CAT Coalition
Planning Scenarios Working Group
October 28, 2020 Webinar
Notes and Summary of Discussions

Welcome

Matt Hardy welcomed everyone to the call. Justine Sydello recapped the agenda for today and alerted everyone to the upcoming AASHTO Annual meeting.

Zenzic AV Planning

Matt Hardy introduced Michael Talbot and Richard Porter to present the Zenzic Connected Autonomous Mobility Testbed and 2030 Roadmap. Michael Talbot introduced that Zenzic was set up in 2017 as a partial public/not for profit agency to advance automated vehicles. Richard Porter introduced himself and presented the approach to defining the capabilities needed to deliver automated vehicles at scale. Richard introduced the CAM Testbed in the UK. A copy of Michael and Richard's slides were circulated prior to the webinar. Key points and takeaways from the presentation are as follows:

- The testbed included six public test environments that allow organizations to conduct trials on public roads.

- The testbed findings are all connected through data capturing and data sharing. There were challenges getting agencies to share AV data. Zenzic created a model for data sharing by demonstrating the value possible by the joint effort, and this helped to motivate the sharing of data.

- It was noted that interoperability is the key. Three areas were presented (Simulation, proving group, Real world) data is at the center of all three and is the key to maintaining interoperability.

- The effort created a Safety Framework, now adopted as a UK standard and now working with government to bring it back in and determine how it will impact legislation re AVs

- Most all projects in recent years include simulation. Noted a challenge with stove piping of simulation. Noted they are trying proof of concept for coordinated simulation.

Notes on the presentation of the 2030 Roadmap include:

- The Roadmap is a tool to be used by decision makers, investors, etc.

- It includes a summary of benefits (e.g. reduced safety issues of human error (86% of road injury collision); productivity; access to transport; economic growth).

- It was noted that if they took all the milestones and dependences, it would take until 2079 to deliver the vision, but the strategy interweaves these to deliver by 2030.

- Noted that the effort was built upon and leveraged 13 Foundational Roadmaps from other organizations (national and international) and the effort pulled out milestones to create a strategic view).
- As of the most recent update, participation in developing the roadmap included 200 organizations that contributed to roadmap, and 300+ individuals who contributed.
  - This broad level of input gives an unbiased view of the future
- Highest level view of the roadmap:
  - Covers 4 themes (society and people, vehicles, infrastructure, Services)
  - 600 milestones in the roadmap
  - A total of 57 major deliverables are defined in the roadmap
- A graphic illustrated key stages of development and expected timeframes, as follows:
  - Improved safety through assistive features now
  - Highway automation 2026
  - Automated hub to hub operation 2027
  - End customer unattended delivery 2030
- The roadmap can be viewed at the Zenzic website at: www.Zenzic.io/roadmap

Michael and Richard responded to questions from the group:

- Michael Talbot noted that car companies, manufacturers, and other stakeholders all had different approaches. Getting everyone together allowed them to collaborate and communicate better. It was one of the unforeseen and more powerful outcomes of the exercise.

- Philip asked about ongoing updates? Richard noted that in regard to planning for connectivity, especially where high density 5G is needed and how that can be done, there is ongoing updates being developed and reviewed. A question that is often asked is "when can the highway authority stop putting up road signs and start taking others down?". Answer is not likely until 2030, but maybe can avoid 'concrete' type structures. There is more on this in the roadmap.

- Matt asked if local authorities were involved in development of roadmap. Yes, they were. Michael noted the Transport Technology Forum works intensively with local agencies to advance their understanding of technologies, implications, and use of them, helping with the technical expertise.

Survey

Philip noted that the working group chairs recently met and identified some candidate activities this working group could address. A mentimeter poll was used to allow attendees to offer express their interest in a series of candidate activities. The results of the poll are illustrated below.

Please indicate your interest level in pursuing each of the following topics.
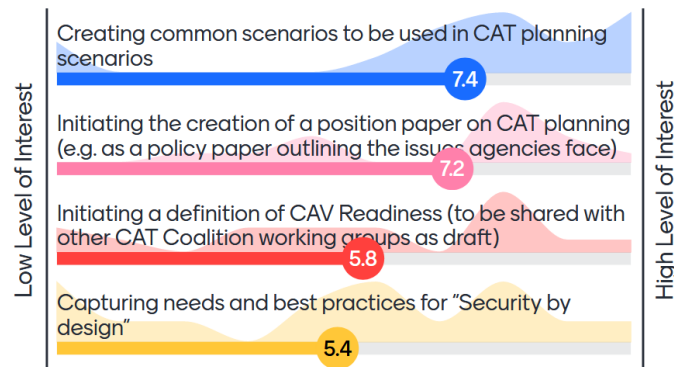
MAASTO CAV Summit

Kristen White (Minnesota DOT) summarized the outcomes of the 2nd MAASTO CAV e-Summit that took place on October 22-23, 2020. The two-day online Summit included a series of state DOT CAV updates and expert presentations on Day 1, followed by a series of breakouts on Day 2 (for DOT officials only) designed to drill down into several important topics.

This Summit follows on the heels of the inaugural 2019 MAASTO CAV Summit that led to a regional MOU among the MAASTO state DOTs. The MOU commits signatories to:
- Ongoing information sharing, sharing best practices, collaborating on regional projects
- Developing a regional strategy for CAV for the region
- Hosting an annual summit

Attendees at this year's Summit confirmed the region's vision as being:
- A national leader in collaborative advancement of connected and automated technologies to increase transportation safety, create a thriving Midwest economy, shape national transportation policy, and enhance quality of life.

Equally important was its mission to:
- Advance regional safety and collaboration to promote unified policy, interoperability across boundaries, and establish cooperative public-private partnerships to safely test and deploy emerging technologies that advance regional and community transportation needs.

The deliberations yielded 14 short, medium, and long-term strategies that emanated from the following Day 2 breakout groups. The eight breakout and working groups included:
- CAV impacts to DOTs (organizational development)
- Research

- Data sharing
- Model AV legislation and engaging policy makers
- Automated freight and platooning
- CAV regional forecasting and planning
- Coordination with local/tribal governments
- Accessibility, equity and unmet transportation needs

The figure below is a snapshot of Kristin's presentation, identifying the short, medium, and long-term strategies that were identified.

2030 MAASTO CAV STRATEGIES

SHORT-TERM STRATEGIES	MEDIUM-TERM STRATEGIES	LONG-TERM STRATEGIES
1. Research CAV impacts on transportation budgets, projects, operations and business needs 2. Leverage industry partners/ academia to research CAV issues 3. Identify opportunities to share data collected across states (and address data governance) 4. Work with local communities to address accessibility and equity for those with unmet transportation needs 5. Host an annual CAV conference 6. Encourage DOTs to understand legislative concerns about CAV, including those that impact DMVs	7. Develop model AV legislation 8. Engage law enforcement and first responders regarding enforcement and public safety 9. Work with Mid-America Freight Coalition to prioritize freight movements for regional CAV efforts 10. Collaborate to develop uniform minimum following distance platooning laws 11. Create a CAV regional forecasting and scenario plans	12. Understand how long-range transportation planning is impacted by platooning, connected vehicle technologies, autonomous shuttles, and other CAV technologies 13. Support local governments in preparing for CAV through education and continued communication 14. Coordinate on US DOT grant opportunities

Member Updates and Volunteers for Future Planning Presentations

Matt Hardy updated the group on the likely meeting of the FCC on November 18, 2020 to vote on the approval of the 5.9 spectrum for unlicensed services.

