national highways

Digital Roads

Safer construction and operations - Faster delivery - Better customer experience

Foreword

We are at the beginning of a digital revolution in roads infrastructure and expect to see more change in the next decade than we have in the last century. This provides an opportunity to make our roads safer, improve customer experience for all, and support our plans for net zero.

Roads are the arteries of our country and we expect most journeys will still be made by roads in 2050. In Connecting the Country[1] we explore what the future could hold, with digital, data and technology transforming how roads are designed, built, maintained, operated, and used.

Realising our long-term vision requires bold action today. Our plans for Digital Roads focus on the here and now and we have already made strong progress. This is helping to deliver our ambitions for the current road investment period (2020-2025) and laying the foundations for an exciting future.

We are committed to harnessing Digital Roads to realise our vision for the Strategic Road Network, enabling Governments' ambition of 'the UK being a world leader in shaping the future of transport', and supporting Britain's growth. We will be judged on our ability to capture this opportunity.

Dipesh Shah OBE

Chairman
National Highways

Nick Harris

CEO
National Highways

Elliot Shaw

Executive Director,
Strategy & Planning
National Highways

Contents

Purpose of the document

This document is intended to align National Highways, our customers and our supply chain behind our vision and plans for Digital Roads. It sets out our vision for Digital Roads 2025, demonstrating why this is important and highlighting the wide-ranging benefits. The document also sets out our approach for delivering Digital Roads, and the tangible changes our employees, customers and supply chain will experience over the coming years.

This forms part of a suite of documents, articulating the Digital Roads vision and our approach for achieving this. For more information please visit:
www.highwaysengland.co.uk/digitalroads

Introduction

Digital Roads will harness data, technology, and connectivity to improve the way the Strategic Road Network (SRN) is designed, built, operated, and used. This will enable safer journeys, faster delivery, and an enhanced customer experience for all.

Our approach to Digital Roads covers everything we do and is structured around **three core themes**:

	Digital Design & Construction	Our activities will be increasingly automated, modular and conducted off-site. This will result in safer production, reduced network disruption, increased productivity and smoother journeys for our customers.
	Digital Operations	Our operations will leverage data to drive increasingly pre-emptive interventions – resulting in improved asset resilience, increased asset life and a safer, smoother running network.
	Digital for Customers	Our customers will be better informed and have trust in the journey information they access, ensuring that they feel safe and in control of their journeys.

Digital Roads represents a step change in UK transport infrastructure and is at the heart of our long-term vision for the SRN. Our approach to Digital Roads considers how we can improve what we do today as well as in the future, embedding digital, data and technology in everything we do.

Digital Roads supports a wide range of Government policies and commitments, providing a common approach for realising shared strategic ambitions and supporting Britain's growth.

Our vision and approach for the current road investment period (RIS2, 2020-2025) is clear and we are now making plans for RIS3 (2025-2030).

The case for Digital Roads

Our focus on Digital Roads will deliver wide-ranging benefits, contributing to our RIS2 (2020-2025) goals, supporting our imperatives (safety, customer and delivery) and laying the foundations for the roads of the future.

Digital Roads are transforming England's major roads, creating a technology enabled / enabling network to deliver world leading road infrastructure…

Growing the economy

£7bn pa of benefits of the UK infrastructure sector from developing a National Digital Twin.[2]

Providing value for taxpayers

£2.23bn National Highways RIS2 effciencies target, which we are on-track to achieve.

Managing and planning the SRN of the future

Up to **80%** highways capacity boost due to autonomous vehicles (assuming full adoption c.2050).[3]

Accelerating and improving delivery of road enhancements

Up to **33%** reduction in the cost of construction.[4]

..Improving safety for all and realising our ambition that no one will be harmed when working on or traveling on the SRN by 2040...

Innovative construction techniques

Up to **37%** reduction in the number of fatalities within the construction sector by 2035.[5]

Pre-emptive operations and automated incident detection and response

zero Injuries or deaths on the SRN by 2040.

Uptake of connected and autonomous vehicles

Up to **90%** potential reduction in traffic accidents through full adoption of connected and autonomous vehicles.[6]

…Improving network performance and ensuring our customers' journeys are reliable, smooth and free from disruption…

Faster construction and maintenance techniques

Up to **50%** Potential reduction in scheme delivery timelines through the use of Digital Design & Construction tools and techniques (by 2030).[7]

Optimising traffic flow with data led decision making and automation

Up to **10%** Potential reduction in traffic delays due to the benefits of full 5G connectivity.[9]

Accurate and real-time information available to customers and seamlessly integrating with third party partners and wider transport network

40% Improvement in customer satisfaction with the accuracy of the roadwork information between 2018 and 2019.[8]

…Improving environmental outcomes and contributing to net zero.

Greener construction and maintenance

Up to **50%** reduction in construction carbon emissions through standardised digital design and modular construction techniques (by 2025).[10]

Enabling the transition to zero emissions vehicles

Improved information provision to customers to reduce range anxiety, which is currently the 3rd largest barrier for purchasing electric cars.[11]

Harnessing technology to optimise traffic flow and operate the network in the most environmentally friendly way

Zero carbon National Highways commitment to support Net Zero by 2050.

Building a platform for Digital Roads – Our 2025 Vision

Design	Construction	Operations	Maintenance	Experience

Our activities will be increasingly automated, modular and conducted off-site. This will result in safer production, reduced network disruption, increased productivity and smoother journeys for our customers.

Our operations will leverage data to drive increasingly pre-emptive interventions - resulting in improved asset resilience, increased asset life and a safer, smoother running network.

Our customers will be better informed and have trust in the journey information they access, ensuring that they feel safe and in control of their journeys.

