

Longer-term implications of Highways England's road period 2 delivery

Future technology preparedness

Final Report

Project Ref: ORR CT 20-09 WS2

Client: Office for Rail and Road

Prepared by Hyperion Infrastructure Consultancy Ltd

Title:	ORR CT 20-09 Workstream 2: Future technology preparedness Final Report	Filename:	orrt20_09_ws2_futtech_final report v03
Date:	March 2021	Version:	Review Final
Author:	Mike Gibb, Hyperion Infrastructure Consultancy Ltd		
Checker	James Elliott, Elliott Asset Management Ltd		

Contents

Executive summary	3
1 Introduction	5
2 RP2 Performance and delivery framework.....	7
3 Strategy and Planning	10
4 Electric/low emission vehicles	16
5 Connected vehicles and automated vehicles.....	18
6 Data	22
7 Conclusions	25
8 Recommendations	28
Glossary of terms	30
References	32
Annex 1 – Progress against expectations/commitments	33

Executive summary

This report presents a review of Highways England's 'future technology preparedness' in four specific areas:

- Strategy and planning;
- Electric/low emission vehicles;
- Connected vehicles and automated vehicles; and
- Data.

to inform the Office of Rail and Road (ORR) both in its role to advise the Department for Transport (DfT) in the development of the third Road Investment Strategy and for its planning for the monitoring regime for the next and future Roads Periods.

The themes within the scope of this review are not subject to explicit targets in the RIS2 [Performance Specification](#), though in many cases they relate to DfT's wider expectations for Highways England, largely expressed in the RIS2 [Strategic Vision](#). Notwithstanding the absence of specific targets or metrics, Highways England has invested and made significant progress in its planning and preparation for the potential impacts and opportunities of developments in technology. Highways England's Digital Roads initiative in itself largely addresses the fundamental point of investigation for this review regarding its planning and preparedness. The investment and activities for Digital Roads are consistent with Highways England's [Licence](#) obligations to provide flexibility and future-proofing in long-term planning for the SRN and drive progress on technology and innovation. A limited comparator study of transport infrastructure owning/operating organisations in the UK and abroad indicates that, overall, Highways England is well-placed regarding its awareness of, planning and support for new technology.

The strategies, plans and roadmaps developed by Highways England – i.e. Information Vision and Strategy, Digital Roads (incorporating, for example, Digital for customer → Connected Services) present ORR with visibility, at a good degree of granularity, of Highways England's plans and ambitions for RP2 and beyond. Thus, these could provide ORR with a baseline to maintain an overview of Highways England's progress against its stated ambitions.

However, the review has identified a potential 'gap' in some instances between Highways England's focus on delivery of its core function and wider DfT/Government goals and objectives that are not subject to explicit targets or outcomes.

Accordingly, the review has identified a number of recommendations for ORR to consider in both advising DfT and developing its monitoring regime in this area for RP3 and beyond:

1. ORR should engage with both DfT and Highways England to determine how best to ensure delivery of DfT's objectives where Highways England does or could have a key role but are beyond the prescribed targets and outcomes defined in the Licence, Performance Specification or Protocols. Clarification of delivery and support in these areas must recognise:
 - Impact on current remit and scope of operation of Highways England beyond its core role as a strategic highways company; and
 - Interaction with prescribed targets and outcomes and impacts on resource need and planning.

2. Particular consideration should be given to those areas where strong national agendas and/or policy objectives exist, and agile and timely response is essential e.g:
 - Decarbonisation where ORR should maintain liaison with the Department for Transport (DfT) / Office for Zero Emission Vehicles (OZEV) / Department for Business, Energy & Industrial Strategy (BEIS) regarding the future role of Highways England / SRN in provision of infrastructure to support Ultra Low Emission Vehicles (ULEV) to inform any future monitoring of Highways England in this area; and
 - Communications and connectivity where ORR should maintain liaison with DfT regarding any future role in provision of infrastructure and/or development of standards/guidance for Highways England in this area to inform its approach to future monitoring.
3. Recognising that Highways England has demonstrated significant investment and progress in most of the themes covered by this review in the absence of specific targets or outcomes, ORR should evaluate the merit of establishing a monitoring regime to address planning and preparation for future technology.
4. In the light of (1-3) above, ORR should investigate whether Highways England's strategies, plans, roadmaps etc represent a suitable baseline for assessing Highways England's delivery against its stated ambitions and specifically;
 - a. Evaluate whether the targets and milestones are sufficiently ambitious;
 - b. Evaluate quantitatively the potential contribution of the planned investment in technology to existing targets, e.g. expected benefit in terms of current safety KPI and PIs; and hence
 - c. Evaluate further development of existing targets to reflect and/or drive investment in and implementation of new technology.

1 Introduction

Programme overview

'CT20-09 Longer-term implications of Highways England's road period 2 delivery' is a programme of work commissioned by the Office of Rail and Road (ORR) to look at Highways England's planning and direction of travel in a number of areas. The overarching aim is to inform ORR's planning for future monitoring and advice to the Department for Transport (DfT) for RP3 and beyond, rather than to assess Highways England's performance in RP2.

The programme comprises four workstreams:

WS1 – How Highways England is managing congestion and delay

WS2 – Future technology preparedness

WS3 – Routes to Market review

WS4 - Planning and early delivery of life extension renewals

This report presents the findings and recommendations from WS2 which is a review of how Highways England is planning and preparing for the potential opportunities and impacts of the development of technology on its management and operation of the SRN.

Workstream scope

The potential breadth of '*future technology*' within Highways England is very wide. Therefore, a scoping exercise was undertaken collaboratively with both ORR and Highways England which identified three themes to explore in this review:

1. Organisational strategy and planning to adopt/support future technology developments from the near to longer terms.
2. Recognising that changes to the national vehicle fleet are already underway and are likely to accelerate with increasing uptake of electric/low emission, connected and automated vehicles, understand how Highways England is preparing for the impact of these on the SRN and how to support use.
3. 'Data' was identified by Highways England themselves as an important theme that had not been explicitly addressed in its earlier fore-sighting through the development of 'Connecting the Country: planning for the long term', but which had since emerged as an area of significance and focus for the business.

It is recognised that this scope excludes areas where Highways England has also invested to make demonstrable progress, such as digitalisation of standards, and both the design and construction processes, the latter including extensive work and collaboration with industry on connected and autonomous plant (CAP).

Scoping for this project also determined that a study of comparator organisations – i.e. organisations with a comparable function and remit to Highways England – would be of value to provide a general insight into the current state of practice elsewhere and, perhaps, examples of innovation and/or good practice that Highways England may wish to consider for application to the SRN.

Approach

An information gathering exercise was undertaken to establish an evidence base for the review. This comprised four elements:

1. Review of publicly available documents and information, and further information provided by Highways England
2. Engagement with internal stakeholders from Highways England
3. Interviews with key external stakeholders
4. Information from a study of other transport infrastructure owners/operators

This information has been assimilated and assessed to identify findings and recommendations that have then been further developed through review and discussion with both ORR and Highways England.