Christos Xenophontos with PIARC asked for help in responding to a comprehensive survey being conducted as part of PIARC's TC 1.1 on the Performance of Transport Administration. The Survey is part of the research that TC 1.1 is doing on into the Role of Transport Agencies in Responding to and Shaping New Transport Technologies and Service Models. You can access the Survey here: https://www.piarc.org/en/News-Agenda-PIARC/News/2020-10-23,Take-part-in-PIARCs-survey-on-the-Future-of-Transport-November-2020.htm.

Mark Norman from TRB drew attention to the nine white papers coming out of TRB's Shared Mobility Forum.

Matt Hardy identified several potential topics for future webinars (Ohio, Pennsylvania, Michigan collaboration; Minnesota Automated Package Delivery; and Fairfax County (VA) Local AV Shuttle Demonstration)

He also drew attention to future work to take place under the auspices of NCHRP 23-15 for Prioritization of Risks Related to Connected and Automated Vehicles and Emerging Technologies.

Next Webinar and Close

The Planning Work Group Co-chairs and supporting staff are working on the 2021 calendar of webinars with the intention to follow the same frequency and timing as the 2020 webinars.

CAT Planning Working Group – October 28, 2020 Webinar Participants

- Matt Hardy
- Justin Sydello
- Daniela Bremmer
- Cynthia Jones
- Tom Kearney
- Shane McKenzie
- Amanda Hamm
- Kandee Bahr Worley
- Will Lusk
- Virginia Reeder
- Tom Kern
- Charles Wade
- Melanie Alvord
- Abbas Mohaddes
- Linda Sitz

- Kristin White
- Hari Sripathi
- Ali Lohman
- Kyle Miller
- Charles Wade
- Scott Belcher
- Mark Norman
- Mike Floberg
- Mark Wingate
- Jeremy Raw
- Gummada Murthy
- Ray Derr
- Dean Deeter

CAM Testbed UK

Data   Parking   Rural   Highways   Urban   Physical   Virtual

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CAM Testbed UK

CAVWAY
Configurable junctions
Flexible connectivity

HORIBA MIRA-Coventry University CAV Testbed
Urban parking
Limit of controllability
Connected and configurable

Midlands Future Mobility
Highly connected real-world and digital environments

ConVEx Project
Data
Virtual

Millbrook-Culham Urban Testbed
Secure site
Controlled and semi-controlled

Smart Mobility Living Lab
Public and private London roads
Digital and real-world testing

BIRMINGHAM

ALL WITHIN 3HRS

LONDON

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Interoperability is a key

Simulation

Data

Proving Ground

Real World
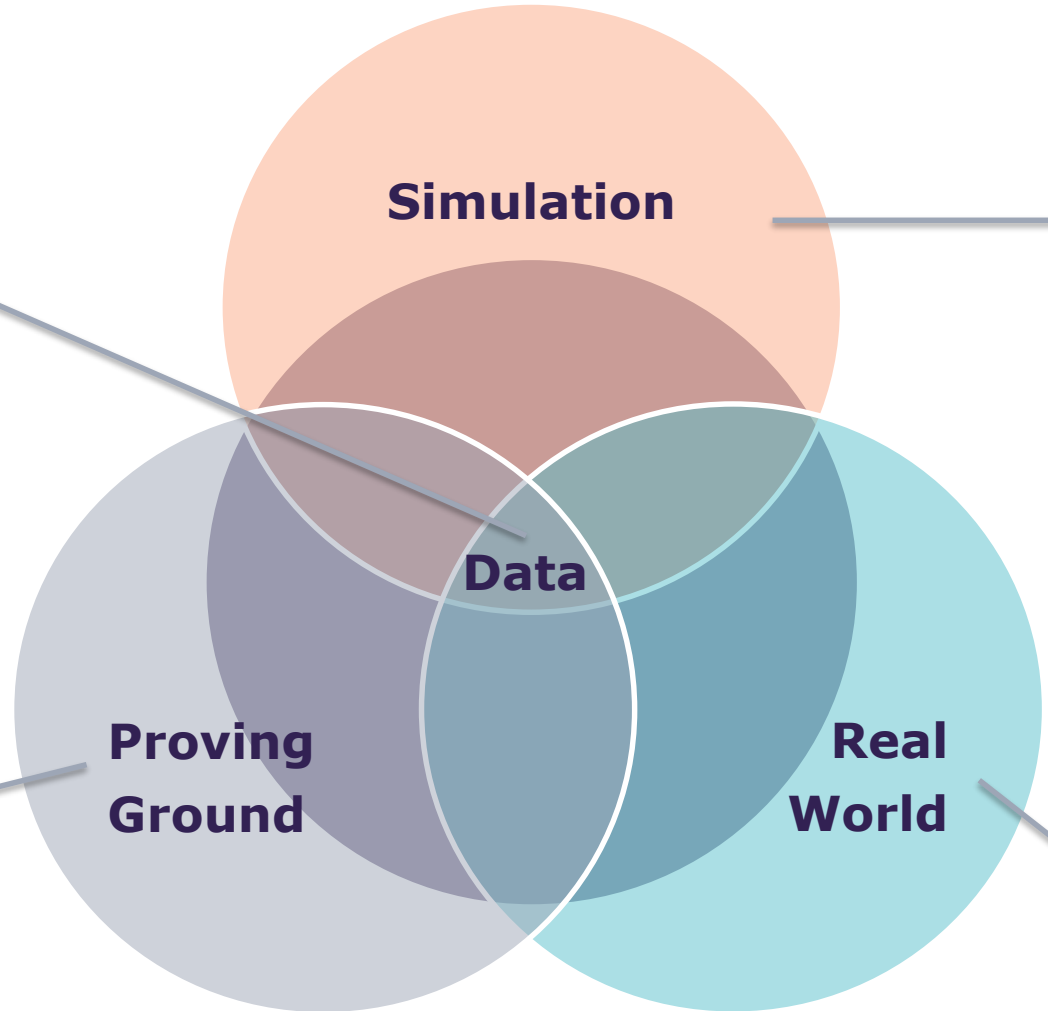
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Safety Framework
Authored by TRL

- Ensures a consistent customer journey for organisations testing connected and self-driving technologies in the UK.

- Provides the ability to move safety cases between CAM Testbed UK facilities with a common approach.

- Builds on existing processes and best practice.

- Focuses on safety cases that scale with complexity of Operational Design Domain (ODD).

- The Safety Case framework is the basis for and complementary to BSI PAS 1881.

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Simulation

- Government and industry currently must develop bespoke modes for each simulation or digital twin application.

- Due to the proprietary nature of the simulations that are created development is stove piped which is complicated to integrate later.

- A significant consequence is that there is no ability to benchmark across different simulations and therefore little trust in results across different platforms.

- A lack adoption of open standards drives even more investment in proprietary business models which constrains innovation and competition.