Optimal network planning options are identified in a **cost and time effective** manner

Digital designs are produced as standard to **improve efficiencies**

Our digital twin **is** used to conduct **long term planning** and develop more effective **asset strategies**

Our contractors' **feedback is integrated** into our digital designs to **improve accuracy**

Construction sequence simulated and optimised with rehearsals to **improve efficiencies**

Off-site, modular construction is default method, where practical, resulting in **faster construction** times

Predictive analytics to manage and plan work appropriately, **improving delivery** speed

Greater data sharing enables collaboration with construction partners to **reduce duplication**

More automated traffic management through **electronic signage** to minimise impact of roadworks

We **pre-emptively prepare and respond to changes** in operational conditions to **improve safety**

Incident Detection is used at scale to automatically **identify incidents**

Digitally-enabled maintenance workers can access Work Management Systems and **expert advice** when undertaking activities

Asset and environmental condition data is embedded in operational process and used to inform **decision making**

Autonomous maintenance tools carry out repetitive tasks to **improve safety**

Remote diagnostics and maintenance of our technology assets to reduce network disruption

More automated signals, signs and lane closures are used to manage traffic flow more effectively

We receive better quality data from our customers, which enhances our own asset and operational data to **inform decision making**

Our customers are kept informed in-journey (consistently across the SRN) through collaborating with third parties (e.g. wayfinding service providers)

We provide our customers **end-to- end journey support** in collaboration with local highways authorities, transport operators and 3rd party service providers

We work with the **supply chain and wider private sector** (e.g. vehicle manufacturers) to identify and test new opportunities to improve customer service

---

Digitised design standards combined with databases such as topographical and environmental data are used to create **initial designs faster**

More virtual consultations with our customers and stakeholders **improve accessibility**

Use of **standard components** in design where possible to **improve efficiencies**

Asset digital twin **information is accessible** to those who need it to **support maintenance planning**

Updated control room technology provides **greater oversight and control of the network**

Incursions are minimised when on-road workers are near live traffic to **improve safety**

On road workers can **access and update our central systems** whilst on the road in **real-time**

Coordination of construction and maintenance activities to reduce customer disruption

Impact of roadworks is assessed and mitigated to reduce disruption

Our customers access reliable **pre-journey information** (consistently across the SRN) through their preferred digital channel, **personalised for their needs**

Large scale **connected corridor trials based on customer insights** are underway throughout the country to **improve customer experience**

Machine-led, human aided tools are used to create **automated designs** to improve efficiencies

Connected construction site providing accurate and regular data exchange on construction activities to improve delivery

Use of **connected and autonomous solutions**, where possible, to **improve safety**

Collection and sharing of detailed incident information with the Emergency responders to reduce incident clearance times

'**Any desk, any operator**' integrated network control and **enhanced situational awareness**

On-road workers' **patrols conduct asset condition surveys** and fault reporting

Optimum operational interventions are identified and implemented

Timely, accurate and fit-for-purpose asset data is used to keep our roads in **good condition**

We work harmoniously with our surroundings to deliver an **improved environment**

Our **call centre staff have access to fit-for-purpose information**, that enables them to provide **excellent customer service**

Digital Design & Construction

- **Digitally enabled design**
- **Modular and standardised approaches**
- **Automated construction**

Digital Operations

- **Intelligent asset management**
- **Enhanced operational capability**
- **Digitally enabled workers**

Digital for Customers

- **Information provision**
- **Customer engagement**
- **Partnership and alliances**

Digital Design & Construction

Our activities will be increasingly automated, modular and conducted off-site. This will result in safer production, reduced network disruption, reduced carbon emissions, increased productivity and smoother journeys for our customers.

Summary of our ambitions for 2025

Digitally enabled design – Scheme designs and long-term planning is based on fit-for-purpose data and enabled by digital tools. We integrate digitised design requirements, existing data feeds, digital design tools and digital twins, to enable safer, more efficient and greener outcomes.

Modularised and standardised approaches – The use of offsite fabrication and modular construction is increased and components are standardised. This improves safety, reduces carbon emissions and minimises disruption.

Automated construction – Digital rehearsals and the use of connected and autonomous plant are embedded in our construction processes, improving efficiency and enhancing safety.

Please visit the Digital Roads virtual learning environment to access the full list of our Digital Design & Construction 2025 ambition statements.

Key benefits:

All our schemes are designed with the safety of our construction workers and customers in mind. Innovative and modern methods of construction will ensure all our sites are safer.

The use of digital design tools will ensure that we get designs right the first time, reducing the need to make changes at later stages. The use of modular and offsite fabrication will reduce carbon emissions, shorten road closures and enable smoother customer journeys.

Digital design tools will enable us to consider the environmental impact of our schemes and minimise carbon emissions where possible. Offsite fabrication and modular construction will also reduce waste and minimise carbon emissions.

Case study – Rapid Engineering Model

Technology is changing the way infrastructure is designed, delivered and operated. The Rapid Engineering Model (REM) was developed by National Highways and is just one of the tools we are now using to increase the speed, quality and safety of road design. This will also form the basis of the creation of a company-wide Digital Twin.

So far, we have developed 11 schemes using the REM workflow. The time to produce the operational concepts for these schemes has decreased from around nine months for traditional approaches to a matter of weeks. Some aspects of preliminary design **timescales have decreased from around a year to just eight weeks**.

Alongside REM, we are using drones to build 3D maps of the network. We have recently mapped all 120 miles of M25 and are putting this data to immediate use on construction sites. Sharing this data across project teams will help to reduce carbon emissions by 95% (compared to traditional surveys), improve safety outcomes by reducing exposure of road workers to live traffic and minimise customer journey disruption caused by lane closures.

Case study – Connected and Autonomous Plant

Connected and Autonomous Plant will (CAP) transform our construction sites by delivering safe, automated and efficient construction processs.

We are trialing multiple use cases for CAP. For example, we have **deployed an automated dump truck trial** as part of the A14 upgrade scheme. This is one of several steps we are taking for CAP to become the business as usual approach by 2035 and deliver **£200bn of benefit by 2040**.

Our CAP roadmap sets the vision and key activities that need to be delivered for CAP to become the business as usual approach by 2035.

Digital Roads 2025 – Improving design and construction activities

Our activities will be increasingly automated, modular and conducted off-site. This will result in safer production, reduced network disruption, increased productivity and smoother journeys for our customers.

