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Future of Mobility - Roadmaps and perspectives: The UK's approach to CAV development and the 2030 CAM Roadmap

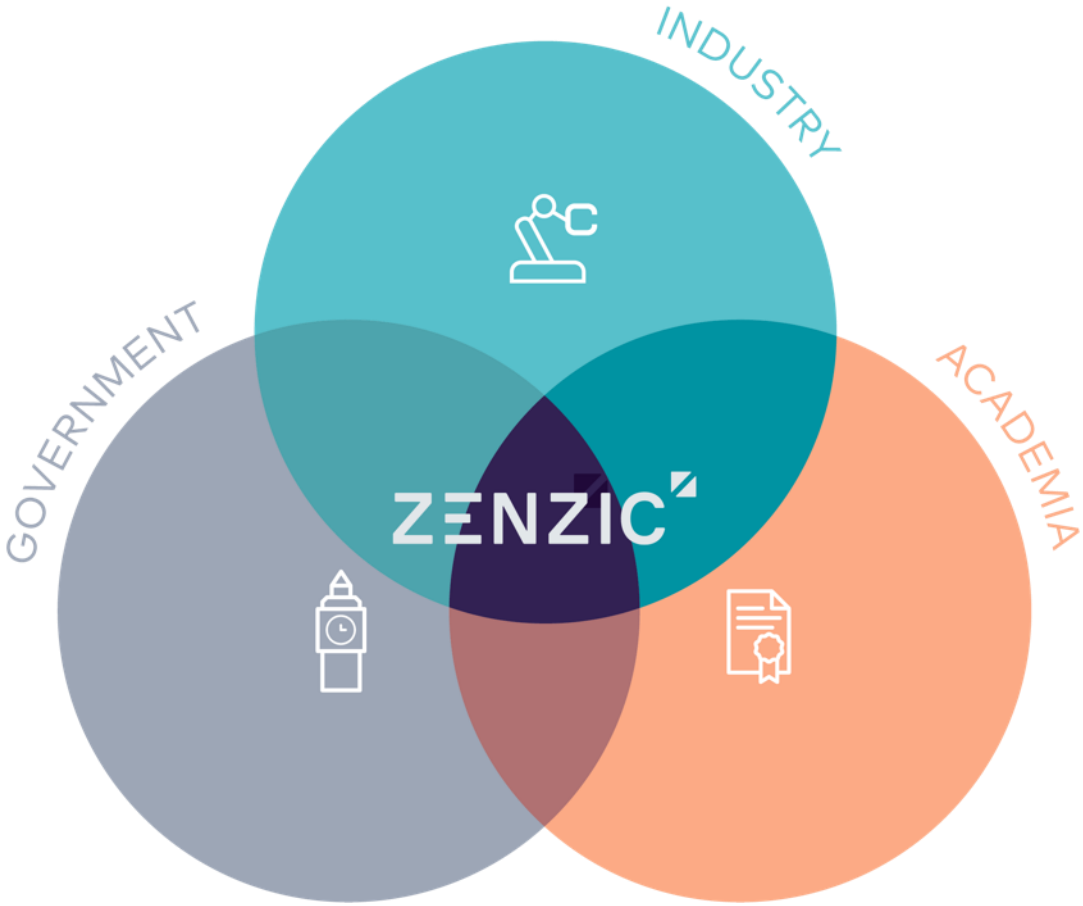
January 2020

United Kingdom

zenzic.io

Zenzic (formerly Meridian) was created by government and industry to accelerate the self-driving revolution in the UK. Zenzic is channelling £200 million of investment to unite industry, government and academia in the move to a safer, more inclusive and productive mobile future.

Championing the UK connected and self-driving vehicle ecosystem



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Value of the global market for intelligent mobility estimated to be worth

£900bn 2035

CCAV/TSC 2017

Total global disclosed investment since 2010 across 10 CAV technology clusters stands at approx

$220bn

McKinsey 2019 report

Serious accidents prevented

+47,000

2030

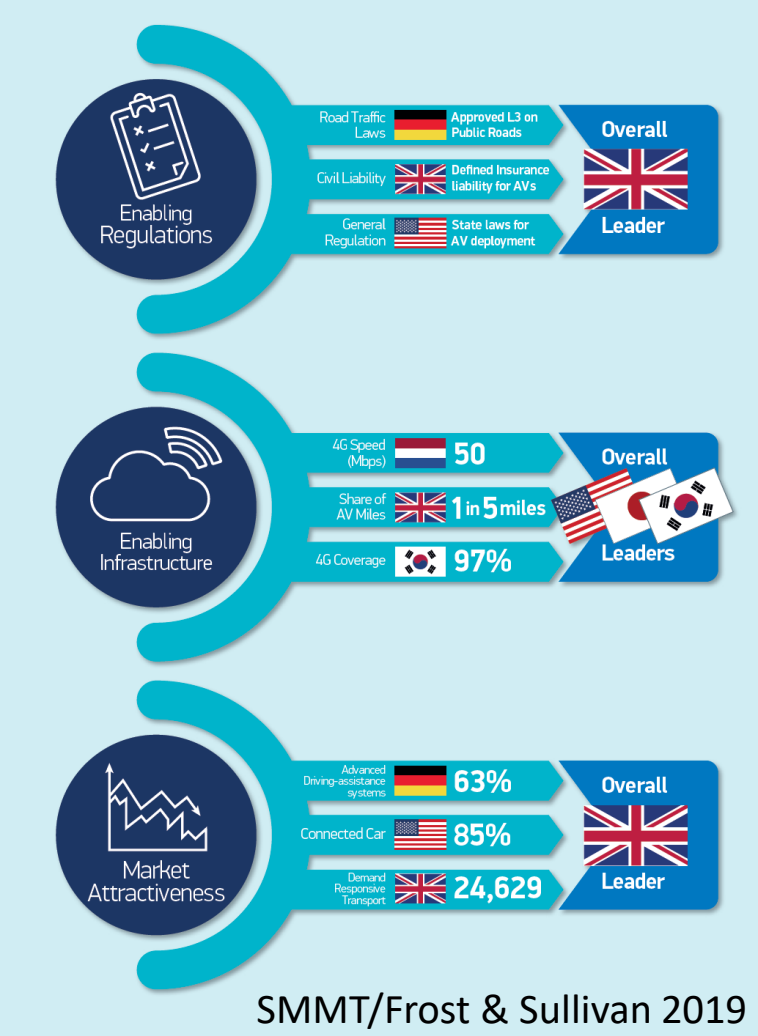
SMMT 2019 report

Lives saved

+3,900

SMMT 2019 report

The UK is competitive in the Global CAV market



SMMT/Frost & Sullivan 2019

7 | United Kingdom

Policy and legislation	Technology and innovation	Infrastructure	Consumer acceptance
2	9	12	10

KPMG AVRI 2019

8 | Germany

Policy and legislation	Technology and innovation	Infrastructure	Consumer acceptance
6	4	13	13

KPMG AVRI 2019

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UK National Policy

£200m

Public/private investment into testing infrastructure.