Presentation of report

The following sections of the report present:

- **Section 2 - RP2 performance and delivery framework**
Overview of Highways England's current obligations and the associated monitoring regime, together with the wider expectations for Highways England.
- **Section 3 - Strategy and planning**
Summary of Highways England's progress and planning for the opportunities and impacts of technological advances, together with key findings relevant for ORR's future planning and monitoring.
- **Section 4 - Electric/low emission vehicles**
Overview of Highways England's role during RP2 in supporting the uptake of electric/low emission vehicles and observations on issues for ORR, DfT and Highways England to consider for future Roads Periods.
- **Section 5 - Connected vehicles and automated vehicles**
Overview of Highways England's developing role and direction to support Connected Vehicles (CV) and Automated Vehicles (AV) based on research and development that continues from RP1 and is planned to extend to RP3. Key findings relevant for ORR's future planning and monitoring.
- **Section 6 - Data**
Summary of Highways England's capability and strategy development with respect to data and data management and key findings including perspective of external stakeholders.
- **Section 7 - Conclusions**
Presentation of the principal conclusions from the review that are of relevance for ORR's planning for RP3 and future roads periods.
- **Section 8 - Recommendations**
Recommendations for ORR to consider in its preparation for RP3 and beyond.

A glossary of terms and list of references shown as (x) are included at the end of this report.

2 RP2 Performance and delivery framework

Overview

The principal requirements and targets for Highways England's management, operation, maintenance and enhancement of the strategic road network (SRN) are set out in its [Licence](#) (1) and the [Performance Specification](#) presented within DfT's Road [Investment Strategy 2: 2020–2025](#) (RIS2) (2). These requirements and targets form the basis of ORR's monitoring regime for Highways England.

Highways England's principal corporate documents that present its approach and programmes for delivery during RP2 are its [Strategic Business Plan 2020 – 2025](#) (SBP) (3) and [Delivery Plan 2020 – 2025](#) (DP) (4). These documents focus primarily on how Highways England will achieve the prescribed objectives and targets from the Licence and the Performance Specification.

The *Strategic Vision* element of the RIS2 document identifies a number of expectations from Highways England's operation and management of the SRN that extend beyond the specific requirements of the [Licence](#) and targets of the [Performance Specification](#) and reflect wider aims for both Highways England and the SRN in supporting national economic, environmental and societal goals, and liaising with and supporting key stakeholders, such as local/regional transport authorities.

Highways England: Licence (1)

Highways England operates under a Licence from DfT that sets out its statutory obligations. Most relevant to this study is the requirement that Highways England must:

Provide for sufficient flexibility and future-proofing in planning the long-term development and improvement of the network, taking account of long-term trends, uncertainties and risks - including new and emerging technologies and long-term trends in climate and weather conditions.

Notably, the Licence also emphasises the broader expectations of Highways England:

The Licence emphasises that the role of Highways England is about more than just complying with the letter of the law. We expect the company to go the extra mile in the way it engages with road users and collaborates with other organisations to develop shared solutions. And they must take a lead in promoting and improving the role and performance of roads in respect of broader communal responsibilities, such as the aesthetics of design, safety and the environment, as well as driving forward wider progress on technology and innovation.

Road Investment Strategy 2: 2020–2025: Performance Specification (2)

The RIS2 *Performance Specification* does not place explicit requirements on Highways England regarding the planning for, or the adoption of new technology, though 'Outcome 4: Delivering better environmental outcomes' does include a commitment to "Investigate and assess incorporating into new and existing contracts air quality standards for supply chain vehicles deployed on Highways England work..." which infers the consideration of low emission vehicles.

Road Investment Strategy 2: 2020–2025: Strategic Vision (2)

While the RIS2 *Performance Specification* does not define requirements for Highways England in preparing for the opportunities and impacts of future technology, the *Strategic Vision* element of that document does present expectations for Highways England to deliver beyond the immediate

scope of the Performance Specification to support improved performance and delivery and wider societal benefit. These expectations include that Highways England will:

- have a role in the development of regulations and infrastructure standards for connected vehicles and automated vehicles and will provide guidance for local authorities;
- work with manufacturers of CV/AV and other stakeholders to create the right flows of data and information to and from Connected and Automated Vehicles (CAV)s;
- will ensure that both motorways and trunk 'A' roads are suitable for regular use by automated vehicles - without the need for major upgrades to the physical infrastructure on trunk 'A' roads;
- will continue with existing provision of data and ensure an open architecture that allows software developers to provide users with new services;
- will continue to invest in connectivity, fitting cabling alongside the SRN and evaluating 5G; and
- will Invest in staff and skills "to become one of the world's most tech-savvy highway operators."

Road Investment Strategy 2: 2020–2025: Protocols (2)

The RIS2 documents presents a number of Protocols which assign responsibility to Highways England for functions or activities that are not core to its role as a strategic highways company. None of the current Protocols are relevant to the theme of this review.

Strategic Business Plan 2020-2025 (3)

Highways England's Strategic Business Plan (SBP) notes that the RIS2 publication recognises:

"...the importance of the SRN to the economy, social wellbeing and connecting the country"

and that

"... government considers our roads as a fully integrated system, and a part of the broader UK transport network."

The SBP recognises some of the expectations raised in the RIS2 *Strategic Vision*, stating that Highways England will:

- develop standards for infrastructure to support connected and autonomous travel;
- work with vehicles manufacturers on information flow to/from vehicles; and
- develop skill capabilities in conjunction with supply chain.

and makes specific commitments to:

- "engage with car manufacturers by November 2020 to understand how we can help build greater awareness and understanding of 'eCall' or SOS buttons"; and
- Further develop its Rapid Engineering Model – a digital, automated design tool developed in RP1 initially to support smart motorway design.

The SBP also introduces Highways England's Digital Roads initiative – see Section 3.

Delivery Plan 2020-2025 (4)

Regarding deploying or supporting the implementation of new technology during RP2, the Delivery Plan (DP) states that Highways England will:

- look to using Electric Vehicle (EV)/Ultra-low emission vehicles (ULEV) for its own fleet subject to meeting Traffic Officer (TO) towing requirements; and
- complete the NRTS transformation programme in RP2; fit cabling alongside the network and use fibre optic cables and digital technology to improve and future-proof services.

The DP also refers to Highways England's Information Vision and Strategy (see Section 6) and its plans to:

- improve its data analytics capability in RP2;
- invest in building data-to-intelligence services and building an open-data architecture;
- Improve data and information governance;
- make data and insights accessible and share this information, e.g. with local authorities; and
- Refresh data at a greater rate and make better use of data to understand & predict maintenance requirements.