Our focus on Digital Roads means that each year the design and construction of the SRN will be improved:

Access to a **standardised components library**, which improves efficiency and increases design accuracy.
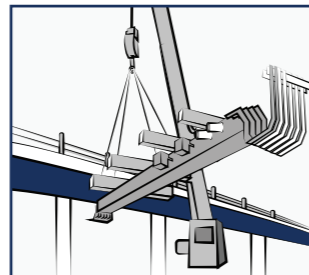
Increased use **modular construction** and **off-site manufacturing** techniques. This will result in increased productivity, and improved financial and environmental outcomes.
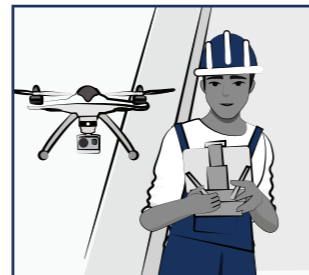
Regular use of **digital technology** (e.g. drones and aerial surveillance) **for surveys** reduces the need for preconstruction site visits and investigations.
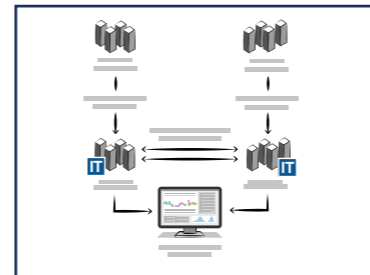
Use of the **same data sources** across construction partners on all sites, providing a **single source of the truth**. This improves collaboration and delivery outcomes.

Regular use of **digital rehearsal** tools to **rehearse construction site activities**. This results in more efficient delivery, improved safety and minimised customer disruption.

Ubiquitous use of **innovative construction technology** (e.g. automated plant) wherever practicable.

Detailed **digital twins** of all new schemes are built to support decision making of design and construction activities.

Timeline

2020 | 2021 | 2022 | 2023 | 2024 | 2025

Test and trials of the use of **automated design tools and semi-autonomous plant** (e.g. cone laying machine).

Standardised guidelines and training is issued on the use of data and digital systems on construction sites.

Increased use of **machine-led, human aided scheme designs**. Integration of the standardised component library with other design tools, leading to a **digitally enabled collaborative design workflow**.
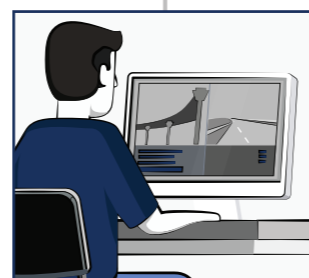
The use of **Rapid Engineering Model** for new schemes results in time savings of over 50% at the initial design stage.

Automated scheme design tools accurately estimate duration, sequencing and costing of construction activities at the design stage, improving collaboration across teams.

All **new construction sites are connected**. This enables real-time data to be collected on time sensitive activities, and allows for faster decision times.
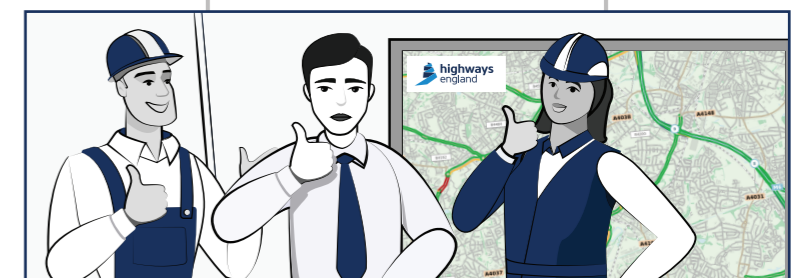
Road design and construction activities are increasingly **automated, modular and conducted off-site**. This is resulting in safer production, reduced network disruption, increased productivity and smoother journeys for our customers.

Digital Operations

Our operations will leverage data to drive increasingly pre-emptive interventions – resulting in improved asset resilience, increased asset life and a safer, smoother running network.

Summary of our ambitions for 2025

Intelligent asset management – Data and technology is harnessed to enable predictive asset management. Better coordination of roadworks and the deployment of connected and autonomous plant will improve efficiency and reduce customer journey disruption.

Enhanced operational capability – Greater automation and network adaptability is enabled through the use of data and sensor technology. When the unexpected does happen, customer safety is enhanced and traffic is managed efficiently.

Digitally enabled workers – Digitally enabled workers have access to accurate, up to date and consistent information, enabling them to do their work more efficiently and more safely.

Please visit the Digital Roads virtual learning environment to access the full list of our Digital Operations 2025 ambition statements.

Key benefits:

Digital surveillance techniques will reduce the need for human intervention and improve safety outcomes for our maintenance crews. Automatically detecting and responding to incidents will make our network safer for all.

Using digital tools will enable better coordination of roadworks, reducing network disruption. Our enhanced control room and operational capability will enable us to optimise traffic flow, reducing congestion and emissions.

Improved traffic flow will help to reduce carbon emissions on the SRN. Artificial intelligence and roadside technology will contribute to using network capacity more efficiently and operating our roads in a zero carbon way.

Case study – Intelligent maintenance techniques

We are trialling a new technique to prepare roads for resurfacing that promises to improve safety for road workers, use less water and increase efficiency.

Currently, when repairs are needed to concrete structures, workers use hand-held, high-pressure water jets to prepare the surface. It's a laborious process that can take many hours. We worked with one of our suppliers to pilot a new **automated system called Aqua Prep that combines the latest technology in high pressure water with robotic equipment**. It is good for the environment because the technique uses only half the amount of water compared with our existing method, and it completes tasks much faster. Using techniques such as this more widely will improve safety and shorten roadworks, reducing disruption for road users.

Case study – Single View of the Network and data trials

We are developing a Single View of the Network to enable our Regional Operational Control Centre colleagues to **access reliable, fit-for-purpose network information through a single platform**. This combines data feeds from disparate sources and enables our colleagues to easily access all available data in one place, improving the speed and accuracy of decision making. This will support incident detection and resolution, keeping traffic flowing smoothly.

We are creating an **analytical solution to predict the impact of events** (e.g. football matches) on traffic flow. This will enable our colleagues to take a more pre-emptive approach to network management.

We have also **launched a trial to understand how third-party data might be used to improve the service we provide to our customers**. In particular, we are exploring opportunities to use crowd-sourced incident data from Waze to reduce delays caused by congestion and improve incident clearance times.