Testbed UK is the world's only coordinated ecosystem

£250m

Public/private funding for 80+collaborative R&D projects to date

Open regulatory approach

Testing on UK roads now

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Law Commission
Reforming the law

Centre for Connected & Autonomous Vehicles

World class regulatory environment

2015 Code of Practice

The Code of Practice for testing anywhere in the UK <u>now</u>

Facilitating testing in the real world without special permits or surety bonds, the 2015 Code sets out that testers must obey all relevant road traffic laws and that:

- Test vehicles must be roadworthy;
- A suitably trained driver or operator (not necessarily in the vehicle) must be ready, able, and willing to take control; and
- Appropriate insurance must be in place

- (Although permission from the road owner/operator is not required testers should discuss plans with them and use a data recorder.)

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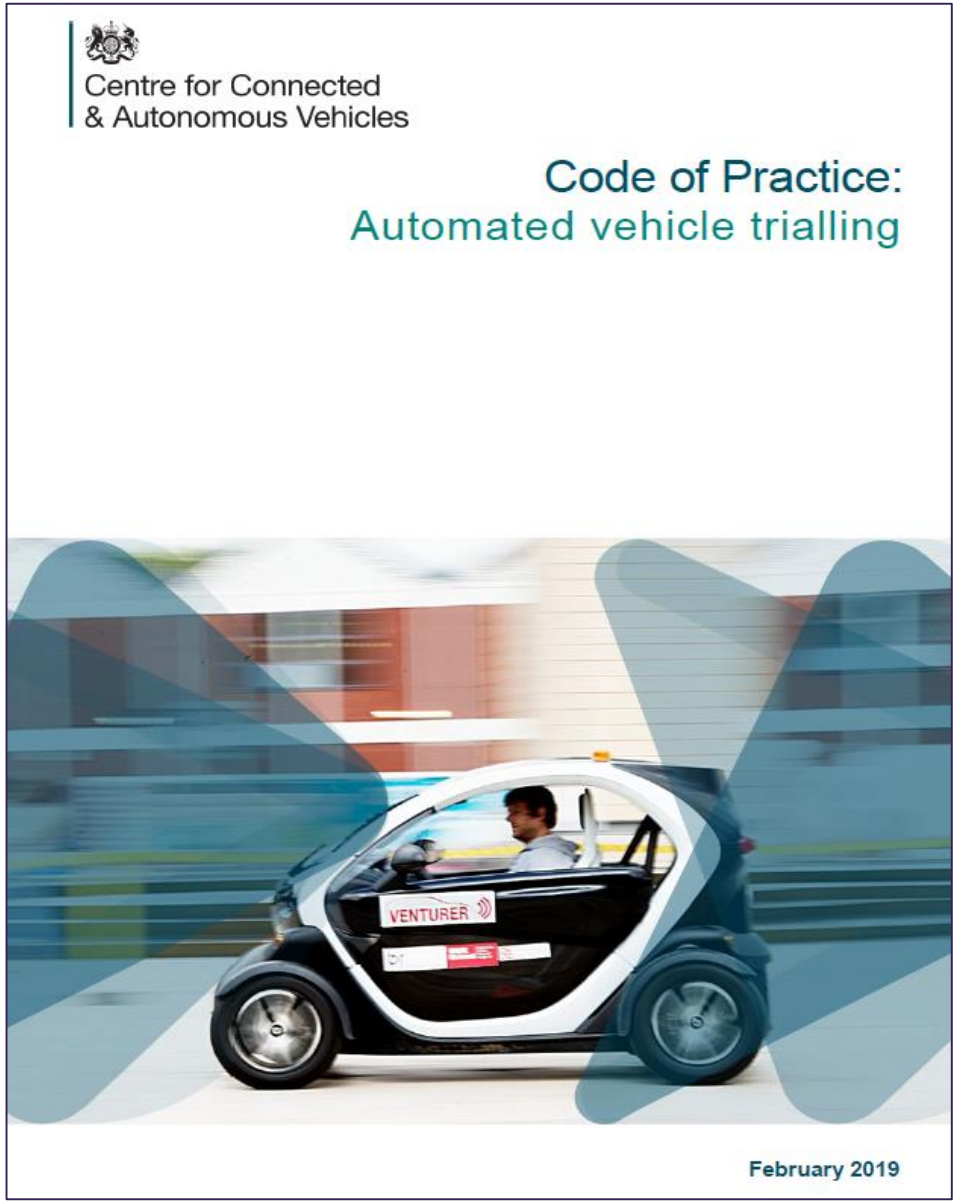
Centre for Connected & Autonomous Vehicles

Code of Practice update

- **Additional advice and guidance** (e.g. contact with emergency services, local authorities, and network operators)

- Initiated **CAV PASS** (**CAV P**rocess for **A**ssuring **S**afety and **S**ecurity), bringing together,
  - Department for Transport teams (vehicle standards, cyber security, road safety, licensing)
  - Agencies (VCA, DVSA and DVLA)