The SBP and the DP are focussed primarily on delivery to achieve the specific requirements of the [Performance Specification](#); in relation to planning for the opportunities and impacts from new technology these documents largely present 'high-level' plans and aspirations with relatively few specific actions or commitments.

A brief summary of Highways England's progress against the above expectations and commitments is presented in Annex 1.

3 Strategy and Planning

During RP1 Highways England published ‘Connecting the Country: Planning for the long term’ (CtC) (5) which set out Highways England’s vision, and challenges, for its management of the SRN to 2050. This is a key document in providing direction and focus for Highways England’s longer-term planning. It identified nine trends over the key areas of demand, infrastructure and vehicles over the next 30-years which would impact of the SRN, and what they would mean for Highways England’s operation and delivery.

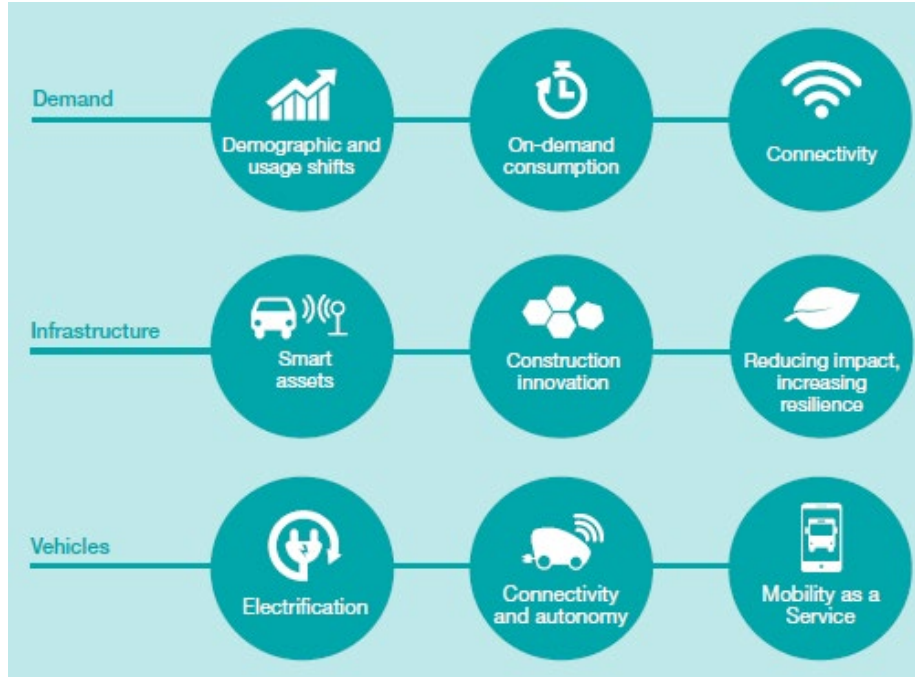


Figure 1 – Trends identified in CtC

These trends included aspects of future technology, ie: smart assets, construction innovation, electrification, and connectivity & autonomy. CtC also proposed a framework for how it could develop its operation and delivery to meet these challenges over the longer term.

	Next steps →				Future ambition →
Design, construction, and maintenance	Deploying new materials and construction techniques	Increasing asset connectivity and digitisation	Automating construction to speed up delivery	Creating a network of self-sustaining, smart assets	
Connected and autonomous vehicles	Providing network connectivity	Realising fully connected and safer roads	Preparing for a driverless network	Supporting CAV-only roads	
Customer mobility	Providing for new mobility choices	Creating high quality connections for our customers	Enabling seamless journeys across integrated transport modes	Providing guaranteed customer journeys	
Energy and the environment	Providing clean energy infrastructure		Phasing out internal combustion	Improving the environment, with a positive bio-diversity footprint	
	Reducing impacts on our neighbours	Progress reduce, reuse & recycle			
Operations	Maximising data to inform operations	Integrating networks between the road, operators, and customers	Creating an intelligent, self monitoring, and reactive network	Achieving a near zero disruption network	

Figure 2 – Five change themes from CtC

It is evident that since the publication of CtC Highways England has invested significant effort and resource in further developing both its strategy and plans to exploit the opportunities and manage the potential impacts from developing technology across the full range of its business. This effort is aligned, coordinated and managed through the Digital Roads (DR) initiative (6, 7, 8), which it launched publicly at Highways UK on 5th November 2020.



Figure 3 – Digital Roads vision from Highways UK launch

Broadly, DR will support Highways England’s stated imperatives (Safety; Customer; Delivery) through providing:

“Safer Construction and Operations - Faster Delivery - Better Customer Experience”

It will also enable improved performance in delivery of existing targets and objectives (e.g. KPIs) with expected contribution to:

- Improving safety, Zero Harm target;
- Increased efficiency;
- Faster delivery (Project Speed);
- Improvement in air quality; and
- Decarbonisation.

Highways England has identified the potential headline benefits that its investment in new technology may yield (8):

- £51bn - The annual UK economic benefit of connected and autonomous vehicles by 2030;
- Infrastructure AI could boost GDP by 16% by 2030;
- Zero fatalities on the network by 2040;
- £7bn pa of benefits of the UK infrastructure sector from developing a National Digital Twin;
- 5G connectivity to reduce traffic delays by 10%; and
- Data-driven decision-making can boost output and productivity by 5-6%.

In order to deliver these benefits, the operational goals for DR are to:

- capture a company-wide view of planned and ‘in-flight’ activities associated with the vision for Digital Roads;
- develop cross-organisation ownership & buy-in, i.e. avoid silo working;
- inform the supply chain of Highways England’s direction and objectives in order to promote innovation across the whole supply chain; and
- support the move from concept to implementation by developing detailed roadmaps and workplans for RP2 together with a longer-term road map outlining the vision for radical change to 2045+.

The overall ownership of DR rests with Strategy and Planning Directorate which provides the Chair for the Digital Roads Programme Board that has been established to ensure cross-Directorate engagement, endorsement of products and a company-wide view. DR is structured under three core themes with ownership of these themes allocated across the business.

Core theme	
Digital Design and Construction	Owned by Major Projects; aligns with Major Projects ‘Digital by Default’ programme
Digital Operations	Owned by Operations, aligns with ‘Operation Excellence’ programme
Digital for Customers	Owned by Information Technology Directorate and aligned to Highways England’s Customer Service Strategy; significant development work has gone into this theme to establish what is best for the customer in end-to-end journeys, i.e. not just SRN.

Table 1 – Digital Roads core themes

Below the core themes are 35 ambition statements for RP2 which have been defined and cross-linked to promote cross-organisational working and coordination. The programme for RP2 has been designed to lay the groundwork to support innovation and more radical change for RP3 onwards.