The lessons and outcomes from these trials will form an integral part of our future company-wide Digital Twin, which will further improve our ability to oversee and manage the network.
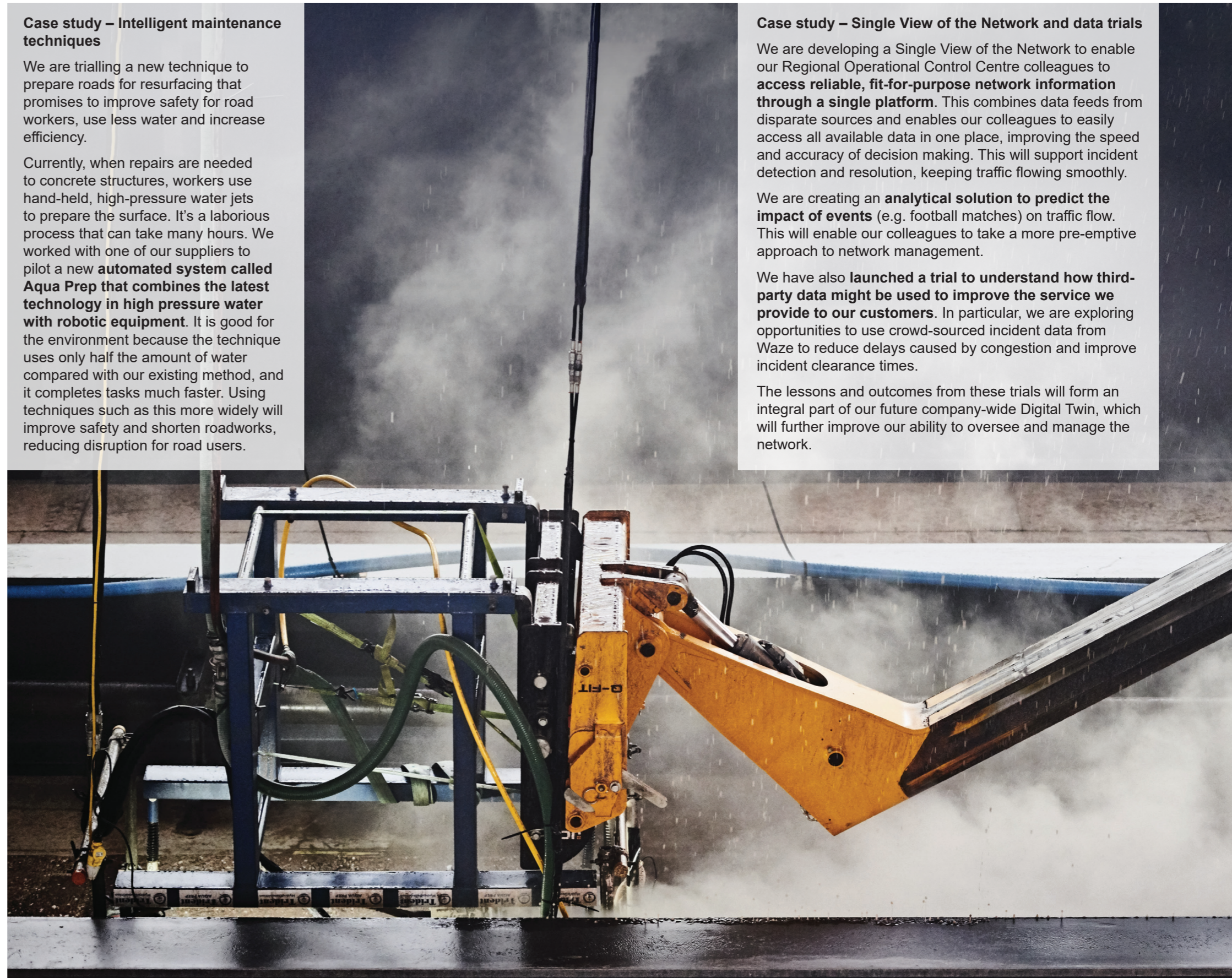
Digital Roads 2025 – Improving operations and maintenance

Our operations will leverage data to drive increasingly pre-emptive interventions - resulting in improved asset resilience, increased asset life and a safer, smoother running network.

Our focus on Digital Roads means that each year the operation and maintenance of the SRN will be improved:
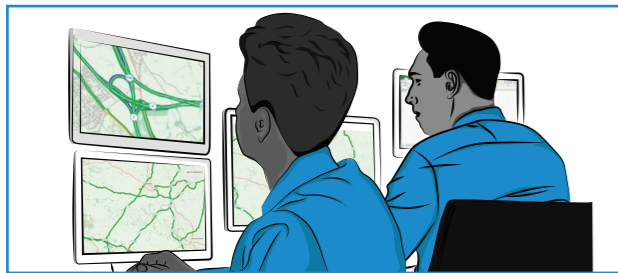
Full deployment of **Advanced Traffic Management System**. All Control Centre colleagues have received training on how to utilise the the new system to better control network flow.

Use of technology solutions (e.g. enhanced data analytics) **reduces the risk of working in live traffic**.
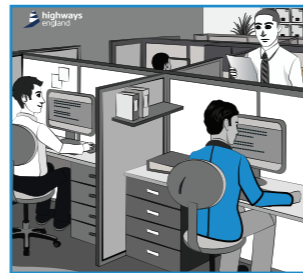
Production and sharing of more reliable network information (e.g. about roadworks), enabling our customers to make more informed journey decisions.
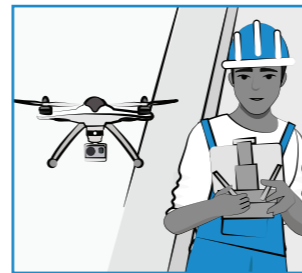
Regular **use of technology solutions** (e.g. aerial surveillance) **for inspections** to improve efficiency and safety.
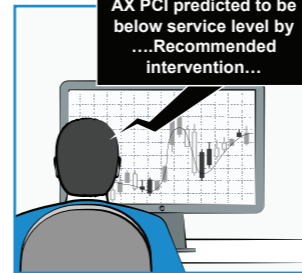
Use of **artificial intelligence** and **machine learning** tools to **predict and prevent asset failures**.
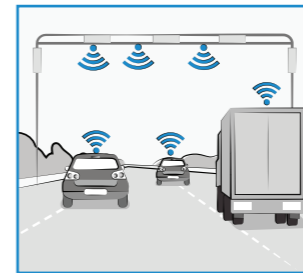
Access to more reliable weather, asset, and network condition data through third-party partnerships and an expanded sensor network for greater oversight, improved safety and control of the network.
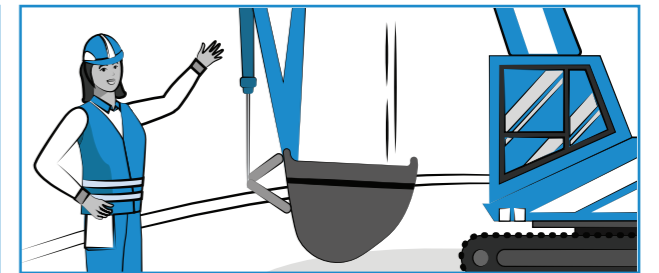
Updated **contracts and standards** to encourage maintenance partners to increase the use of **innovative technology** (e.g. semi-automated plant to improve safety).