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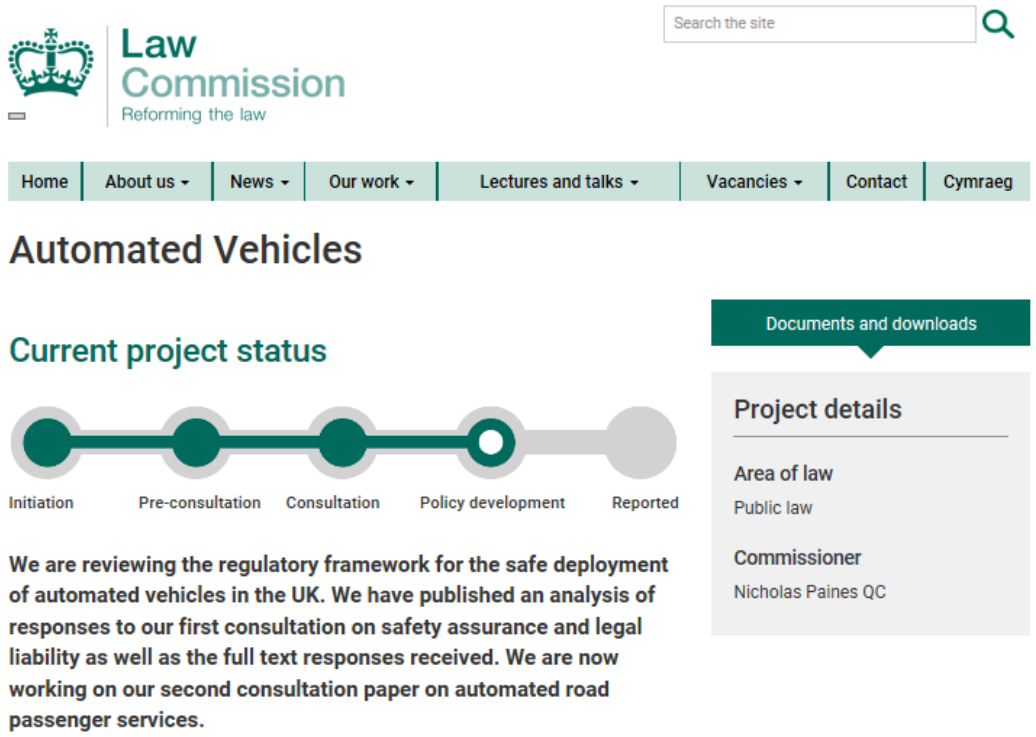
The Law Commission

- **3 year review** to prepare driving laws for self-driving vehicles
- Reviewing regulatory framework **to enable the safe and effective deployment** of AVs
- Considering how safety can be assured both before and after automated driving systems are deployed
- Published interim findings from preliminary consultation in June 2019
- **Second paper on the regulation of highly automated road passenger services (HARPS) closes 3 February**



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Scottish Law Commission
promoting law reform

Law Commission
Reforming the law

CAM Testbed UK

CAM Testbed UK

A CAVWAY
Configurable junctions
Flexible connectivity

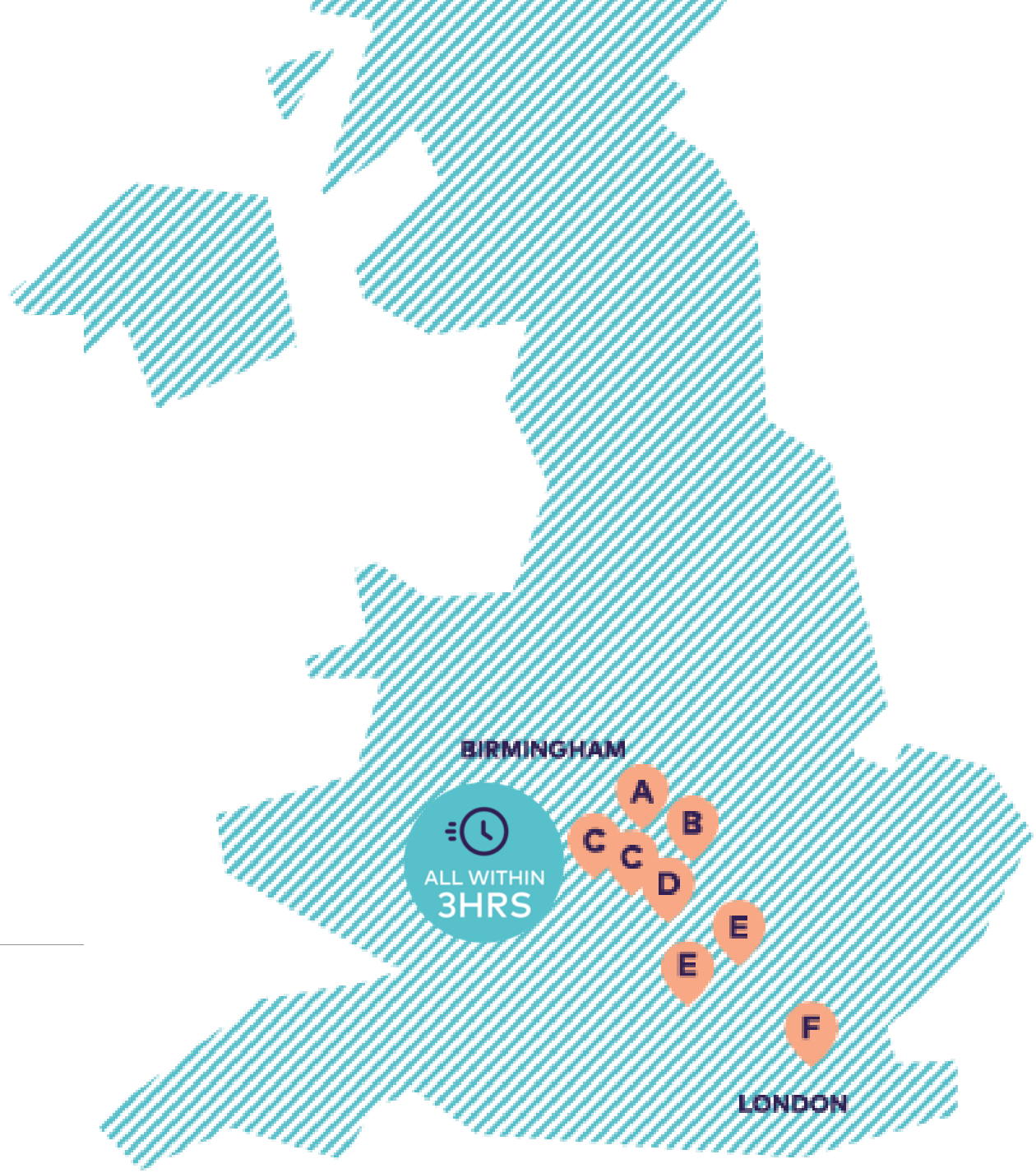
B HORIBA MIRA-Coventry University CAV Testbed
Urban parking
Limit of controllability
Connected and configurable

C Midlands Future Mobility
Highly connected
real-world and digital
environments

D ConVEx Project
Data
Virtual

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

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



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World class network

Testing capabilities

Data Parking Rural Highways Urban Physical Virtual

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THE WORLD'S FIRST 5G Transport Open Test Bed: 1Gbps at 250kph

Safety Case Framework – a report by Zenzic, authored by TRL

The framework sets out high level safety requirements for use across the Testbed UK ecosystem – enabling a consistent approach and delivering a more seamless customer journey.