Core theme	Sub-theme	Ambition statements/activities
Digital Design and Construction	Digitally enabled design	Digitised requirements; Effective management and exploitation of data; Machine-led, human aided tools; Digital twin
	Modular & standardised approaches	Modularised and off-site fabrication will become the default where practical; Standardised components
	Automated construction	Connected and semi-automated plant (CAP); Enhanced safety on-site; Digital rehearsal
Digital Operations	Intelligent asset management	Predictive asset management; Data and Systems; Digital surveillance; Roadworks planning; Automated and autonomous plant
	Enhanced operational capability	Control room technology; On-road technology; Sensor technology and data science; Reduced closure impact; Improved detection; Emergency services

Core theme	Sub-theme	Ambition statements/activities
Digital for Customers	Digitally enabled workers	IT equipment; Reduce on-road worker and live traffic conflict
	Information provision	Close to real-time; Consistency; Digital channels; Roadside technology; Signs & signals
	Customer engagement	Customer contact; Better quality data; Network trials; Working with vehicle manufacturers;
	Partnership and alliances	End-to-end journey support; Better information for the freight and logistics sector; Network changes; Innovation; Future connectivity

Table 2 – Digital Roads sub-themes and ambition statements

The outcome focus for DR during RP2 is reflected in the suite of summary roadmaps, detailed roadmaps, workplans and expected outcomes together with RACI charts for workstreams to be delivered that have been developed to a level of granularity to support management and delivery.

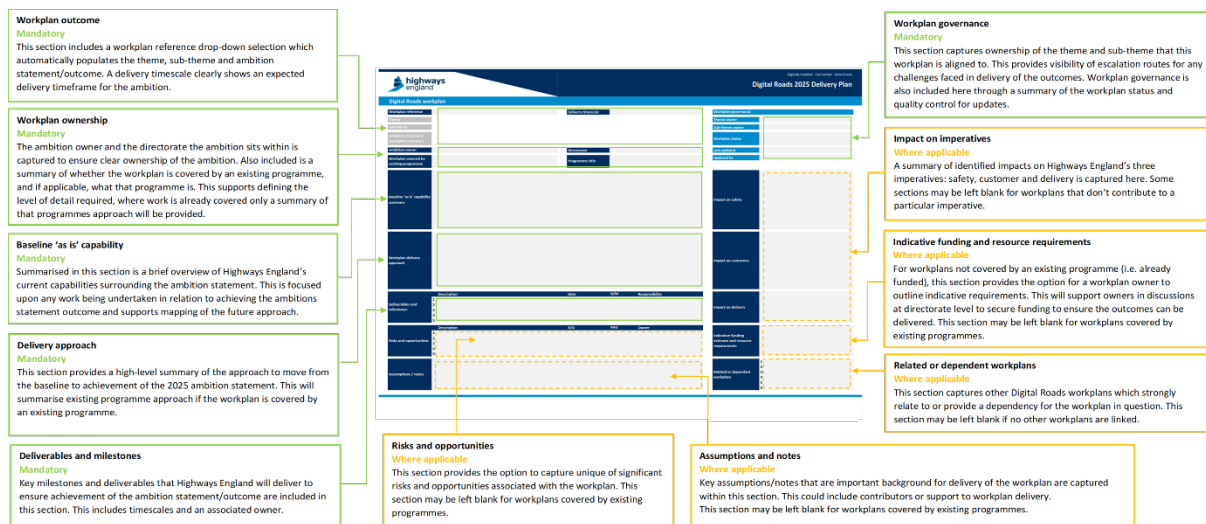


Figure 4 – Digital Roads detailed workplan development

These roadmaps and workplans have been developed in collaboration with key stakeholders across the Highways England business to avoid duplication and gaps. Also, as many of the workstreams brought under the wrapper of DR are already 'in flight' as part of existing programmes (such as OE 2025 [9]) - with owners, funding and timetables already in place - milestones in the DR roadmaps are not constraints on those workstreams but have been developed with the owners to be realistic.

DR has been launched publicly and is being actively promoted to the supply chain and stakeholders through a range of promotional material and, from Highways England feedback on recent events, is evidently being well received. However, implementation still requires consideration of:

- handover of the concept to the rest of the business;
- governance and management of delivery; and
- funding where DR has identified gaps in existing workstreams. (It is anticipated that Designated Funds will be key for this, especially the customer-related element, subject to development and approval of business cases).

At present the more detailed planning in DR is focussed on RP2, while the roadmap for 2025 – 2045 provides an informed/best view of the future looking further ahead. It is anticipated that DR will continue to be developed with a refresh for 2025 to present a delivery programme for RP3.

CtC, which is also owned and maintained by Strategy & Planning (S&P) directorate, is seen as complementary to DR and will continue to be refreshed as it provides a broader, socio-economic scope and looks at the impact of long-term external trends on the SRN, issues largely beyond Highways England control, in contrast to the nearer-term delivery focus of DR.

It is recognised that the pace of change in technology makes deciding when and where to invest challenging. The combination of the long-term foresighting of CtC with near term delivery planning of DR provides Highways England senior management with a mechanism to inform investment decisions in this field.

The identification of developments and trends to inform both CtC and DR is picked up through horizon scanning work undertaken by both Safety, Engineering & Standards directorate (SES) and S&P. This horizon scanning on trends also allows S&P to advise SES on research studies that need to be undertaken. The standards subsequently developed from the research are an important enabler for the implementation of new technology.

Strategy and Planning key findings

The key findings regarding Highways England's planning and preparation for the impacts of future technology considering the evidence obtained, including from engagement with external stakeholders, and in the context of ORR's future monitoring are as follows:

- Highways England has developed and launched 'Digital Roads' (DR) which complements and moves on from 'Connecting the Country' in providing a delivery-focussed approach for RP2 to 'establish a platform' in digital technology development and implementation to support 'more radical change' to 2045+.
- The development of DR represents a significant effort to address the challenge of identifying and aligning current work strands and, hence, also identifying gaps to be addressed. The result should provide a framework for consistency of approach across Highways England and a 'wrapper' to draw together and align work strands across the business.
- The benefits are seen as enabling delivery of existing targets and objectives (e.g. KPIs) and improving performance delivery.
- DR effectively gives ORR good visibility of Highways England's plans to develop its adoption of technology in RP2 at a level of significant detail and granularity.
- The roadmaps in DR potentially provide ORR with a baseline for assessing Highways England's progress against its stated ambition.
- DR in itself largely addresses the fundamental point of investigation for this review, ie Highways England's 'future technology preparedness'. The investment and activities for DR are consistent with Highways England's [Licence](#) obligations to provide flexibility and future-proofing in long-term planning for the SRN and drive progress on technology and innovation.

- It is envisaged that Highways England will, at the appropriate time for its business planning, refresh the DR roadmap for RP3. This would provide ORR with similar insight into the development and progress of Highways England's planning for the impacts and opportunities of future technology beyond RP2.
- Connecting the Country (5) will be maintained alongside DR as it provides a broader socio-economic view of trends outside Highways England's control and, in tandem with DR, provides senior management with a valuable basis for investment planning which is challenging given the pace of change in technology.