| 2020	2021	2022	2023	2024	2025
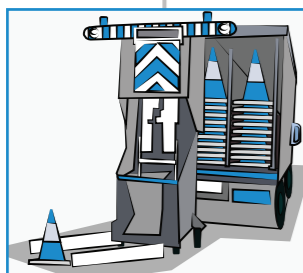
Trials of the use of **connected and autonomous plant** to perform maintenance activities - building our understanding of their impact on safety and delivery times.

Increased remote diagnosis of roadside technology assets to improve safety by reducing on-site human intervention.
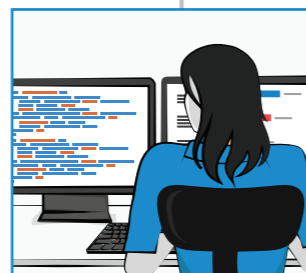
'Single View of the Network' includes **predictive capabilities**, enabling faster incident detection and response.
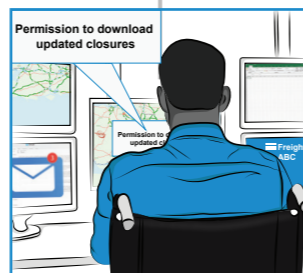
Roadworks planning tool provides an **integrated view of progress across all roadworks** programmes. This improves efficiency and helps minimise disruption to customer journeys.
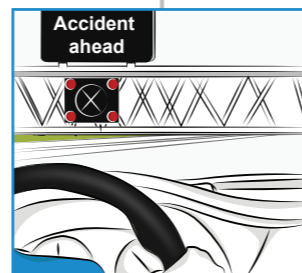
Automatic update of variable message signs, allowing customers to respond quickly to potential problems.

National Highways shares **accurate data about road incidents** with Emergency Services, enabling faster incident resolution.
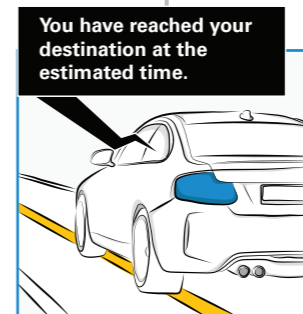
Customers are provided with **up-to-date roadworks information** through a range of digital channels, supporting them to better plan their journeys.
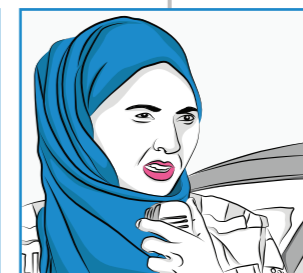
Traffic Officers use **digital tablets to provide up-to-date information to customers** and to exchange information (e.g. traffic condition) with Control Centres in real-time.

Our operations use **data to drive increasingly pre-emptive interventions** - resulting in improved asset resilience, increased asset life and a safer, smoother running network.

Digital for Customers

Our customers will be better informed and have trust in the journey information they access, ensuring that they feel safe and in control of their journeys.

Summary of our ambitions for 2025

Information provision – Our customers receive accurate, consistent, and close to real time journey information through their preferred digital channels.

Customer engagement – We receive better quality data from our customers, which informs our decision making and enables our call centre staff to provide excellent customer service. We enable the deployment of vehicle technology and connectivity, focusing on the benefits to customers.

Partnerships and alliances – We work with local highway authorities, transport operators, vehicle manufacturers and technology providers to improve customer experience and provide end-to-end journey support.

Please visit the Digital Roads virtual learning environment to access the full list of our Digital for Customers 2025 ambition statements.

Key benefits:

Accurate, consistent, and close to real time information will enable road users to react to potential hazards in advance. Our infrastructure will support the uptake of connected and autonomous vehicle safety technology.

Customers will receive improved information to support journey planning and decision making. This will keep traffic free flowing and reduce congestion.

The uptake of low emissions vehicles will be encouraged by improving access to information relating to charge point location and availability.

Case study - Every Customer Has An Opinion (ECHO)

We are focused on enhancing our relationships with, and understanding of, our customers. A key element of this is **enabling customers to quickly and easily tell us about their experiences of our services**. Providing real-time feedback and insights to support continuous improvement and innovation.

In 2019 we launched ECHO, our digital real-time customer feedback collection tool. ECHO data is being used to identify and prioritise areas of improvement related to:

i.   the information we share with our customers

ii. format in which we share information

iii. customer experience when contacting National Highways directly.

We will continue to enhance and develop the ECHO tool (e.g. integration with other systems). This represents a key step forward that will inform many of our future service improvements.

Case study - Enabling a connected and autonomous future

The growth of connected and autonomous vehicles (CAV) is expected to be one of the most significant changes ever to occur in transport. Connected systems promise integrated, reliable, and safer travel, whilst autonomy could increase accessibility, reduce incidents, and increase national productivity.

Working with other government authorities, agencies, academia and industry, we have conducted multiple CAV trials on the SRN. This forms part of our preparations to ensure the SRN is able to accommodate vehicles with varying levels of connectivity and autonomy.

We are clearly defining our role in the safe deployment and operation of CAVs on the SRN and are actively factoring this into our long term planning and investment decisions.

Digital Roads 2025 – Improving customers' journeys

Our customers will be better informed and have trust in the journey information they access, ensuring that they feel safe and in control of their journeys.

Our focus on Digital Roads means that each year our customers journey experience on the SRN will improve:
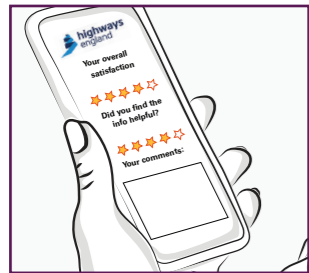
"It's easier to **provide direct feedback** on National Highways digital services."

"I use **Traffic England website** to find information about the road network."

"The **accuracy of information about planned road closures** has improved and I have more confidence in the information I receive."