Second release to be published

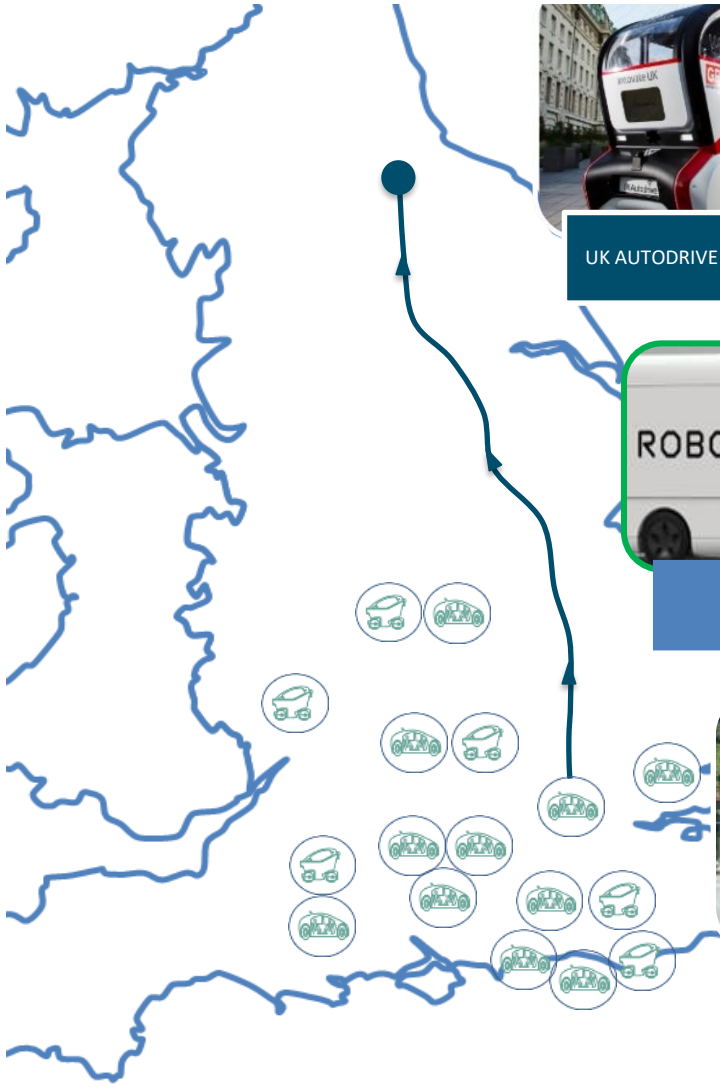
February 2020

ZENZIC TRL

To get a copy of the framework visit zenzic.io

80+ collaborative CAV R&D projects

R&D Projects: £250m across 80+ projects and trials



UK AUTODRIVE (Completed)

GATEWAY (completed)

VENTURER (completed)

STREETWISE

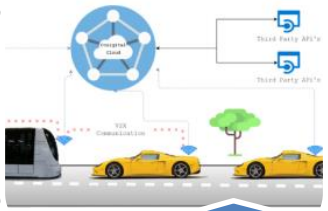
HUMANDRIVE

ROBOPILOT

DRIVEN

FLOURISH

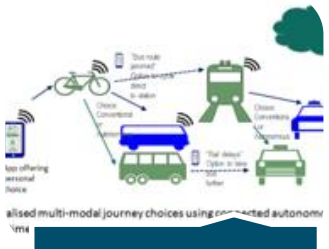
INSIGHT



SYNERGY

CAPRI

T-CABs



MultiCAV

SHIFT

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On Highway

Off Highway

Centre for Connected & Autonomous Vehicles

CAVFORTH | CONNECTED AUTONOMOUS VEHICLES

Fusion

ALEXANDER DENNIS

Stagecoach

UWE Bristol | University of the West of England

Centre for Connected & Autonomous Vehicles

Edinburgh Napier UNIVERSITY

TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

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CAVFORTH | CONNECTED AUTONOMOUS VEHICLES

- UK’s first full-sized, 43-seat autonomous bus tested in Manchester (2019)
- A part-government funded consortium to pilot a fleet of 5 autonomous buses across the Forth Road Bridge, Scotland

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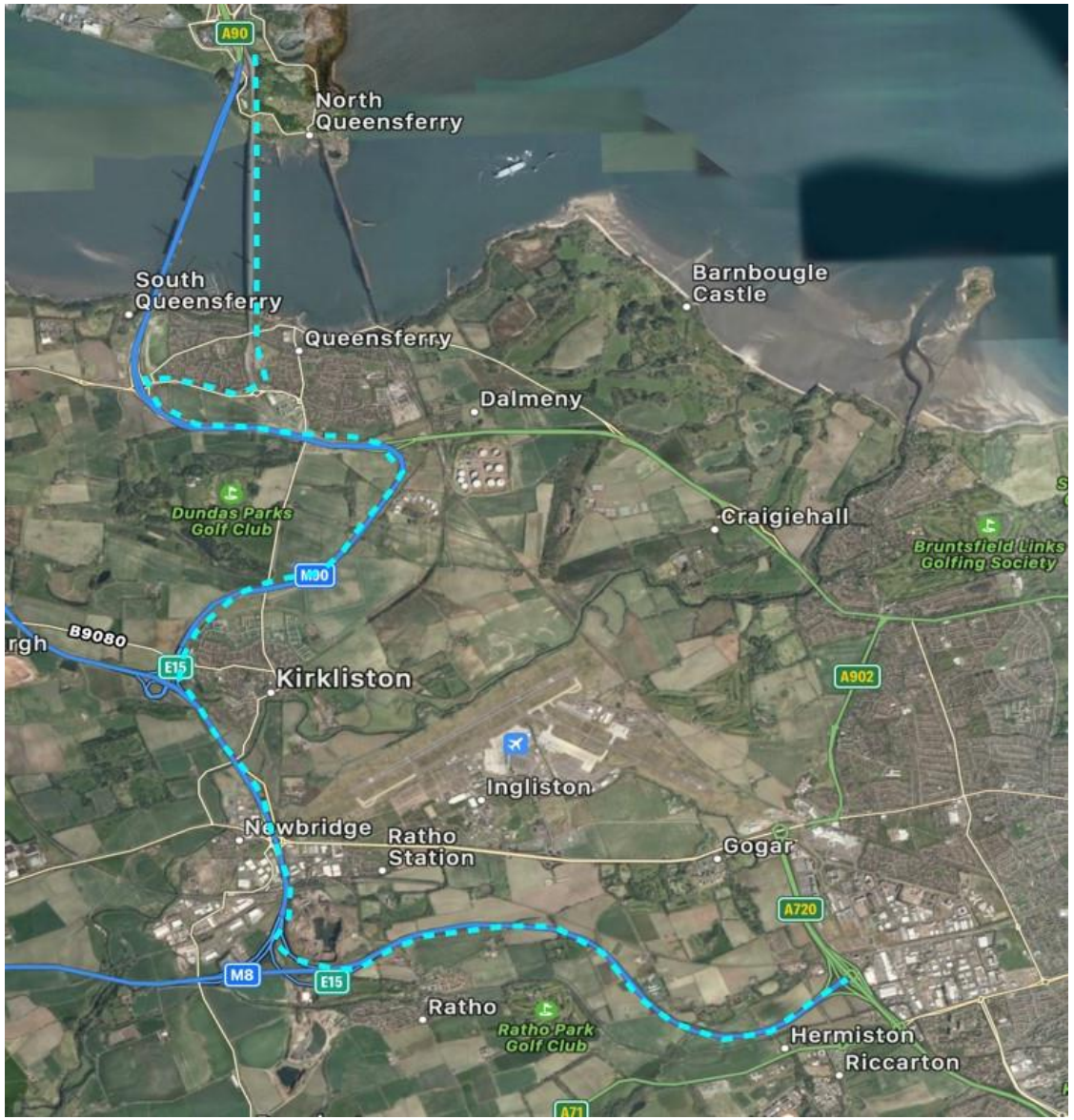
CAVFORTH | CONNECTED AUTONOMOUS VEHICLES

