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
European leadership in safe and sustainable road transport through automation

- 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
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.**

- **Hands-on/Eyes-on:** Starting 2020’s
  - **Autonomous:** Starting in small fleet 2020’s
- **New Urban Mobility Concepts (Confined Areas)**
- **Highway (Corridors):** Travelling Comfort & Safety
- **Rural Traffic Flow & Safety**
- **Hands-off/Eyes-off:** Started in 2018
  - **Hands-off/eyes-off:** 2020’s

Complexity Traffic Scenario

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

<table>
<thead>
<tr>
<th>Technological enablers</th>
<th>Highway</th>
<th>Corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle</td>
<td>Infrastr.</td>
<td>Vehicle</td>
</tr>
<tr>
<td>Perception</td>
<td>ISAD B/C</td>
<td>Perception</td>
</tr>
<tr>
<td>Interaction with traffic</td>
<td></td>
<td>Cooperative</td>
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<tr>
<td>ISAD A</td>
<td>Realtime digital twin</td>
<td></td>
</tr>
<tr>
<td>2020-2030</td>
<td>ISAD A (relevant areas)</td>
<td>Costs/uptake Extended ODD</td>
</tr>
<tr>
<td>2030-2040</td>
<td>ISAD B/C (other areas)</td>
<td>ISAD A</td>
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<tr>
<td>2040-2050</td>
<td>See Rural</td>
<td>See Rural</td>
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<tr>
<td>Description</td>
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<td>-------------</td>
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<tr>
<td>Highway with L3-4 in mixed traffic, with limited ODD</td>
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<tr>
<td>Start with small market up-take and ODD, which can then be extended</td>
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<table>
<thead>
<tr>
<th>Use Cases</th>
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<tbody>
<tr>
<td>Traffic Jam Chauffeur:</td>
</tr>
<tr>
<td>- L3 in traffic jam up to 60km/h, following vehicle in front, optionally with lane change</td>
</tr>
<tr>
<td>- System can bring veh. to safe stop in lane, if driver does not take over on request</td>
</tr>
<tr>
<td>Highway Chauffeur:</td>
</tr>
<tr>
<td>- L3 on highway up to 130km/h, incl. lane ch.</td>
</tr>
<tr>
<td>- System can bring veh. to safe stop on emergency lane</td>
</tr>
<tr>
<td>Highway Pilot Platooning:</td>
</tr>
<tr>
<td>- L4 on highway up to 130km/h</td>
</tr>
<tr>
<td>- No driver intervention needed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standardisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test methodology</td>
</tr>
<tr>
<td>Standardization of interfaces, components and tooling</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use case traffic jam on highway is important in metropolitan regions</td>
</tr>
<tr>
<td>Important enabler for L3 and higher automation levels in future</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALKS extension nearly finished</td>
</tr>
<tr>
<td>UN ECE (VMAD, FRAV), NHTSA (ANPRM), CATARC (GB/T) on-going</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vehicle Enablers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sense: first use of laser scanner and multi-sensor fusion (&gt;=3 sensors)</td>
</tr>
<tr>
<td>Plan: safe&amp;fast interaction with other traffic participants in dynamic sit., reinforcement learning techn. for driving strat.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Infrastructure Enablers</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD map and RTTI for all use cases (ISAD B-C)</td>
</tr>
<tr>
<td>Additionally, C2X for platooning (ISAD A)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Validation Enablers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common test methodology, based on data base of crit. scenarios (edge cases)</td>
</tr>
<tr>
<td>Scaling and mapping of test results to validation targets</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Societal benefits, Demonstrations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptance of positive risk balance (vs. human model)</td>
</tr>
<tr>
<td>Transparency on safety-relevant incidents (near-misses)</td>
</tr>
<tr>
<td>FOT for impact analysis (safety, customer time, energy efficiency)</td>
</tr>
</tbody>
</table>
(2) Agenda 2030 & (3) Outlook 2040: corridors first enabled for better highway use cases

- **Driving Assistance**
  - Comfort: Slow, e.g. during Traffic Jams (<30 kph)
  - Safety: Safety relevant assistance during driving (70 to 100 kph)
  - Routes on highways (separated carriageways), possibly with lane restriction

- **Hands-off / Eyes-on**
  - Lite: Driving mostly automated, attention still required (70 to 100 kph)
  - Boost via Infrastructure Support

- **Hands-off / Eyes-off PLUS**
  - Transport of goods and people along highways, mostly right lane (100 kph, others 100kph + overspeeding)
  - Flexible routes on highways

- **Hand-off / Eyes-off**
  - Transports of goods and people on highways (130 kph, 130+ kph on German highways)

- **full highways automated driving safety concept**
Low Speed use cases will evolve and combine to master traffic complexity challenges