"The information I receive from National Highways is **accessible and tailored to suit my specific needs**."

"I've noticed that **road incidents are cleared faster** and I have more **accurate information** about any delays, so I can get to work on time."

"I receive **up-to-date roadworks/incident information through my wayfinding app** – providing journey information that I can trust."
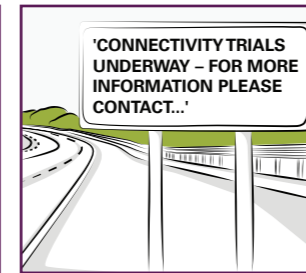
"I am **aware of the connectivity trials** taking place on the strategic road network and am interested to see what this will mean for me."

"The **automated incident feed is vital when planning delivery routes** and ensures that we meet our Just-in-Time deadlines."
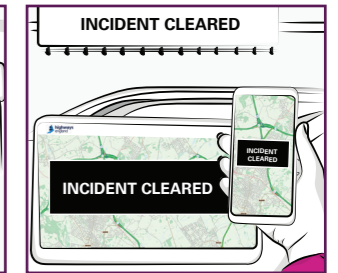
"All **digital channels and roadside signs provide consistent information** and I don't have to make a decision about which source to trust."

2020	2021	2022	2023	2024	2025

"I'm better informed about delays through **clearer variable message signs** on the road."
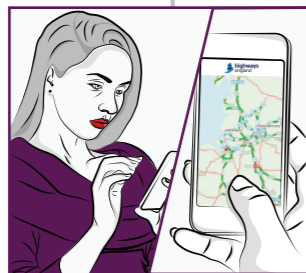
"The Traffic England Web service has been improved and it is now **easier to find useful live information** about the Strategic Road Network."

"It's now possible for me to **report an incident to National Highways through my wayfinding app**, this helps clear the road faster."
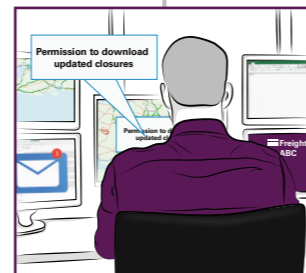
"The new **data feed and map showing planned road closures** has made my job of planning freight routes much easier."

"**Variable message signs** always allow me to react in good time to problems ahead."

"When I contact National Highways, I get a **response back through my preferred channel** and always know the status of my request. "
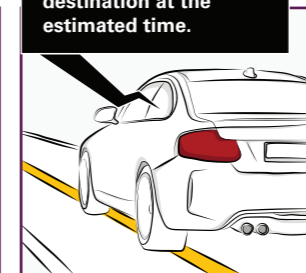
"My commute is now more predictable as **temporary road closures are cleared faster** and I have reliable roadworks status information."

"It is helpful that Traffic Officers are able to use a **digital tablet** to provide me with **up to date information** when supporting me on the roadside."

"I have **trust in the journey information I access, and feel safe** and **in control of my journeys**."

Our 2050 Vision

Safer construction and operations - Faster delivery - Better customer experience

2025	2025-2035	2035-2045	2045+
Digital Roads platform established	*Increased connectivity, autonomy and data sharing*	*Significant autonomy*	*Fully connected and autonomous*

Our activities will be increasingly automated, modular and conducted off-site. This will result in safer production, reduced network disruption, increased productivity and smoother journeys for our customers.

Our operations will leverage data to drive increasingly pre-emptive interventions - resulting in improved asset resilience, increased asset life and a safer, smoother running network.

Vehicles are **increasingly autonomous**, improving safety and capacity on the SRN

Increased **asset connectivity** across the network enabling pre-emptive intervention

Full **network connectivity** solution rolled out supporting in-vehicle communications

Material deployment of **connected and autonomous vehicles**

Freight Platooning is operational on the network

Personalised, dynamic **in-vehicle messaging** is fully operational to improve customer experience

Pro-active information provision to MaaS and logistics **fleet** operators to **guarantee journey timings**

Seamless journeys across **integrated transport networks** improving end to end customer journeys

WHO air quality target achieved and no new petrol or diesel vehicle sales

Moving pilots into **full scale deployment** optimising network services

Comprehensive **EV charging infrastructure** to support ICE phase-out and decarbonisation

Minimise road signage deployment, enhancing network control

Zero harm on SRN target achieved

Single view of **automated network planning** enabling full asset life optimisation

Largely **automated construction** to accelerate delivery

Net zero carbon target achieved

No roadwork disruption on the network

Air Quality: ✓

EV charging in 2 miles

Low bridge 2 miles ahead

REDUCE SPEED TO 60

REACHING DESTINATION IN 10 MINS

Zero harm on SRN ✓

Live network status: Dense traffic flowing at and average of 69 mph — Secure Network