4 Electric/low emission vehicles

During RP1 Highways England was tasked by DfT with delivering an initial phase of the roll-out of charging infrastructure to support the take-up of electric vehicles (EV) and address the issue of 'range anxiety' which may present a barrier to that take-up. This was expressed as a commitment in the [RIS1 Investment Plan](#) (10).

The Company will work on the recharging facilities on the SRN to allow it to be a truly national network. Many motorway service areas have already invested in rapid charging points. The company will work with operators to ensure this becomes a comprehensive national network. More generally, the Company will have the aim of ensuring that 95% of SRN will have a charging point every 20 miles. Wherever possible, these will be rapid charging points that can charge a battery-powered electric vehicle in less than 30 minutes.

This task represented a new area of operation for Highways England which presented challenges, such as engaging with a new supply chain. Highways England commissioned a study which showed that, with charge points already being provided at motorway service areas (MSAs), gaps in provision were mainly in rural areas. The requirements for sites to be suitable for Highways England customers, i.e. safe, secure and always accessible, constrained the locations available. The installation programme was funded through Highways England's RIS1 Designated Funds (initially the Environment Fund, subsequently the Air Quality Fund) and delivery was either through grant funding to site owners (often local authorities) or installation by commissioned contractors.

By the end of RP1 Highways England had exceeded the target for provision and the task is now complete.

Over the course of RP2 further roll-out of charging infrastructure will be through Project Rapid which is the responsibility of the Office for Zero Emission Vehicles (OZEV – formerly Office for Low Emission Vehicles [OLEV], part of DfT and BEIS). Highways England is a stakeholder in Project Rapid; it sits on the steering group and will also have a commercial interest as it holds the lease for 30 of the 116 Motorway Service Area (MSA) sites, which are the first priority for OZEV. Analysis has shown that the most significant barrier to the rollout of charge points is the cost of grid connection and the issue of MSA leases is a key factor in this. While there is currently no agreed DfT/Highways England/OZEV strategy for charge points at MSAs, Highways England is committed to facilitate this where possible.

There are no explicit requirements on Highways England in either the [Licence](#) or DfT's RIS2 document regarding the roll-out of EV charging infrastructure in RP2, nor does it have a delivery role in Project Rapid.

Electric and low emission vehicle key findings

The key findings regarding Highways England's planning and preparation for the impacts of future technology considering the evidence obtained, including from engagement with external stakeholders, and in the context of ORR's future monitoring are as follows:

- Highways England has delivered its RIS1 target for provision of charging points.
- There are no explicit requirements on Highways England for provision of charging infrastructure in RP2.
- Highways England is engaged with current planning for EV charging infrastructure being undertaken by the Department for Transport (DfT), the Department for Business, Energy & Industrial Strategy (BEIS) and the Office for or Zero Emission Vehicles (OZEV). Highways

England has a role as a leaseholder for some MSAs where charge points will be installed and will look to facilitate grid connections where appropriate.

- Highways England does not have a delivery role in Project Rapid, which is the OZEV led initiative on provision of EV charging infrastructure which will commence during RP2.
- It is important that Highways England recognises the importance of the decarbonisation agenda, which is very high priority for DfT, and is proactive about how it can contribute to this, e.g. the establishment of a dedicated Highways England lead for EV charging infrastructure would be welcomed by OZEV (11).
- In addition to static EV charging facilities, Highways England will have a key role to play in the provision and/or operation of infrastructure to support decarbonisation of freight. Although there are currently several competing technologies (e.g. in-road induction systems, on-road and above-road conduction systems for dynamic charging of HGVs) it is timely to start strategic planning for the joined-up provision of charging infrastructure to optimise the availability of static and/or dynamic charging facilities.
- ORR should maintain liaison with DfT/OZEV/BEIS regarding the future role of Highways England/SRN in provision of charging infrastructure to inform any future monitoring of Highways England in this area (see Section 8).

Comparator case study for vehicle freight charging

The comparator study undertaken as part of this review generally showed that Highways England is well placed regarding international practice in planning for future technology. There were, however, some examples that may be useful for Highways England, DfT and/or ORR to consider, including that below relating to strategic planning for decarbonisation of freight transport in Sweden.

Trafikverket (the Swedish Government agency responsible for long-term planning, construction, operation and maintenance of transport infrastructure) has been tasked with developing plans to introduce dynamic charging for HGVs on 3% of network by 2035. This entails piloting different technologies: induction (in road), conduction (on-road and above road) and planning where most effective locations on network are to install ERS, given its cost, to provide most effective joined-up solution of static and dynamic charging solutions. (11)

5 Connected vehicles and automated vehicles

Highways England has participated, and continues to participate, in several projects, trials and programmes on the development of connected vehicles (CV) and automated vehicles (AV); a brief overview of some of these is presented in Table 5 below:

Project	Overview
UK Connected and Intelligent Transport Environment (UK CITE) link	Establishment of live road testbed for connected and automated vehicles. Partners from highways authorities, academia/research organisation, motor manufacturers, communications/technology companies
European InterCor (Interoperable Corridors) link	Successful testing of innovative cooperative ITS (C-ITS) services
HumanDrive link	Project with Nissan on autonomous vehicles
Helm UK link	UK Heavy Goods Vehicle Platooning project Work on the effects of freight platooning is currently underway with the early results from off-road trials being evaluated and further trialling in progress.
CEDR Call 2017 Automation link	Collaborative multi-national research programme to investigate impact of vehicle fleet automation for national road authorities.
A2/M2 corridor trials	Highways England led with DfT, TfL and Kent CC undertaking technical field evaluation of connected vehicle services (aligned to C-Roads Day 1 services). A2/M2 is the UK's contribution to the InterCor Euro-regional C-ITS project.
Connected Digital Roads link	Project on provision of real time information for CV/AV. Provided an early opportunity for HE to engage with stakeholders including vehicle manufacturers and wayfinding service providers.
Midland future mobility link	This was local authority led, Highways England's role highlighted contractual issues to be addressed in connected service provision.
Data task force	Data sharing forum that will make new sources of data available to Highways England; looking at ingesting data from vehicles and the value to HE of that data, can help HE influence data exchange protocols & regulations.
CAViAR (Connected and Autonomous Vehicles: Infrastructure Appraisal Readiness) link	Highways England working with Loughborough University on impacts of/readiness for CV/AV, e.g. roadworks, merging/diverging sections, lane markings

Table 5 – Overview of Highways England participation in CV/AV development studies

From its engagement with these trials and key stakeholders and its work and trials during RP1, Highways England is now developing its direction in this area for RP2 and beyond. This is consistent with its stated view of its role from CtC:

We believe that our role is to enable and support, rather than to drive vehicle technology change. So this requires us to take a watching brief, be prepared to change course as technology evolves, and identify where our playing an enabling role can help catalyse wider change.