- 15 mile route from Edinburgh to Fife
- Estimated to carry up to 10,000 passengers per week
- Passenger services to commence in 2020



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Inclusive mobility is a strong theme

AURRIGO

Blind Veterans UK
Rebuilding lives after sight loss

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The UK Connected and Automated Mobility Roadmap to 2030

The CAM ecosystem has many players across multiple industries

Uncoordinated efforts → **Maximum benefit not realised**

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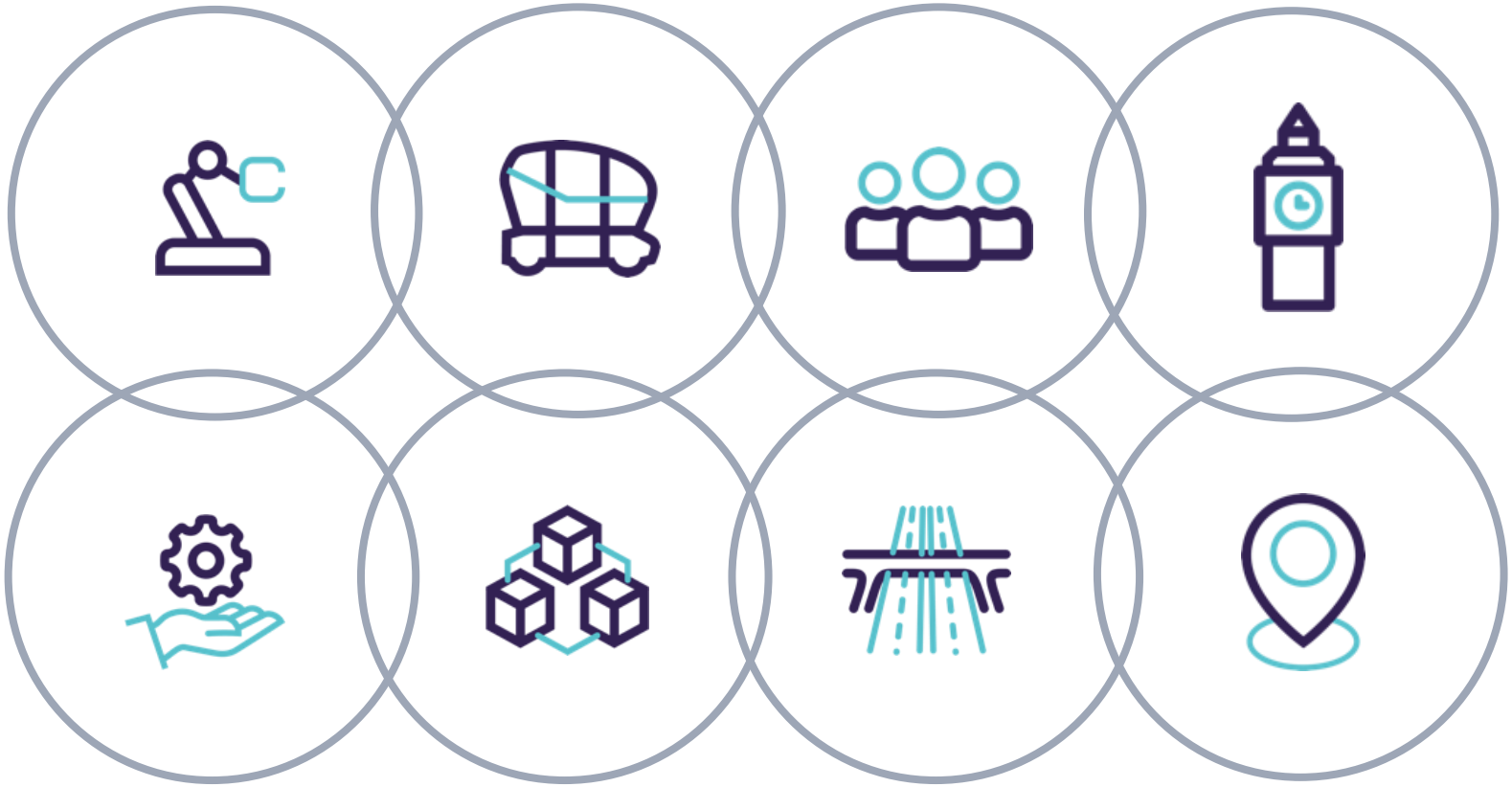
Coordinated and collaborative direction leads to benefits for all



- **Single vision**
- **Interdependent**
- **Focused investment**
- **Articulated path to scale**

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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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How was the roadmap created?