Net zero carbon ✓

Pavement condition index: 90 0800; 01/01/2050

Next high speed train Departs in 00:05:05

Our customers will be better informed and have trust in the journey information they access, ensuring that they feel safe and in control of their journeys.
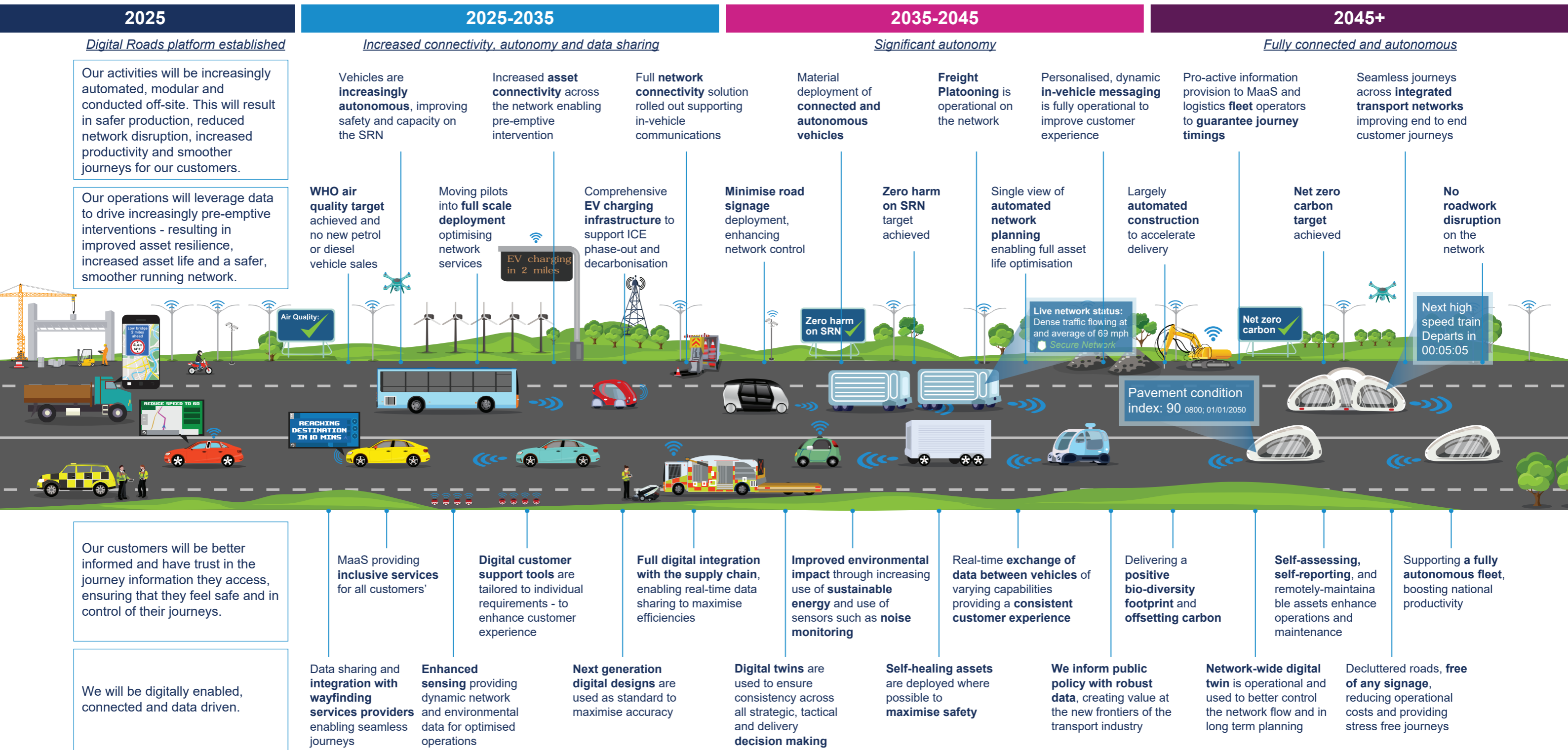
We will be digitally enabled, connected and data driven.

MaaS providing **inclusive services** for all customers'

Digital customer support tools are tailored to individual requirements - to enhance customer experience

Full digital integration with the supply chain, enabling real-time data sharing to maximise efficiencies

Improved environmental impact through increasing use of **sustainable energy** and use of sensors such as **noise monitoring**

Real-time **exchange of data between vehicles** of varying capabilities providing a **consistent customer experience**

Delivering a **positive bio-diversity footprint** and **offsetting carbon**

Self-assessing, self-reporting, and remotely-maintainable assets enhance operations and maintenance

Supporting **a fully autonomous fleet**, boosting national productivity

Data sharing and **integration with wayfinding services providers** enabling seamless journeys

Enhanced sensing providing dynamic network and environmental data for optimised operations

Next generation digital designs are used as standard to maximise accuracy

Digital twins are used to ensure consistency across all strategic, tactical and delivery **decision making**

Self-healing assets are deployed where possible to **maximise safety**

We inform public policy with robust data, creating value at the new frontiers of the transport industry

Network-wide digital twin is operational and used to better control the network flow and in long term planning

Decluttered roads, **free of any signage**, reducing operational costs and providing stress free journeys

Each time period represents a snapshot of the year indicated in the heading. Order and timeline of these milestones is indicative. Whilst no-one can predict with certainty what the future will hold, we believe that these trends will shape the SRN and influence our future operations.

Connecting the country key trends:

Demand — Demographic and usage shifts — On-demand consumption — Connectivity | **Infrastructure** — Smart assets — Construction innovation — Reducing impact, increasing resilience | **Vehicles** — Electrification — Connectivity and autonomy — Mobility as a Service

Our long term approach

Our journey does not stop in 2025... in fact it is just the beginning. Digital Roads 2025 lay the foundations for our longer term 2050 vision.

Whilst we can not predict the future, we are conscious of key emerging digital trends, in particular: data sharing, connectivity, and automation. These will shape the way we travel in the future and we are preparing for them today.

Key focus areas:

Digital Twin: A digital representation of a physical entity and its operation that can be queried. This will enable us to simulate our assets and improve our ability to design, construct, operate and maintain them with safety, customer and environmental outcomes at the forefront.

Connected Services: Connectivity is the use of technologies (e.g. mobile networks) to communicate with other cars on the road (vehicle-to-vehicle, V2V), roadside infrastructure (vehicle-to-infrastructure, V2I), and 'Everything' (V2X). This will enable smoother flowing traffic, reduced incidents and improved environmental outcomes.

Autonomous vehicles: A fully autonomous vehicle is able to operate itself and perform necessary functions without any human intervention. This will enable smoother flowing traffic, reduced incidents and improved environmental outcomes.
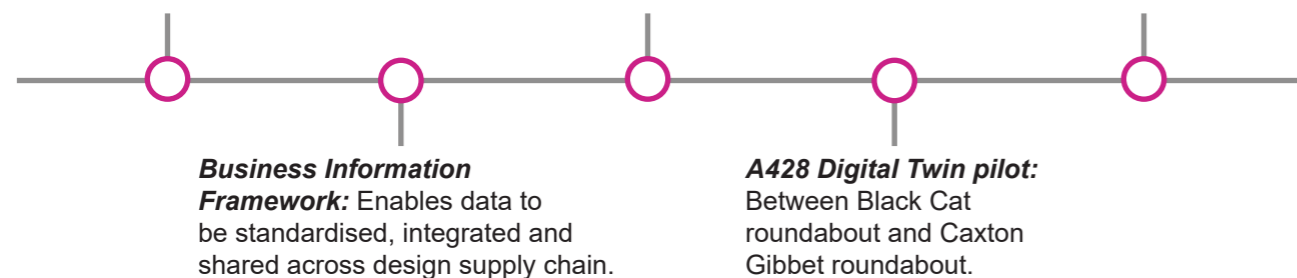
Digital Twin

Our progress so far:

Digital Twin Working Group: Formalised group leading integrated development.