Interoperable Simulation which protects IP

As a testbed customer I want to run a series of tests utilizing different capabilities. For each test I can access services at different test beds with minimal

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SELF-DRIVING REVOLUTION
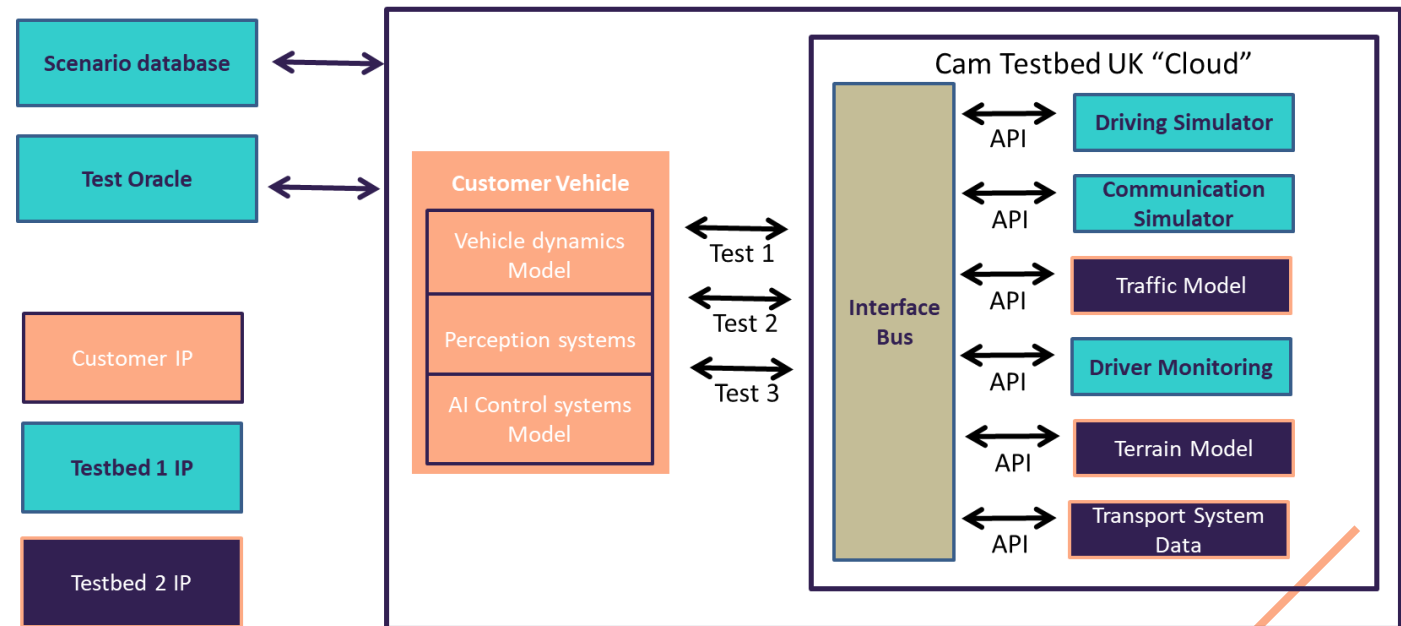
UK Connected and Automated Mobility Roadmap

to **2030**

CAM Creators Update

United Kingdom

What are the benefits of connected and automated mobility (CAM)?

Safety & security

Human error 86% of road injury collisions

Productivity

225 hours driving per year

Access to transport

49% of disabled people in the UK report mobility as an issue

Economic growth

£28bn UK CAV market in 2035

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What is the roadmap?

The UK Connected and Automated Mobility Roadmap to 2030 is a tool for decision makers, investors and policy-makers for our mobile future.

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The roadmap aims to bring forward
connected and automated mobility*

from 2079

*CAM

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"By 2030, the UK is benefitting from **proven** connected and automated mobility, with an increasingly **safe and secure** road network, improved **productivity** and greater **access to transport** for all.

Next-generation services and technology are **designed** and **developed** in the UK, powered by **high value skills** and a strong supply chain, and **driven by public demand**, we are a **world leader**."

2030 Vision

What does the roadmap provide?

Collaborative view

Reduction of risk

Insights

Shared vision

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What does the roadmap build on?

13 "foundational" roadmaps

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Collaboration is key

150+ organisations contributed to the roadmap

250+ individuals contributed to the roadmap

Milestones are connected through almost **600** unique relationships

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Cross-ecosystem contribution means an unbiased view of the future

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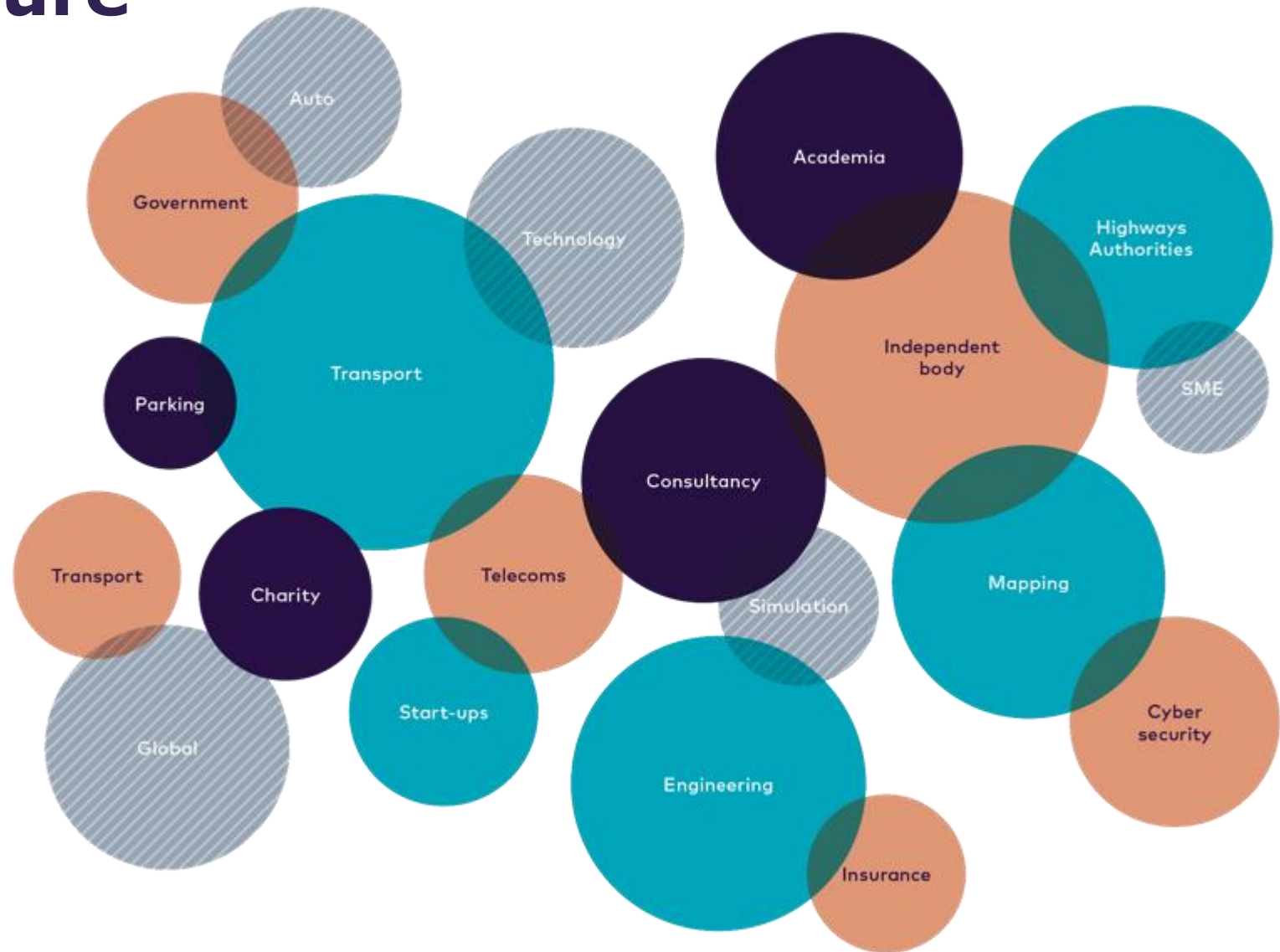
10 UK strengths