What does the roadmap build on?

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What does the roadmap build on?

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What does the roadmap build on?

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13 “foundational” roadmaps

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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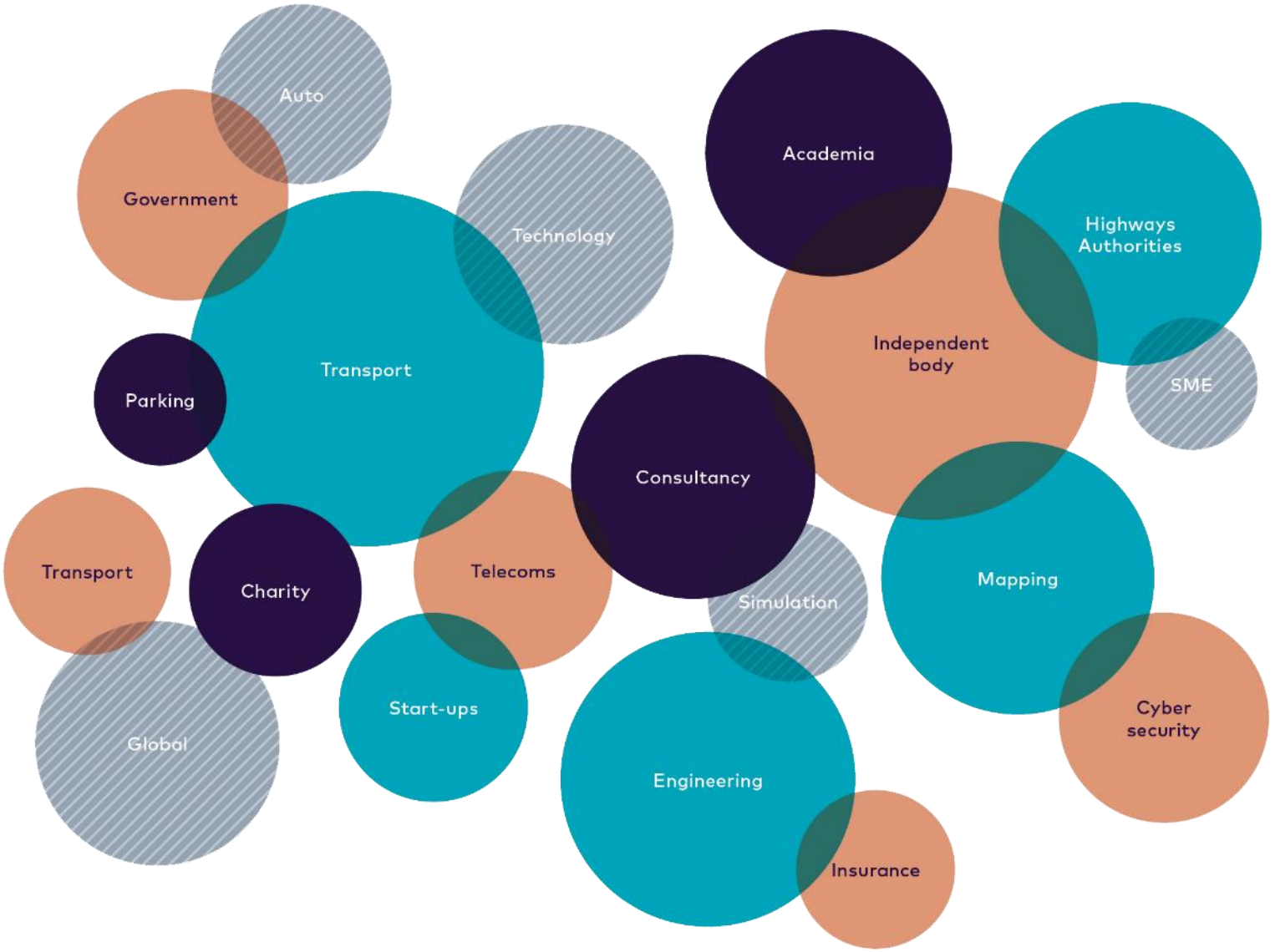
AVL
waze
NOVA MODUS
XAIN.
UCL
Thatcham Research
BUCKINGHAMSHIRE COUNTY COUNCIL
AXA
Applus IDIADA
fta Leading UK Logistics
sciencewise
OMNICAV
telent
Driver & Vehicle Standards Agency
RICARDO
FIVE AI
UNIVERSITY OF SURREY 5G INNOVATION CENTRE
MEDC MICHIGAN ECONOMIC DEVELOPMENT CORPORATION
GoMedia
SIEMENS Ingenuity for life
Park IT
QINETIQ
FORD MOBILITY
Visteon
FRANKLIN ENERGY
Met Office
Loughborough University
ERTRAC
UNIVERSITY OF LEEDS Institute for Transport Studies
ATKINS Member of the SNC-Lavalin Group
UNIVERSITY OF Southampton
WMG THE UNIVERSITY OF WARWICK
CYNAM
IDE INSTITUTE of DIGITAL ENGINEERING
Innovate UK
RAC Foundation
COSTAIN
KPMG
EDAG
Vehicle Certification Agency
elgin
highways england
ALTRAN
Travelai
Clearview Intelligence making journeys work
GSMA
IRM INFORMATION RISK MANAGEMENT ALTRAN GROUP
ARUP
spectris
Atos
smart CAMBRIDGE
ADA
aimsun. A Siemens Company
BRUNTINGTHORPE
THALES
Immense Enabling Intelligent Mobility
BVRLA
valuechain
CHORDANT
RACE
TRL
AURRIGO DRIVERLESS TECHNOLOGY
eatron TECHNOLOGIES
INRIX
BOSCH
WSP
ABI
CIHT
OXFORDSHIRE COUNTY COUNCIL
NOMINET
cpt
SyntheSys
Ordnance Survey
Wireless Infrastructure Group
ANGOKA
ADDISON LEE GROUP
appyparking
VIVACITY
FRAZER-NASH CONSULTANCY
CATAPULT Connected Places
bsi.
NG FORGETTABLE
ageUK Love later life
Ofcom making communications work for everyone
ADVANCED PROPULSION CENTRE UK
AESIN AUTOMOTIVE ELECTRONICS INNOVATION
reed mobility
Brake the road safety charity
Department for Transport
VALERANN MAKING ROADS SMART
National Cyber Security Centre a part of GCHQ
automotive council UK
Burges Salmon
ARRIVAL
A HORIBA COMPANY MIRA
MILLBROOK
dg:Cities
oxbotica
DAC BEACHCROFT

Cross-ecosystem contribution means an unbiased view of the future



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How does it work?