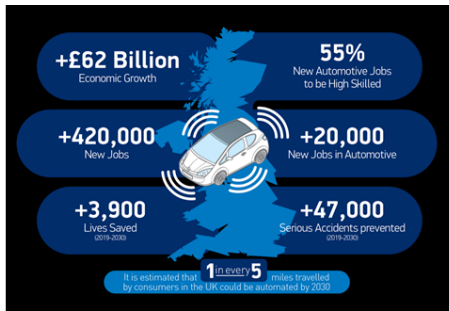
From the above view, connected vehicles and/or automated vehicles are not a deliverable for Highways England; the challenge is to be ready to support their implementation. On this basis, Highways England has determined that a ‘connected services’ approach is the ‘best fit’ for its role. This is based on in-vehicle mobile handsets or factory fitted OEM devices, as access to and use of these is likely to be more widespread than CV/AV use, at least until the market for CV/AV develops. It is recognised that CV/AV manufacturers will need their vehicles to operate effectively across the whole network, not just the SRN; in the short term the provision of supporting infrastructure and connectivity across the whole road network is likely to be uneven resulting in differences in levels of CV services.

Highways England is in the process of developing a [Connected Services Roadmap](#) (12) for its future development as a business-wide initiative in this area focussed on the ‘connected customer’; this is aligned with the ‘Digital for Customer’ core theme of Highways England’s Digital Roads initiative. A Responsible, Accountable, Consulted, Informed (RACI) approach is being developed to manage this across the Highways England business, to make goals clear and avoid duplication of effort, and the programme will be subject to the Digital Roads governance regime.

Connected Services – What are they?

Connected Services use communication technologies such as mobile networks to communicate with the driver, other cars on the road (vehicle-to-vehicle [V2V]), roadside infrastructure (vehicle-to-infrastructure [V2I]), and ‘Everything’[V2X].

They are not limited to vehicle systems



Connected and Autonomous Vehicles: The Global Race to Market – SMMT 2019 Frost & Sullivan
<https://www.smmt.co.uk/wp-content/uploads/sites/2/SMMT-CONNECTED-REPORT-2019.pdf>




- Benefits**
-  **Reduced Need for New Infrastructure:** V2V & V2I communications can reduce the need for building new infrastructure and reduce maintenance costs
 -  **Travel Time Dependability:** V2V, V2I, and V2X can substantially reduce uncertainty in travel times via real-time, predictive assessment and communication of travel times, diversions or road works on all routes
 -  **Active Traffic Communications:** Enabling messages to be sent and received directly by vehicles will allow them to advise and be advised of incidents ahead, where there are gaps or no infrastructure is installed.



Figure 5 – Overview of Connected services

The aim is to deliver a level of functionality that matches the current most advanced motorway sections, in terms of active traffic management and information provision, across the whole SRN within two years. This should deliver safety benefits, though it is recognised that it will require a review of communications infrastructure options and impact on regional operations centres. The rollout of services will be based on what can realistically be delivered now or in the short term, which is consistent with the Digital Roads philosophy, though the programme can be adapted to meet customer needs as they emerge.

A key decision by Highways England is to adopt cellular communications technology as the platform for these services. Its own role in the development/deployment of cellular to serve the SRN is not clear, so Highways England recognises that it needs to develop dialogue with vehicle manufacturers and the Mobile Network Operators (MNOs) to understand respective roles and requirements. Ofcom requires mobile networks to provide voice and data coverage for 90% by area of UK by 2026 therefore, while recognising there will be local 'not spots' to address, this should support Highways England's aim to offer services across the whole of the SRN.

It has been noted from discussion with both Highways England and local authority stakeholders that availability/provision of 5G coverage can be a challenge and that the installation of good fibre infrastructure is key to supporting this. However, Highways England has stated that there is no current provision within the National Road Telecommunications Service 2 (NRTS2) contract for the replacement or upgrade of fibre to meet future technologies (i.e. CV/AV) given the cost, time and network disruption this would entail. There may be localised capacity available and, again locally, some RIS2 roadside improvement schemes may upgrade existing duct and fibres to increase capacity. The NRTS2 network is scheduled for completion in June 2022 and there will be capability to consider future technology requirements from then. Note that there is no existing fibre provision on the APTR network, and none is currently planned.

The forthcoming report on trials on the A2/M2 corridor (which were undertaken by Highways England in collaboration with DfT, TfL and Kent County Council) corridor will show comparable performance and function between ITS-G5 & cellular platforms and cellular is seen as a good option in terms of cyber security, however Highways England has identified that requirements and capabilities in terms of locational accuracy and latency of information transition need to be further investigated and developed.

Concurrently Highways England is also developing its Operational Technology Strategy (OTS) which is a 15-year vision for Technology Services with associated plans to support delivery. The vision recognises that these services, which connect customers, control centres and on-road resources, need to be prepared for the change and challenges presented by CV and AV. The OTS, which is supported by a series of Service and Product Roadmaps that will state their evolution and requirements for the next 5 – 10 years, is due to be ready for internal consultation by the end of March 2021.

Standards and legislation around CV and AV are evolving and it is essential that Highways England is abreast of and involved in this development, e.g. to assess the impact on design standards (DMRB), and the enforcement of variable speed limits transmitted in-vehicle, and alignment with common international practice. Highways England's CV/AV trials, engagements in testbeds, such as Midlands Future Mobility, as well as its European project involvement will support its role in the development of standards for CV/AV infrastructure. This will be particularly important if, in future, Highways England is assigned a role in providing infrastructure to support connectivity.

Highways England recognises the benefit of the funding it has received in RIS1 (through the Designated Funds) for trials and development in this area, particularly in comparison to the devolved administrations and local authorities. While it is focussed on its own delivery targets, and there is no overarching national strategy for the support of CV/AV, it does recognise and accept its role in sharing the benefits of its funding and development and providing guidance to local authorities and other stakeholders, given that end-to-end journeys generally neither start nor finish on the SRN.

It is envisaged that Designated Fund funded development in this area will continue through RP3. There is no current plan to provide input on investment to support connected services and CV/AV into the investment programme planning for RIS3.