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**Parking / Confined Areas → Urban**

→ mastering traffic complexity

<table>
<thead>
<tr>
<th>Technological enablers</th>
<th>Confined</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vehicle</strong></td>
<td><strong>Infrastr.</strong></td>
<td><strong>Vehicle</strong></td>
</tr>
<tr>
<td><strong>2020-2030</strong></td>
<td>C2X communication</td>
<td>Perception Safety</td>
</tr>
<tr>
<td><strong>2030-2040</strong></td>
<td>Uptake Extended ODD</td>
<td>Uptake Extended ODD</td>
</tr>
<tr>
<td><strong>2040-2050</strong></td>
<td>See Rural</td>
<td>See Rural</td>
</tr>
</tbody>
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[www.ertrac.org](http://www.ertrac.org)
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

<table>
<thead>
<tr>
<th>Restricted</th>
<th>Red Carpet</th>
<th>Residential</th>
<th>Bus-like</th>
<th>Taxi-like</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport of goods, parking</td>
<td>Transport of goods</td>
<td>Last mile transport of goods and people</td>
<td>Transport of goods and people on pre-defined routes</td>
<td>Transport of goods and people in urban areas</td>
</tr>
<tr>
<td>&lt;25 kph</td>
<td>&lt;25kph, others 50 kph + overspeeding</td>
<td>&lt;25kph, others 30 kph + overspeeding</td>
<td>50 kph, others 50kph + overspeeding</td>
<td>same</td>
</tr>
<tr>
<td>Private, gated area, one-lane road – valet parking (today limited 10kph)</td>
<td>Dedicated lane on primary road</td>
<td>Well structured residential lane that guarantees lane driving</td>
<td>Mixed traffic lane on primary and well-structured secondary roads</td>
<td>Complex urban road net</td>
</tr>
</tbody>
</table>

Predefined routes
- "simple" safety concept
- Full high complexity/low speed automated driving safety concept

Flexible routes on defined net
Speed and complexity combine on rural roads.

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Enabler</th>
<th>Technology Enabler</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020-2030</td>
<td>Costs/uptake/performance</td>
<td>ISAD D/E (HD map + RTTI)</td>
</tr>
<tr>
<td>2030-2040</td>
<td>Perception on a higher level</td>
<td>ISAD B/C on high level roads</td>
</tr>
<tr>
<td></td>
<td>First small ODD</td>
<td></td>
</tr>
<tr>
<td>2040-2050</td>
<td>Full ODD for defined road network</td>
<td>ISAD A in relevant areas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ISAD B/C in all areas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Realtime digital twin</td>
</tr>
</tbody>
</table>
(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

**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)

**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)

**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 ($v \leq 110$ km/h), typically oncoming traffic, large variation in road infrastructure types and conditions as well as in quality of digital map data and connectivity.

**Use Cases (examples)**
- Automated shuttles in sparsely populated areas
- Automated municipal + delivery services in rural areas

**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 $\rightarrow$ more cost-efficient service provision

**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)

**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
Update of ERTRAC Safe Road Transport Roadmap

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)

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)

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” infrastructures 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

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.
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

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

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 accompanying the whole process

Cluster 1
Selected Use Cases in Limited Operational Design Domains:
e.g. restricted traffic in confined areas such as parking and terminals
Combined Use Cases in Extended Operational Design Domains:
e.g. mixed traffic on selected infrastructures on highways and corridors
Complex Combined Use Cases in Large Integrated Operational Design Domains:
e.g. mixed traffic on urban, regional highways and rural roads

Pilots from H2020 FOTs Living Labs
Pilots FOTs Living Labs
Pilots FOTs Living Labs

Cluster 2
Environment perception technologies for CCAM
Safety and reliable on-board decision-making technologies
Predictive and protective safety for highly automated vehicles
Human Machine Interaction (HMI) development for on-board CCAM technology
Addressing User Centre Development of CCAM

Cluster 3
Future-proof methodologies and tools for validation
EU wide database of relevant scenarios for validation
Human Reference for Automated Driving
Specific HMI testing and validation procedures, methods and tools for higher levels of automation

Cluster 4
Physical and Digital Infrastructure (PDI)
Connectivity and Cooperative Systems
Fleet and traffic management in a CCAM ecosystem

Cluster 5
Cybersecurity components and systems
Robustness and resilience
Explainable concepts and training of AI for CCAM applications
All for situational awareness
System architecture for data sharing

Cluster 6
Societal, citizen and user needs - for needs-based CCAM solution development and deployment:
Social-economical and environmental impact analysis and target-based assessment of CCAM benefits;
Workforce development and knowledge enhancement

CCAM SRIA: ENABLERS AND OUTCOMES.
www.ertrac.org
Contact: marzena.jougounoux@ertrac.org
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)