The roadmap is built around four key Themes

Society and People

Vehicles

Infrastructure

Services

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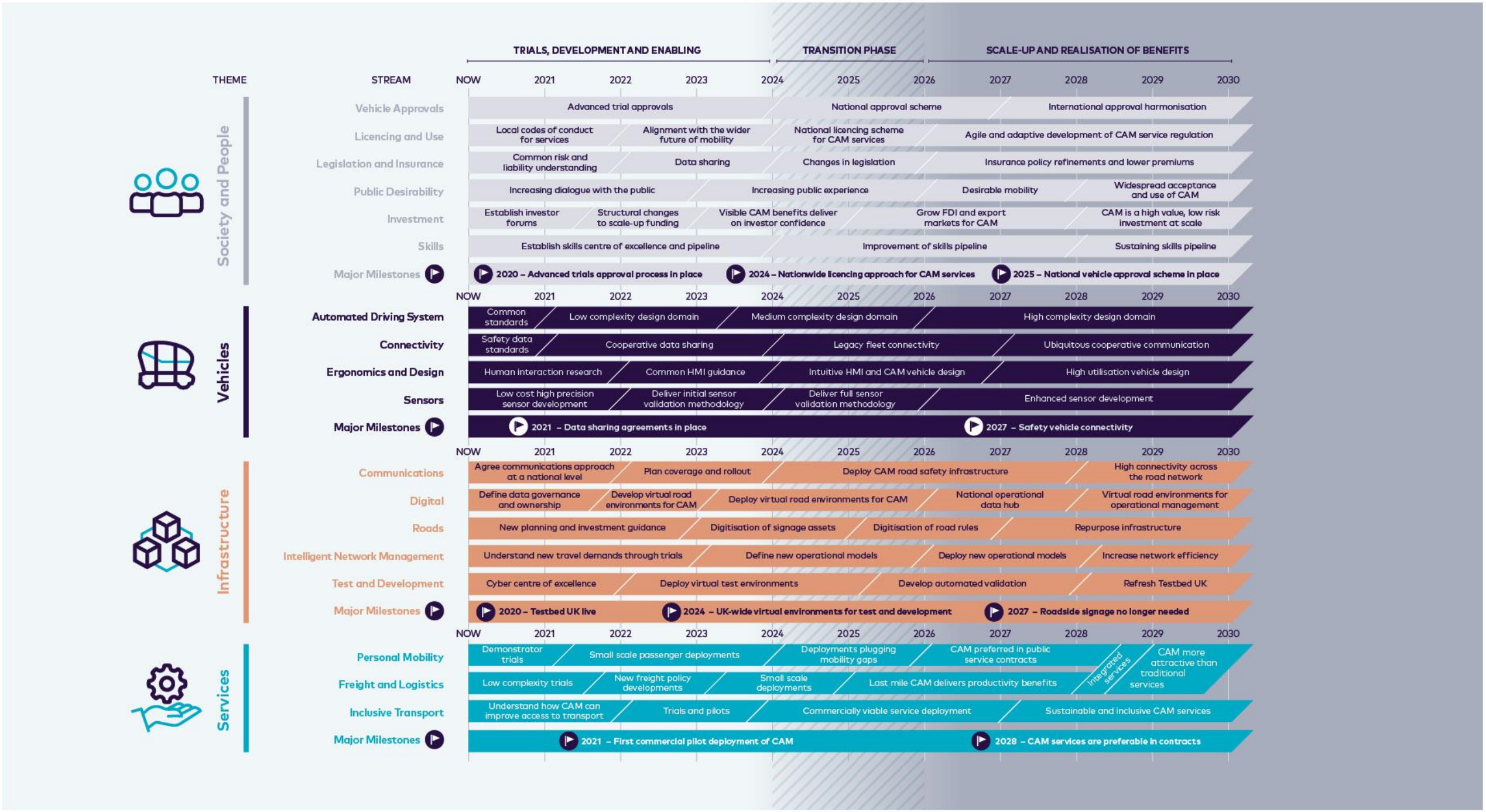
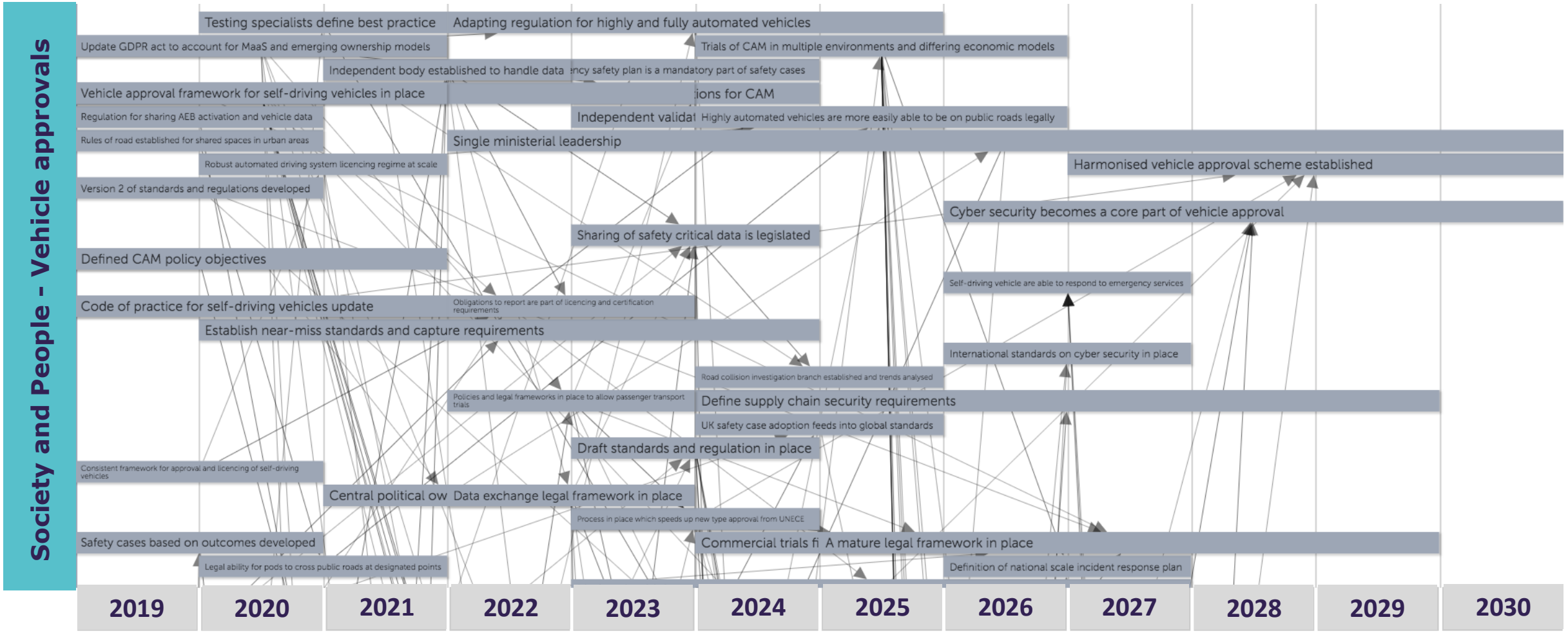