Connected vehicles and automated vehicles key findings

The key findings regarding Highways England's planning and preparation for the impacts of future technology considering the evidence obtained, including from engagement with external stakeholders, and in the context of ORR's future monitoring are as follows:

- Highways England has determined that a connected services approach is the best fit for its role in this area and that a cellular platform is the most appropriate solution to deliver this across the SRN, particularly with the increasing rollout of 5G.
- This development is aligned with the Digital Roads framework and a draft [Connected Services Roadmap](#) (12) which sets out ambitions, activities and milestones has been developed.
- Nationally, focus at present is on the legal/regulatory framework for CV/AV hence DfT's vision or ambition for the role of the SRN is not yet clear and hence there are currently no specific requirements for Highways England. There are, however, aspects of communications and digital infrastructure requirements and provision that may impact on Highways England (11). ORR should, therefore, maintain liaison with DfT regarding any future role for Highways England in this area to inform its approach to monitoring.
- The Centre for Connected and Autonomous Vehicles (CCAV) has noted that Highways England, as owner of the Design Manual for Roads and Bridges (DMRB) is uniquely placed for a role in the development of standards to support CV/AV (11) and this reflects a wider expectation of Highways England expressed in the RIS2 Strategic Vision (2). Highways England recognises the benefit of the funding it has received (through Designated Funds since RP1) and accepts its role in sharing the benefits of this funding through the development of standards and providing guidance to stakeholders such as local authorities as and when requirements become clear.
- Provision of fibre communications infrastructure can support the rollout of 5G network coverage. Highways England's NRTS network currently has only very localised capacity to support CV/AV needs. Further provision could be considered once the NRTS2 upgrade/extension has been completed which is due in June 2022. There is no fibre provision on APTR and this is not included in the NRTS2 plans.
- It is recognised that it is still early in RP2, and that Highways England is still developing its connected services roadmap, but it would be helpful for external stakeholders to have visibility of/engagement on solutions that Highways England is considering for the SRN and how these will integrate with local authority multi-model network O&M requirements (11).
- Highways England envisages that development work on CV/AV and connected services funded through Designated Funds will continue through RP3. There is no current plan to provide input on investment to support connected services and CV/AV into the investment programme planning for RIS3.

6 Data

‘Data’ was included in the scope of this review at the suggestion of Highways England since this is an area that was not explicitly identified as a trend to be monitored in [Connecting the Country: Planning for the long term](#) (5) but has subsequently emerged as an important discipline for Highways England.

Highways England’s response to the identification of ‘data’ as a theme for focus and investment has included developing its internal capability through recruitment of appropriately skilled specialist resources led by the appointment of a Chief Data Officer within the Information Technology directorate (ITD). It has also developed its [Information vision and strategy](#) (13), which is aligned with the Digital Roads framework, predominantly under the Digital for Customer core theme, and has outlined its plan to increase its data maturity and become a data-driven organisation by the end of RP3.

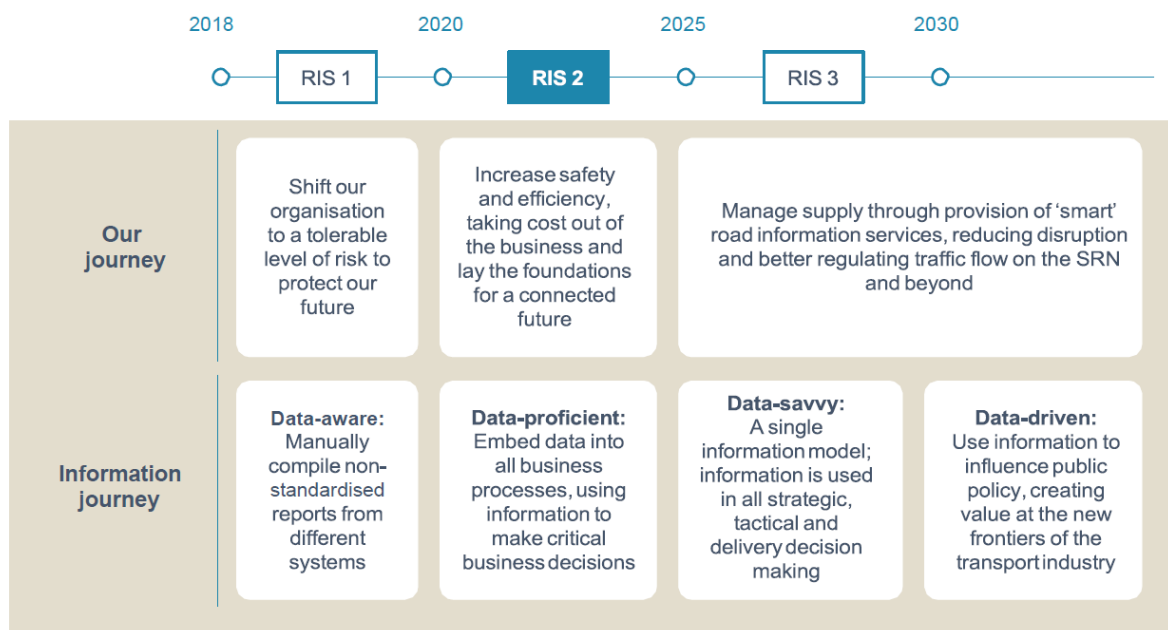


Figure 6 – Highways England ‘information journey’

Key to this approach is to view data as an important asset; Highways England has undertaken an initial evaluation of its data as an asset which resulted in a ‘conservative’ value of £60bn (14). Internally it has developed an information management framework and developed the governance and assurance of both its own and supplier data to improve quality. It is planning in August 2021 to issue frameworks for procurement of all information and technology products, i.e. including data, that are based on bespoke rather than Crown Service terms and conditions to give it the specific controls it requires.

In developing its ‘Digital for Customer’ strategy – one of the core themes under Digital Roads – Highways England has determined that it will focus on the provision of information to allow customers to decide on their own journey planning. Highways England is, therefore, working to review and centralise its data and communications channels with open architecture platforms to support sharing of information with external organisations. There is no plan to commoditise this service – the data acquisition and Highways England resources are publicly funded – though Highways England would expect to benefit from beneficial licensing arrangements with any third-party developers making use of the data.

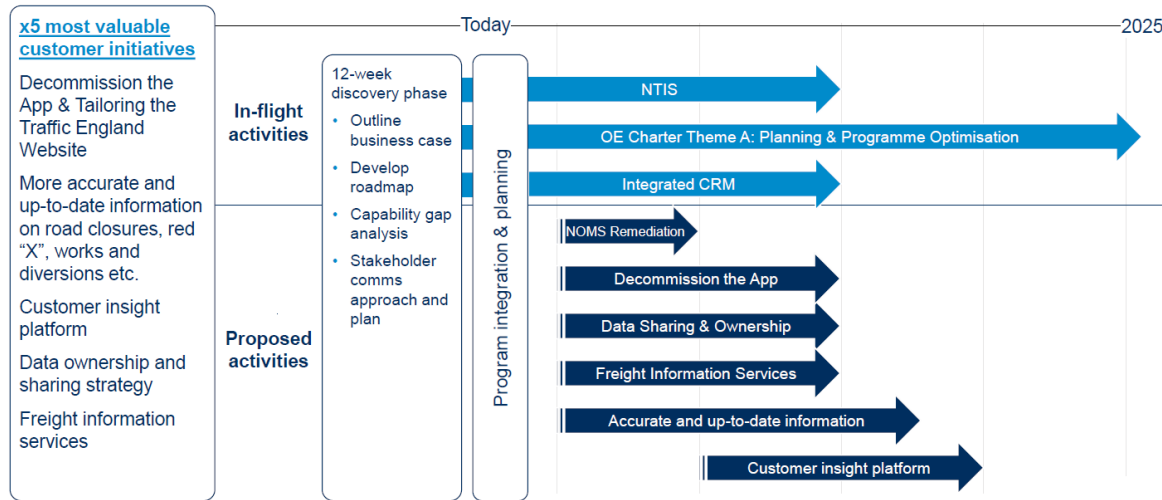


Figure 7 – Digital for Customer RP2 delivery roadmap

Highways England recognises it has a leading role to play in developing the use of data to improve management and delivery for road infrastructure and engages externally across a range of forums, e.g. BSI for security standards, with DfT across various groups for liaison with local authorities, and the European Data Task Force for international collaboration.