01 Software

02 Automation

03 Testing

04 Safety

05 Connectivity

06 Freight/Logistics

07 Sensors

08 Infrastructure

09 Communications

10 Cyber

The roadmap is built around four key Themes

Society and People

Vehicles

Infrastructure

Services

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THEME | **STREAM**

TRIALS, DEVELOPMENT AND ENABLING — TRANSITION PHASE — SCALE-UP AND REALISATION OF BENEFITS

NOW | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030

Society and People

Stream			
Vehicle Approval	Advanced trial approvals	National approval scheme	International approval harmonisation
Licencing and Use	Local codes of conduct for services / Alignment with the wider future of mobility	National licencing scheme for CAM services	Agile and adaptive development of CAM service regulation
Legislation and Insurance	Common risk and liability understanding / Data sharing	Changes in legislation	Insurance policy refinements and lower premiums
Public Desirability	Increasing dialogue with the public	Increasing public experience	Desirable mobility / Widespread acceptance and use of CAM
Investment	Establish investor forums / Structural changes to scale-up funding / Visible CAM benefits deliver on investor confidence	Grow FDI and export markets for CAM	CAM is a high value, low risk investment at scale
Skills	Establish skills centre of excellence and pipeline	Improvement of skills pipeline	Sustaining skills pipeline
Major Milestones	▶ 2020 – Advanced trials approval process in place	▶ 2024 – Nationwide licencing approach for CAM services	▶ 2025 – National vehicle approval scheme in place

NOW | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030

Vehicles

Stream			
Automated Driving System	Common standards / Low complexity design domain	Medium complexity design domain	High complexity design domain
Connectivity	Safety data standards / Cooperative data sharing	Legacy fleet connectivity	Ubiquitous cooperative communication
Ergonomics and Design	Human interaction research / Common HMI guidance	Intuitive HMI and CAM vehicle design	High utilisation vehicle design
Sensors	Low cost high precision sensor development / Deliver initial sensor validation methodology / Deliver full sensor validation methodology	Enhanced sensor development
Major Milestones	▶ 2021 – Data sharing agreements in place	▶ 2027 – Safety vehicle connectivity

NOW | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030

Infrastructure

Stream			
Communications	Agree communications approach at a national level / Plan coverage and rollout	Deploy CAM road safety infrastructure	High connectivity across the road network
Digital	Define data governance and ownership / Develop virtual road environments for CAM / Deploy virtual road environments for CAM	National operational data hub	Virtual road environments for operational management
Roads	New planning and investment guidance / Digitisation of signage assets / Digitisation of road rules	Repurpose infrastructure
Intelligent Network Management	Understand new travel demands through trials / Define new operational models	Deploy new operational models	Increase network efficiency
Test and Development	Cyber centre of excellence / Deploy virtual test environments	Develop automated validation	Refresh Testbed UK
Major Milestones	▶ 2020 – Testbed UK live	▶ 2024 – UK-wide virtual environments for test and development	▶ 2027 – Roadside signage no longer needed

NOW | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030

Services

Stream			
Personal Mobility	Demonstrator trials / Small scale passenger deployments	Deployments plugging mobility gaps	CAM preferred in public service contracts	CAM more attractive than traditional services
Freight and Logistics	Low complexity trials / New freight policy developments / Small scale deployments	Last mile CAM delivers productivity benefits	Integrated services
Inclusive Transport	Understand how CAM can improve access to transport / Trials and pilots	Commercially viable service deployment	Sustainable and inclusive CAM services
Major Milestones	▶ 2021 – First commercial pilot deployment of CAM	▶ 2028 – CAM services are preferable in contracts

Simplifying the 600 relationships in the roadmap

Society and People – Vehicle approvals

Testing specialists define best practice

Adapting regulation for highly and fully automated vehicles

Update GDPR act to account for MaaS and emerging ownership models

Trials of CAM in multiple environments and differing economic models

Independent body established to handle data · ncy safety plan is a mandatory part of safety cases

Vehicle approval framework for self-driving vehicles in place

ions for CAM

Regulation for sharing AEB activation and vehicle data

Independent validat   Highly automated vehicles are more easily able to be on public roads legally

Rules of road established for shared spaces in urban areas

Single ministerial leadership

Robust automated driving system licencing regime at scale

Harmonised vehicle approval scheme established

Version 2 of standards and regulations developed

Cyber security becomes a core part of vehicle approval

Defined CAM policy objectives

Sharing of safety critical data is legislated

Self-driving vehicle are able to respond to emergency services

Code of practice for self-driving vehicles update

Obligations to report are part of licencing and certification requirements

Establish near-miss standards and capture requirements

International standards on cyber security in place

Road collision investigation branch established and trends analysed

Policies and legal frameworks in place to allow passenger transport trials

Define supply chain security requirements

UK safety case adoption feeds into global standards

Draft standards and regulation in place

Consistent framework for approval and licencing of self-driving vehicles

Central political ow   Data exchange legal framework in place

Process in place which speeds up new type approval from UNECE

Safety cases based on outcomes developed

Commercial trials fi A mature legal framework in place

Legal ability for pods to cross public roads at designated points

Definition of national scale incident response plan

| 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |

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Major deliverables

The culmination of long strands of independent Milestones

KEY

ID	Milestone	Date
HF06	Human factors special interest group established	2020
LR08	Defined ODD catalogue for type approvals	2021

Harmonised vehicle approval scheme established (LR57)