M25 3D Mapping: First milestone in creating a much wider and integrated digital twin.

Data analytics: Building predictive analytics capability.

Business Information Framework: Enables data to be standardised, integrated and shared across design supply chain.

A428 Digital Twin pilot: Between Black Cat roundabout and Caxton Gibbet roundabout.

During RIS2 and beyond, we will:

– Define common data rules, governance and architecture.

– Produce detailed Digital Twins for all new schemes.

– Embed data into all business processes, using information to make critical business decisions.

– Plan for extending Digital Twin across the wider network.

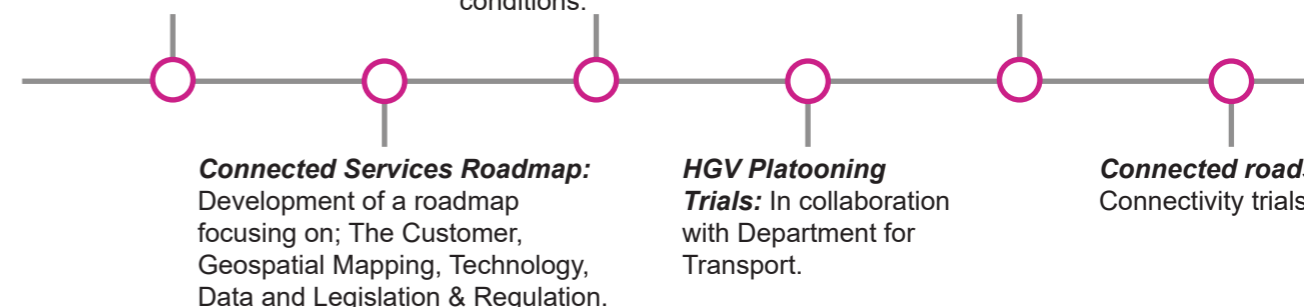– Incorporate our work into national digital twin.

Connected services

Our progress so far:

A2M2 Connected Corridor: Testing in-vehicle signage, road works warning, probe vehicle data and green light optimised speed advice.

Midland Future Mobility: 40 miles of road testing in-vehicle signage and warnings for emergency vehicle approaches, emergency braking and traffic conditions.

Cyber-Security: Business case and resource plan for a security operations capability.

Connected Services Roadmap: Development of a roadmap focusing on; The Customer, Geospatial Mapping, Technology, Data and Legislation & Regulation.

HGV Platooning Trials: In collaboration with Department for Transport.

Connected roads: Connectivity trials

During RIS2 and beyond, we will:

– Evaluate outcomes of existing pilots.

– Conduct trials to understand the value and benefits of connectivity to our customers and operations.

– Build a foundation to enable our roads to be 'Connected Roads Level 1' (ITS UK classification).

– Enable road users to receive information regarding roadworks and speed limits through smart-phone services and connected cars.
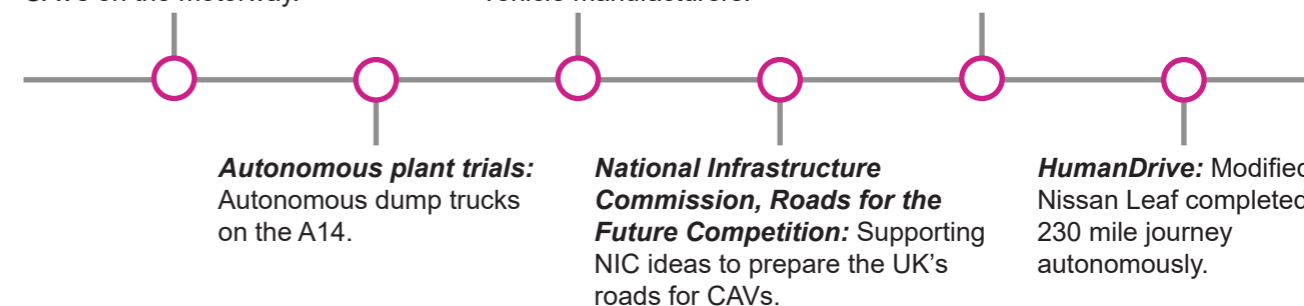
– Monitor and harness 5G roll out.

Autonomous vehicles

Our progress so far:

Connected and Autonomous Vehicles Infrastructure Appraisal Readiness: To understand the challenges that could be faced by CAVs on the motorway.

Raising awareness of vehicle technologies: Through industry bodies, 'Driving for Better Business' and engaging vehicle manufacturers.

Autoplex: Trial of level 4 automation around junctions and slip roads.

Autonomous plant trials: Autonomous dump trucks on the A14.

National Infrastructure Commission, Roads for the Future Competition: Supporting NIC ideas to prepare the UK's roads for CAVs.

HumanDrive: Modified Nissan Leaf completed 230 mile journey autonomously.

During RIS2 and beyond, we will:

– Continue to build understanding of the readiness of the Strategic Road Network to support CAV deployment, through enhanced trials and engagement.

– Actively enable the deployment of CAVs on the SRN.

– Continue to work with vehicle manufacturers and industry bodies to improve customer awareness of the technology in their vehicles.

– Finalise changes to construction and maintenance contracts to encourage the use of automated techniques by supply chain.

References

1. National Highways, Connecting the Country - Planning for the long term, 2017

2. Digital Framework Task Group (DFTG), Centre for Digital Built Britain, 2017

3. Friedrich, B, "The Effect of Autonomous Vehicles on Traffic." , 2016*

4. Industrial Strategy - Construction sector deal, 2018

5. National Highways, Connected and Autonomous plant - Roadmap to 2035, 2020

6. The Society of Motor Manufacturers and Traders Ltd (SMMT), 2021

7. Industrial Strategy: Government and Industry in Partnership; Construction sector deal (2018)

8. National Highways, Network Information System (NIS) Survey, 2019

9. O2, "The value of 5G for cities and communities report", 2018

10. Construction Sector Deal, 2018

11. Transport Focus, 'Going electric: the drivers' view', 2021

This publication is part of a suite of Digital Roads documents, which set out the latest National Highways thinking and approach for Digital Roads. All documents can be found in the Digital Roads virtual learning environment.
To find out more, visit: www.highwaysengland.co.uk/digitalroads