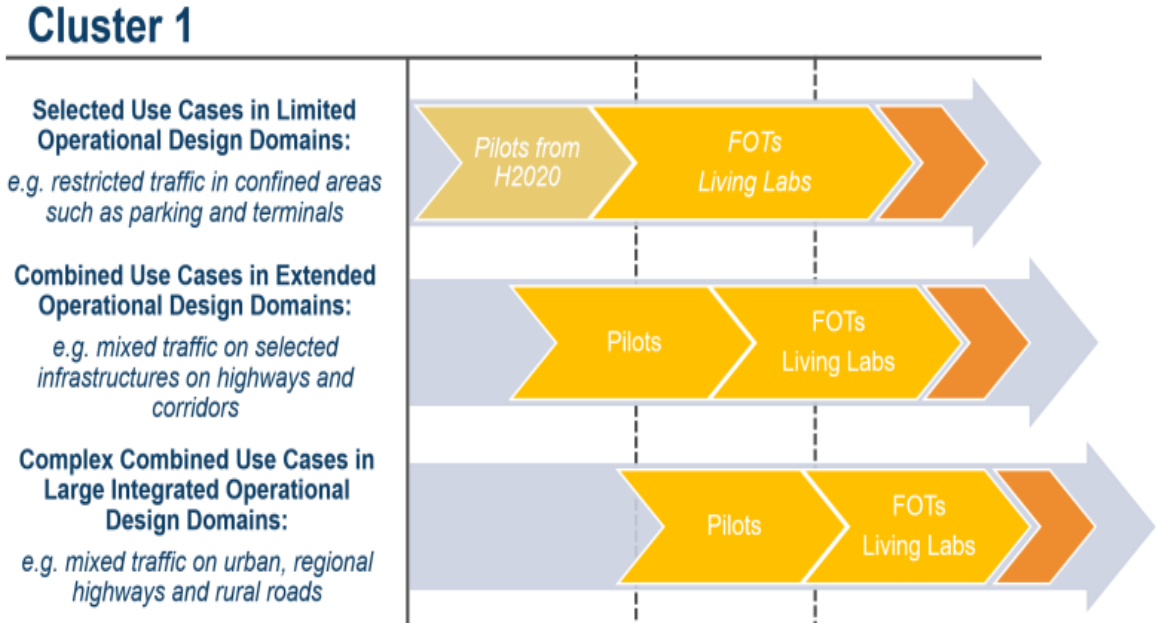


Cluster 7 is accompaniing the whole process









CCAM SRIA: ENABLERS AND OUTCOMES.

AG

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Next Steps / Milestones in 2021

- ERTRAC Annual Conference: online, in July (date tbc)
- ITS World Congress Hamburg: 11-15 October
- H2020 RTR Conference: 14-15 December (tbc)