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Key enablers

KEY

ID	Milestone	Date
AF01	Develop methods for testing AI and ML systems	2023
AF03	Verification that AI and sensor fusion algorithms are able to self-determine exceedance of ODD	2030
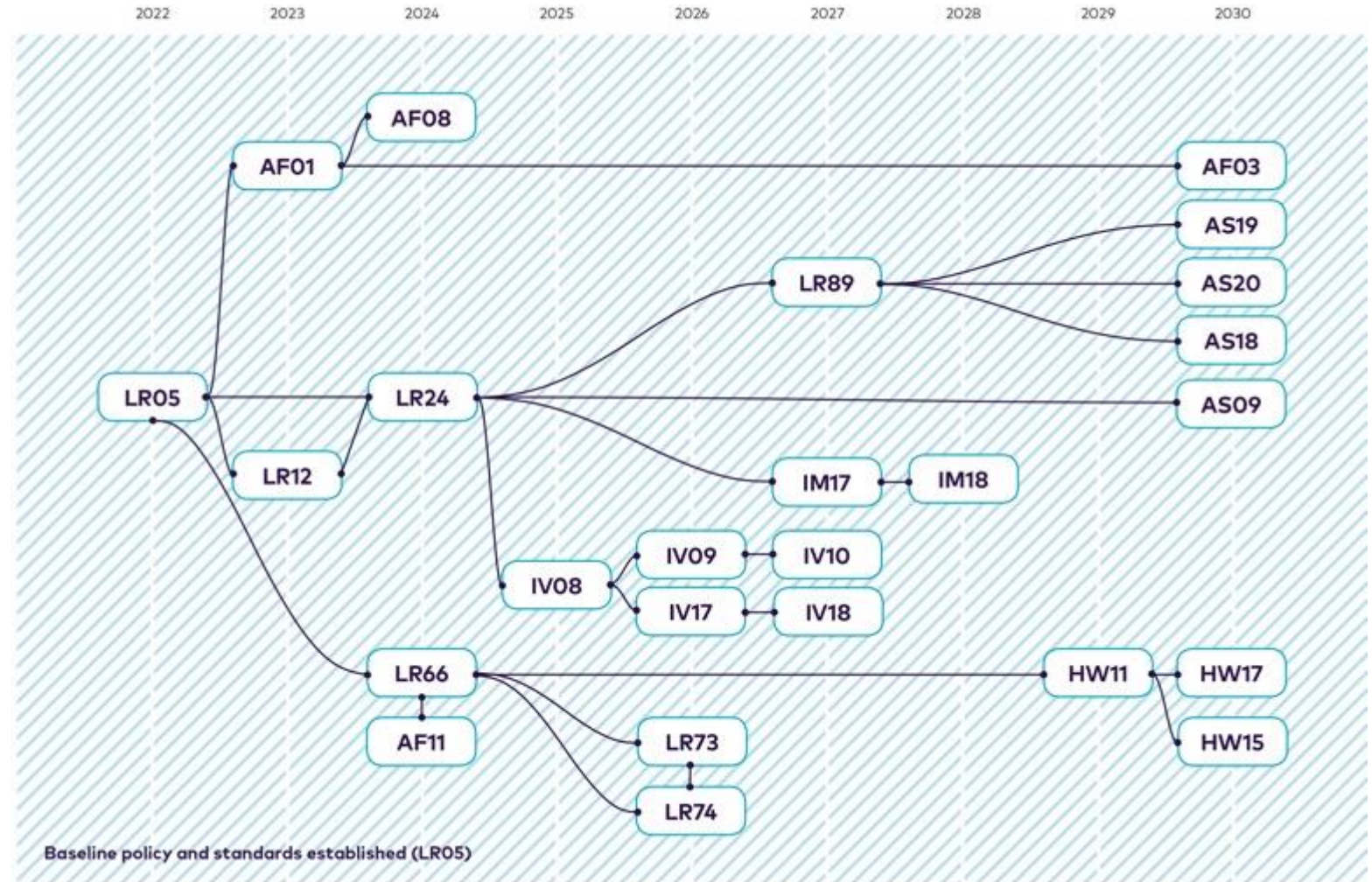
Baseline policy and standards established (LR05)

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Critical waypoints

KEY

ID	Milestone	Date
CM11	First service deployed utilising safety messages	2026
CM15	Safety messages from all new vehicles and all new highway schemes	2027
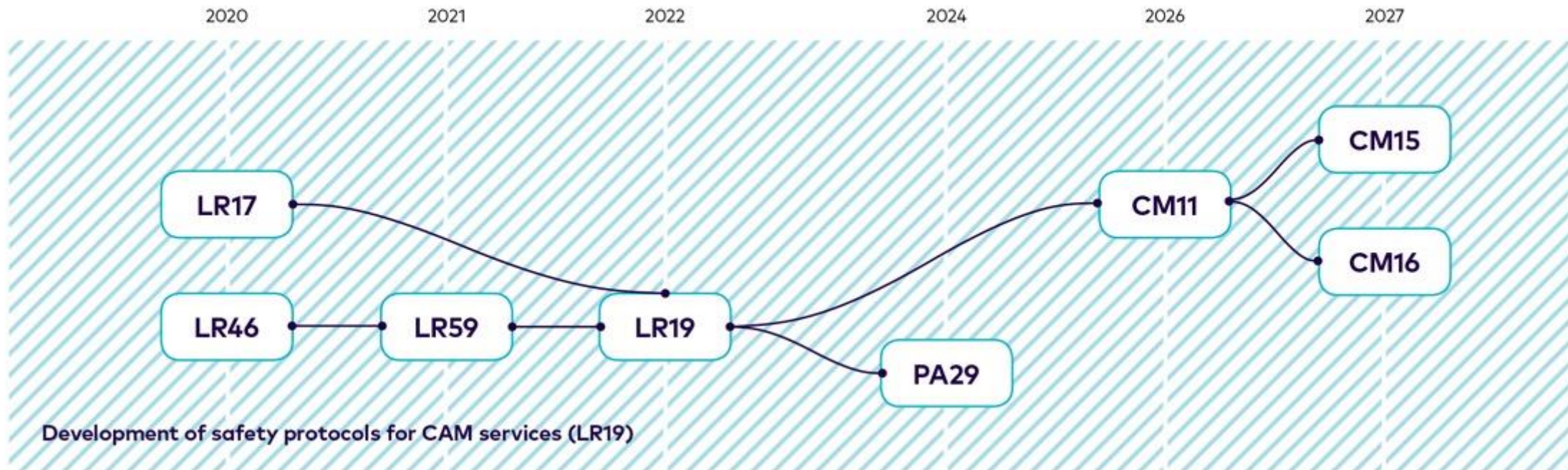
Development of safety protocols for CAM services (LR19)

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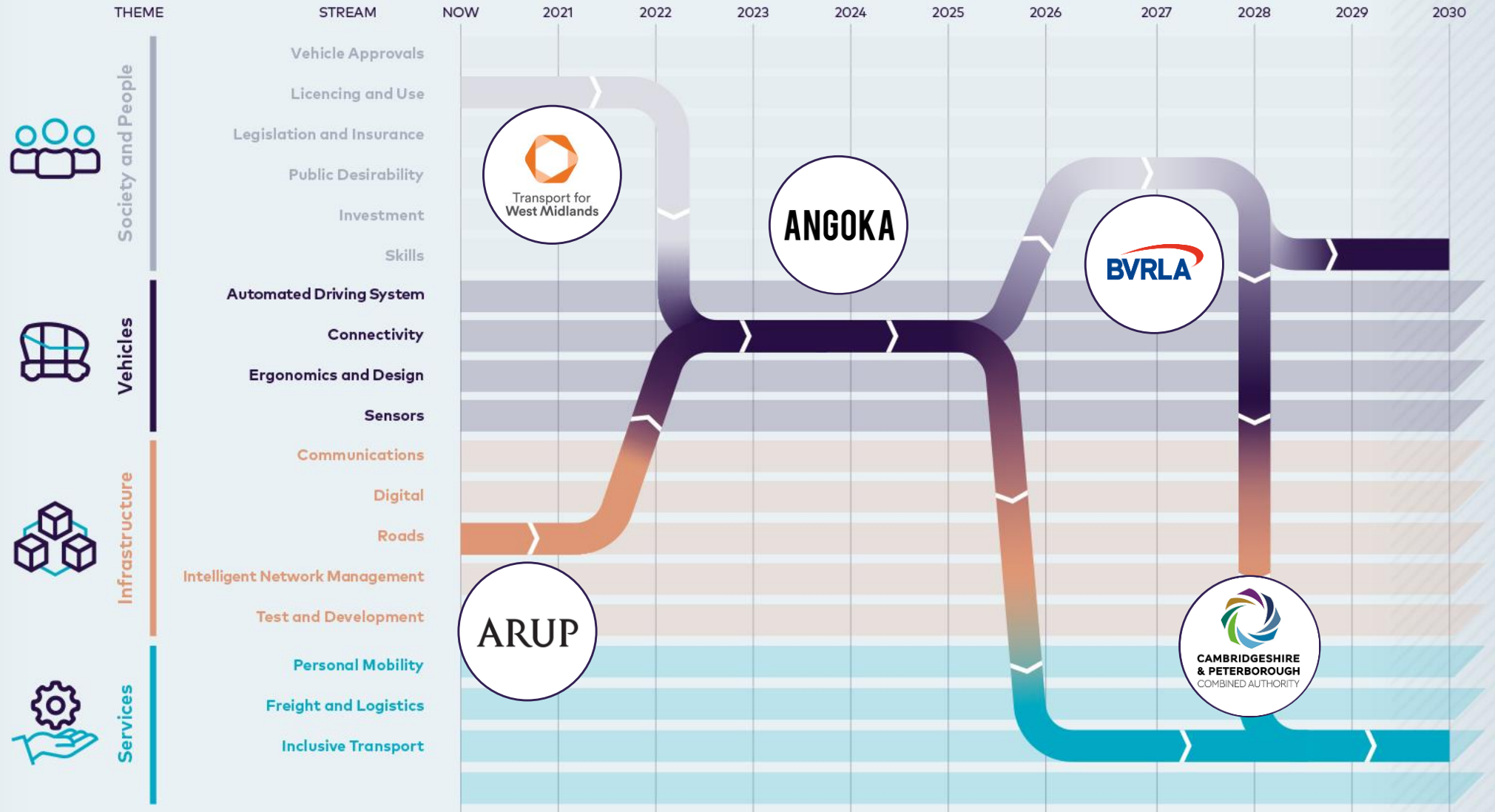
Roadmap Use-Cases