TRIALS, DEVELOPMENT AND ENABLING
TRANSITION PHASE
SCALE-UP AND REALISATION OF BENEFITS
THEME
STREAM
NOW 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030
Society and People
Vehicle Approvals
Advanced trial approvals
National approval scheme
International approval harmonisation
Licencing and Use
Local 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
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
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
Personal Mobility
Demonstrator trials
Small scale passenger deployments
Deployments plugging mobility gaps
CAM preferred in public service contracts
Integrated services
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
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



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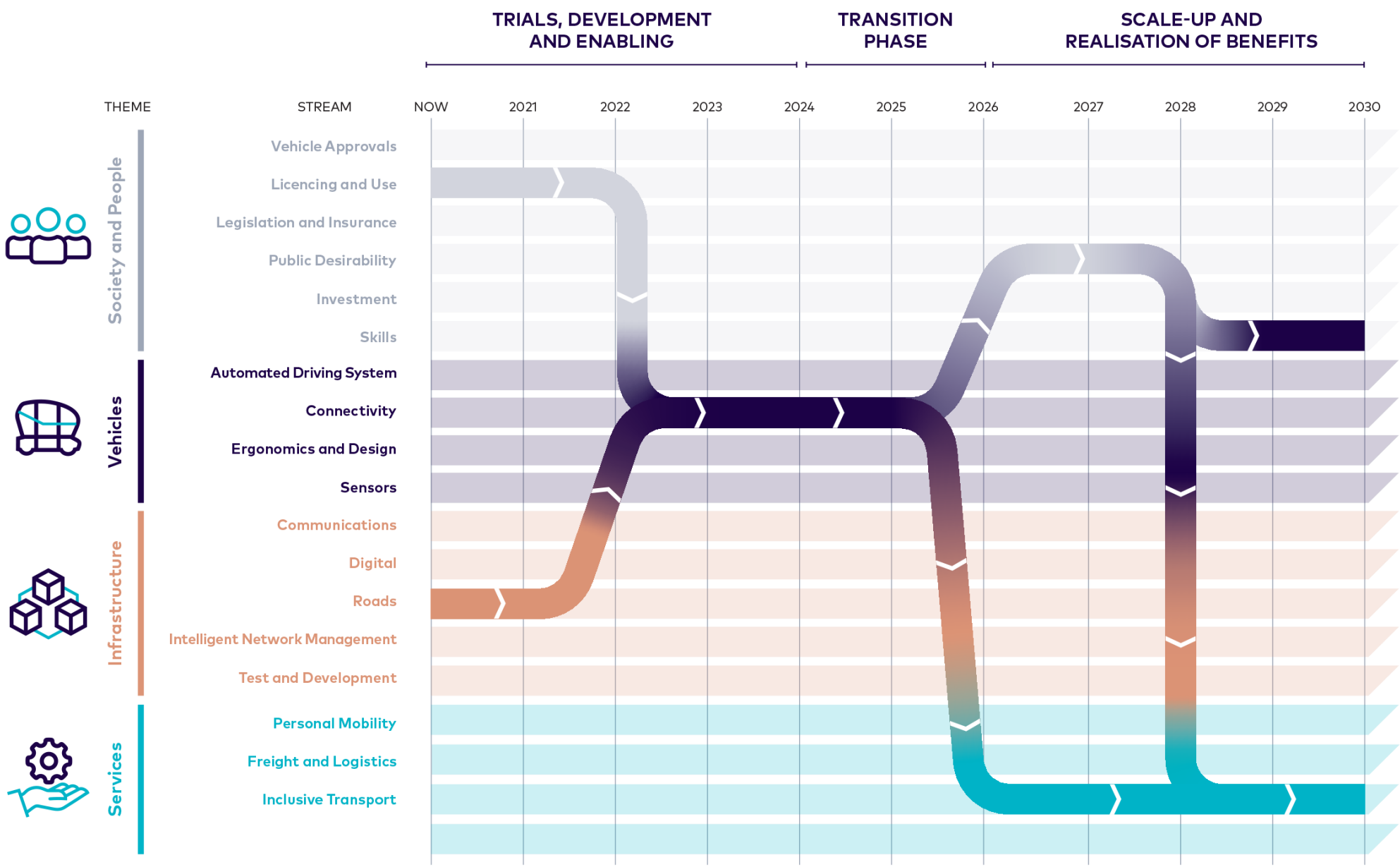
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Connectivity
Ergonomics and Design
Sensors
Communications
Digital
Roads
Intelligent Network Management
Test and Development
Personal Mobility
Freight and Logistics
Inclusive Transport

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Key Golden Thread topics

Legislation and Regulation

Safety

CAM Services

Infrastructure

Public Acceptability

Cyber Resilience

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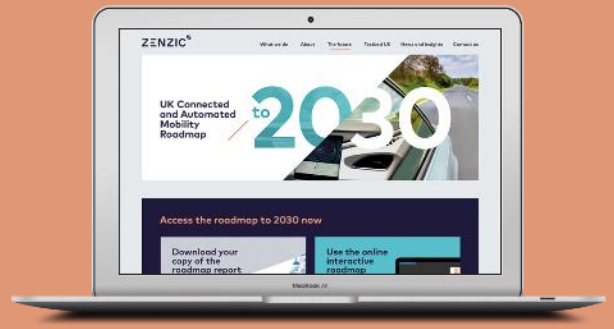
Visit zenzic.io/roadmap

Download your copy of the roadmap report



Access the online interactive roadmap

Find out more at info@zenzic.io

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