Freight Transport Association

What do the FTA see as the next stages for the future?

Improved safety through assistive features

Highway automation

Automated hub-to-hub operation

End customer unattended delivery

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Where do we find these stages in the roadmap?

2019
Improved safety through assistive features

2027
Automated hub-to-hub operation

Now

2030

2025

2026
Highway automation

2030
End customer unattended delivery

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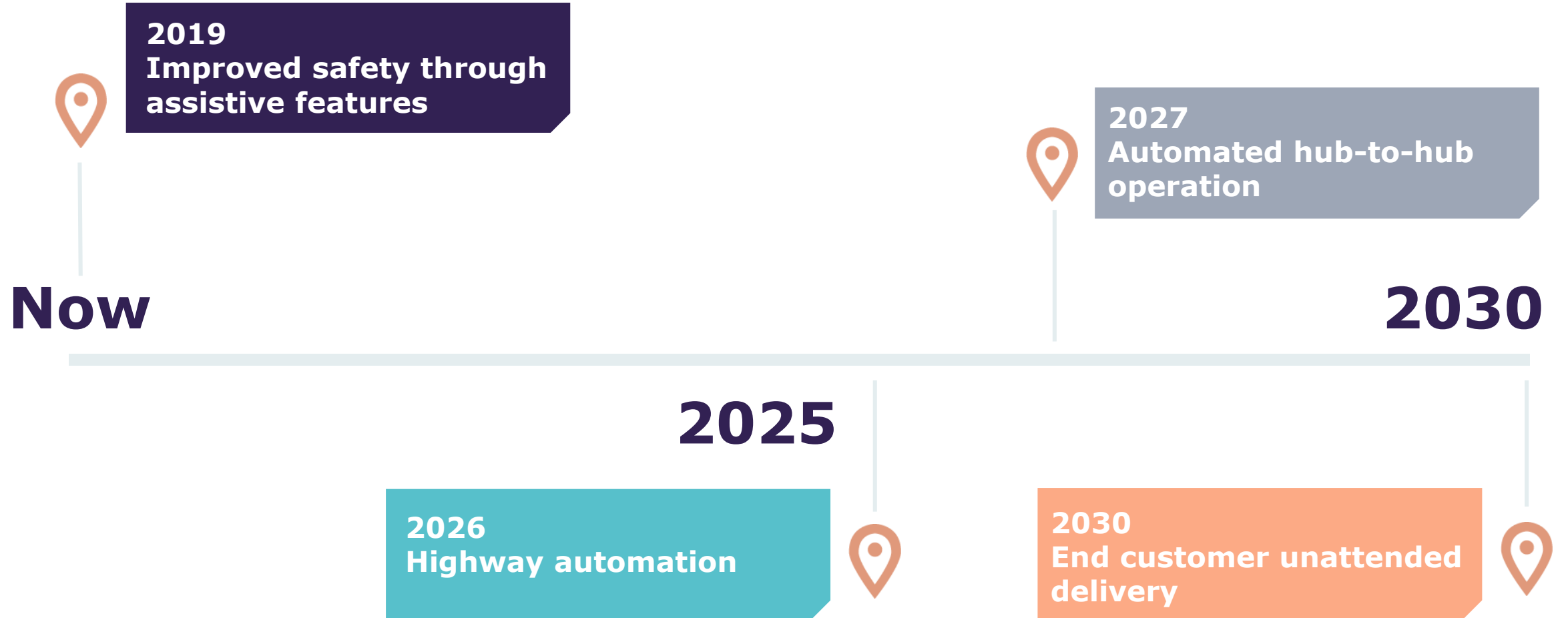
How are the benefits of improved safety through assistive features achieved?

Updated EU regulations for CAM (LR56) – by 2024

Freight and Logistics Trials (FL40) – by 2021

Freight assistive features for traffic congestion (AS06) – by 2024

Improved safety through assistive features

Trust/acceptance in technology

Lives saved

Reduced operations cost

More reliable delivery

'Best-in-class'

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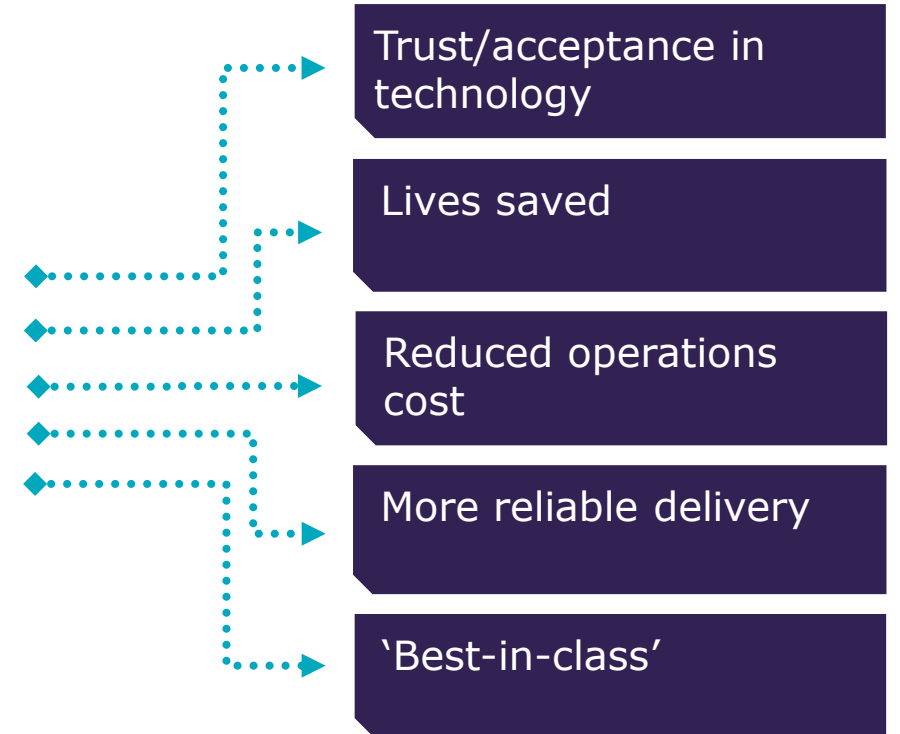
How are the benefits of highway automation achieved?

Freight automated platooning (AS05) – by 2026

National vehicle approval scheme established (LR70) – by 2026

HGV platooning trials (FL14) – by 2020

Operational training deployed including safety driver training (SK08) – by 2029

Call for evidence on improving freight and logistics efficiency (FL25) – by 2022

New freight policy developments (OP26) – by 2023

Highway automation
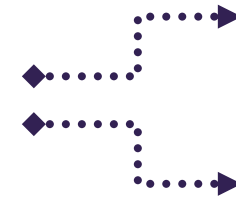
Reduce driver hours

Minimise driver shortage

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How are the benefits of automated hub-to-hub achieved?

National freight traffic control system operational *(FL07)* – by 2027

Automated freight vehicle capability for open roads *(AS13)* – begins in 2024

Establish skills Centre of Excellence and pipeline *(SK05)*– by 2023

Common curb space policy framework in place *(FL26)* - by 2024

Automated hub-to-hub operation
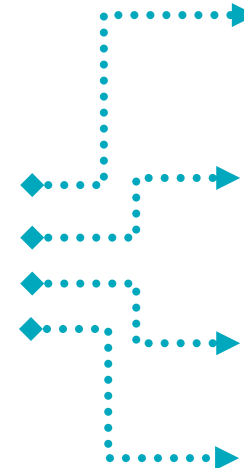
Removal of HGV licensing

Improved safety

Minimizes impact of driver shortages

Lower cost deliveries

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How are the benefits of final unattended delivery achieved?

New urban freight consolidation centres (FL10) – by 2023

Develop fully automated freight vehicles (AS20) – begins in 2026

Technology available for vehicle to recipient delivery **(FL22)** – by 2023

Licencing framework for last mile services (FL23) - by 2024

Common curb space policy framework in place **(FL26)** - by 2024

End customer unattended delivery

Night-time delivery

No more driver shortage

Lower congestion during the day

Lower cost deliveries

Most efficient deliveries

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Want to find out how the Roadmap can benefit your organisation and CAM projects?

Access the interactive Roadmap at **zenzic.io/roadmap**

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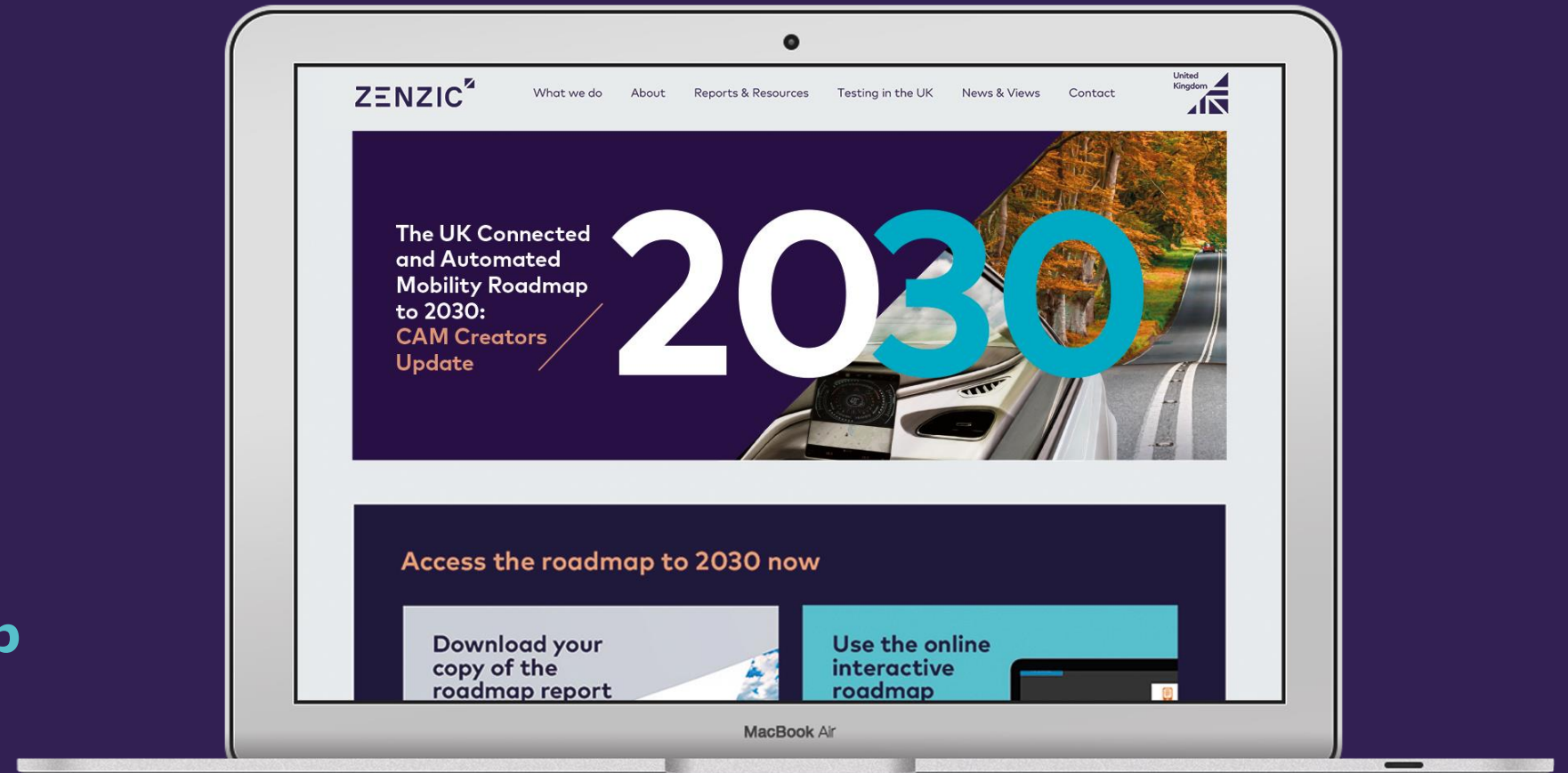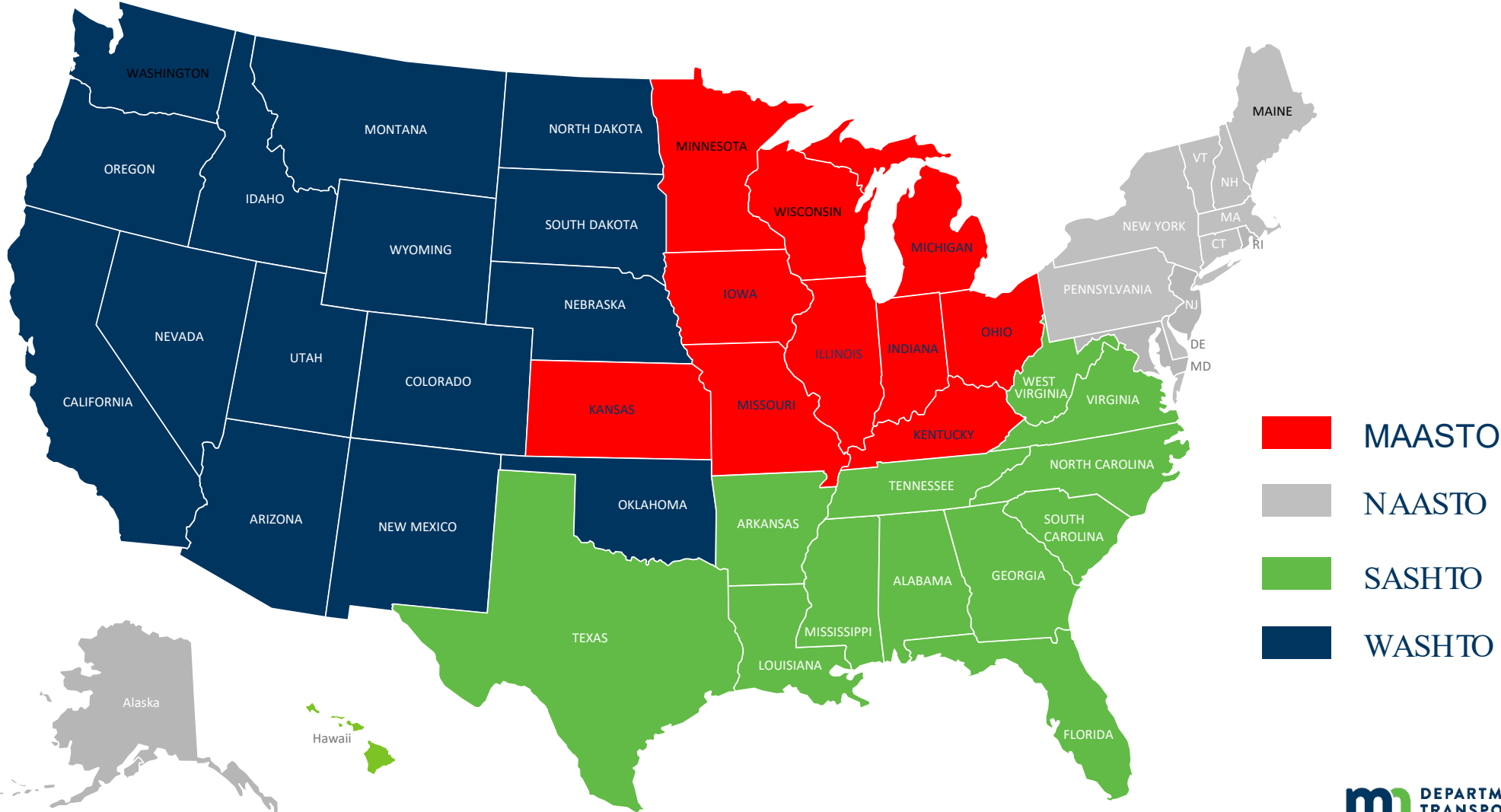
THE COUNTRY'S FIRST CAV MOU!

MEMORANDUM OF UNDERSTANDING

Agreement to Collaborate on Connected and Automated Vehicle Innovations

This Memorandum of Understanding (MOU) is made and entered into by and among the Illinois Department of Transportation, Indiana Department of Transportation, Iowa Department of Transportation, Kansas Department of Transportation, Kentucky Transportation Cabinet, Minnesota Department of Transportation, Michigan Department of Transportation, Missouri Department of Transportation, Ohio Department of Transportation, and the Wisconsin Department of Transportation (Partners).

WHEREAS, private companies are rapidly developing connected and automated vehicle (CAV) technologies, and there are active deployments and testing being conducted in MAASTO states, some without state DOT knowledge or involvement, and

WHEREAS, CAV innovation is much broader than vehicles, and includes significant innovations in the transportation industry, such as managing big data, data privacy, cyber security, intelligent transportation systems, vehicle connectivity, automated safety features, roadway design, licensing and registration, training and education, shared mobility, and multi-modal transportation including transit, active transportation, freight, and ports, and

WHEREAS, CAVs have the ability to greatly increase safety, mobility, equity, efficiency, sustainability, and public health, and

WHEREAS, the Mid-America Association of State Transportation Officials (MAASTO) convened its first CAV summit in 2019 committing to continued collaboration and information sharing, and

WHEREAS, MAASTO states are developing regional priorities and strategies to leverage its strong state leadership, research expertise, and private sector industries, and

WHEREAS, MAASTO has an opportunity to coordinate with other AASHTO regions, regional collaborations , and national organizations such as the Cooperative and Automated Transportation Coalition, the Institute for Traffic Engineers, and the Intelligent Transportation Society of America.

NOW THEREFORE, as leaders of our state departments of transportation, we express our mutual understanding and cooperative relationship as follows:

1. **THAT** the purpose of this MOU is to establish a cooperative and coordinated effort to develop best practices, share information, collaborate on regional projects, and develop a regional strategy for CAV for MAASTO,

2. **THAT** each Partner may appoint and maintain one or more points of contact to represent the respective Partner for this effort. Each Partner may change its own point(s) of contact at any time by

- Ongoing information sharing, sharing best practices, collaborating on regional projects

- Develop a regional strategy for CAV for the region

- Host an annual summit

- The first U.S. region to develop an MOU and work towards developing a regional strategy

DESTINATION CAV

DEPARTMENT OF TRANSPORTATION

SUMMIT AGENDA

- Goal: Hear from national industry leaders and researchers to collaboratively develop a 10-year CAV strategic plan and regional strategy

- Audience: DOT leadership and staff in key functional areas

- Industry representatives may attend Day 1. Day 2 reserved for DOT staff

Day 1 Agenda National Perspectives and Research	Day 2 Agenda Finalizing a Regional Strategy
8:30 - Welcome	9:00 – Welcome & Recap
8:45 - 2019 Summit Recap	9:15 – Overview of MAASTO Regional Strategy
9:00-12:30 - MAASTO state updates	9:45 – Strategy Live Polling
1:00-2:15 - National CAV Panel	1:00-2:15 – Report Out
2:15-3:30 – MAASTO Research Updates	2:15-3:30 – MAASTO States' Round Robin
3:30 - Closing	3:30 - Adjournment

MAASTO CAV MISSION

Advance **regional safety** and collaboration to promote **unified policy**, **interoperability** across boundaries, and establish **cooperative public-private partnerships** to **safely test and deploy** emerging technologies that advance regional and **community transportation needs**.

MAASTO CAV VALUES

SAFETY

SUSTAINABILITY

MOBILITY

EQUITY

2030 MAASTO CAV STRATEGIES

SHORT-TERM STRATEGIES	MEDIUM-TERM STRATEGIES	LONG-TERM STRATEGIES
1. Research CAV impacts on transportation budgets, projects, operations and business needs 2. Leverage industry partners/ academia to research CAV issues 3. Identify opportunities to share data collected across states (and address data governance) 4. Work with local communities to address accessibility and equity for those with unmet transportation needs 5. Host an annual CAV conference 6. Encourage DOTs to understand legislative concerns about CAV, including those that impact DMVs	7. Develop model AV legislation 8. Engage law enforcement and first responders regarding enforcement and public safety 9. Work with Mid-America Freight Coalition to prioritize freight movements for regional CAV efforts 10. Collaborate to develop uniform minimum following distance platooning laws 11. Create a CAV regional forecasting and scenario plans	12. Understand how long-range transportation planning is impacted by platooning, connected vehicle technologies, autonomous shuttles, and other CAV technologies 13. Support local governments in preparing for CAV through education and continued communication 14. Coordinate on US DOT grant opportunities

BREAKOUTS & WORKING GROUPS

1. CAV impacts to DOTs (organizational development)

2. Research

3. Data sharing

4. Model AV legislation and engaging policy makers

5. Automated freight and platooning

6. CAV regional forecasting and planning

7. Coordination with local/tribal governments

8. Accessibility, equity and unmet transportation needs