Data key findings

The key findings regarding Highways England’s planning and preparation for the impacts of future technology considering the evidence obtained, including from engagement with external stakeholders, and in the context of ORR’s future monitoring are as follows:

- Highways England has developed an information vision and strategy with a roadmap to becoming a data-driven organisation by the end of RP3.
- Highways England is actively developing its data capabilities through the appointment of specialist skilled resources and the development of governance and processes to increase data accessibility and improve data quality.
- Highways England views data as an asset and has undertaken an initial valuation of the data that it holds.
- Key stakeholders see Highways England as an important player in terms of scale, skills and resource in this field; the provision of thought leadership in the management and exploitation of data as a valuable asset for the improvement of highway network operation would be welcomed by local authorities in particular (11).
- Highways England is also seen as having a role in the sharing of data and information with stakeholders as well as customers with particular benefits from sharing operational information with other highway authorities to enable effective management of traffic on the local road network as well as the SRN (11).
- Highways England’s Digital for Customer strategy has recently determined its role as an information provider (rather than journey planner) and it is working to review and centralise its data and communications channels with open architecture platforms to support sharing of information with external organisations.

Comparator case studies for data sharing

While it is recognised that Highways England has undertaken significant review and analysis in the development of its Digital for Customer strategy, the comparator study element of the review identified a couple of examples of established data sharing practice that may be of value or interest.

Germany has an established, mature platform (approx. 8 years) for sharing data, the 'Mobility Data Market Place' (11). This is used by 3rd parties including vehicle OEMs; the technology platform for this is currently being upgraded (Mobility Data Platform).

Transport for West Midlands (TfWM) has established a Regional Transport Coordination Centre (RTCC), a multi-agency collaboration which provides realtime information on disruption & its impact across all modes through an online dashboard. This uses open data architecture and a data exchange/integration mechanism has been established and is in operation with, for example, Waze and the police for anonymised ANPR data (11).

7 Conclusions

The themes within the scope of this review are not subject to explicit targets in RIS2, though in many cases they relate to DfT's wider expectations for Highways England, largely expressed in the Strategic Vision element of the RIS2 document. Notwithstanding the absence of specific targets or metrics, Highways England has invested and made significant progress in its planning and preparation for the potential impacts and opportunities of developments in technology.

Digital Roads

The Digital Roads initiative in itself largely addresses the fundamental point of investigation for this review, i.e. Highways England's 'future technology preparedness'. The investment and activities for Digital Roads are consistent with Highways England's Licence obligations to provide flexibility and future-proofing in long-term planning for the SRN and drive progress on technology and innovation. The motivation behind Digital Roads is to improve performance and deliver benefits, which should support Highways England in achieving or exceeding the targets and outcomes it is tasked with delivering.

The strategies, plans and roadmaps developed by Highways England – i.e. Information Vision and Strategy, Digital Roads (incorporating, for example, Digital for customer → Connected Services) present ORR with visibility, at a good degree of granularity, of Highways England's plans and ambitions for RP2 and beyond. Thus, these could provide ORR with a baseline to maintain an overview of Highways England's progress against its stated ambitions.

The information obtained from engagement with transport infrastructure owning/operating organisations in the UK and abroad indicates that, overall, Highways England is well-placed regarding its awareness of, planning and support for new technology in comparison with practice elsewhere. Its established practice in scanning research enables it to keep it abreast of relevant developments.

However, the review has identified a potential 'gap' in some areas between Highways England's focus on delivery of its core function and wider DfT/Government goals and objectives that are not subject to explicit targets or outcomes. From this review, Highways England's role in the provision of infrastructure to support EV serves to illustrate the issue of understanding the expectation of Highways England's investment and delivery beyond the specific targets and tasks assigned through the Performance Specification, Licence and/or Protocols.

Future of EV and charging

Electrification of the vehicle fleet was identified in "[Connecting the Country; Planning for the long term](#)" (5) as one of the future trends for Highways England to consider, noting the *"...bold stances by governments and industry leaders..."* to support the shift to ultra-low and zero emission vehicles which will *"...continue to gather pace over the coming years..."*

During the course of this review the Government has announced the advancement of the cut-off date for sales of petrol or diesel cars from 2040 to 2030 (2035 for hybrid vehicles), illustrating the potential speed and strength of policy change, which will require an agile response across a number of sectors.

While Highways England delivered its RP1 commitment on EV charging infrastructure it has observed that it did not feel that it was necessarily best placed for this role, given its core function as a strategic highways company and the existence of a commercial market in provision. OZEV

recognised that this was not a core function for Highways England and that it did not possess the in-house skills or resources for this task, however it observed (11) that DfT had explored giving Highways England a greater role in Project Rapid, though ultimately alternative delivery agents have been appointed. OZEV emphasised that it is important Highways England recognises the importance of the decarbonisation agenda, which is very high priority for DfT, and is proactive about how it can contribute to this.

Although infrastructure to support uptake of EVs is important, a bigger challenge, across many sectors, is likely to be posed by the decarbonisation of freight. While there is not yet any certainty on technical solutions and publication of Government planning or policy is pending, Highways England recognises it may need to be 'agile' in its response and has noted it would welcome further discussion with DfT on how its ambition has evolved since RIS1. Notwithstanding its 'watching brief' approach (5), it would be timely for Highways England to be undertaking strategic planning in decarbonisation where change is certain and likely to be rapid. ORR and DfT should satisfy themselves that Highways England is able to respond in a timely, agile way when required.

Connected Vehicles (CV) / Automated Vehicles (AV)

A similar, though perhaps not so immediate, situation exists regarding preparation for CV/AV. It has been noted above that DfT's vision or ambition for the role of the SRN is not yet clear and hence there are currently no specific requirements for Highways England. However, it is evident that progress is likely to be made in the near term; automated lane keeping system (ALKS) vehicles are expected on the network by 2021, while vehicles that meet the Society of Automotive Engineers (SAE) level 4 classification are expected by 2025.

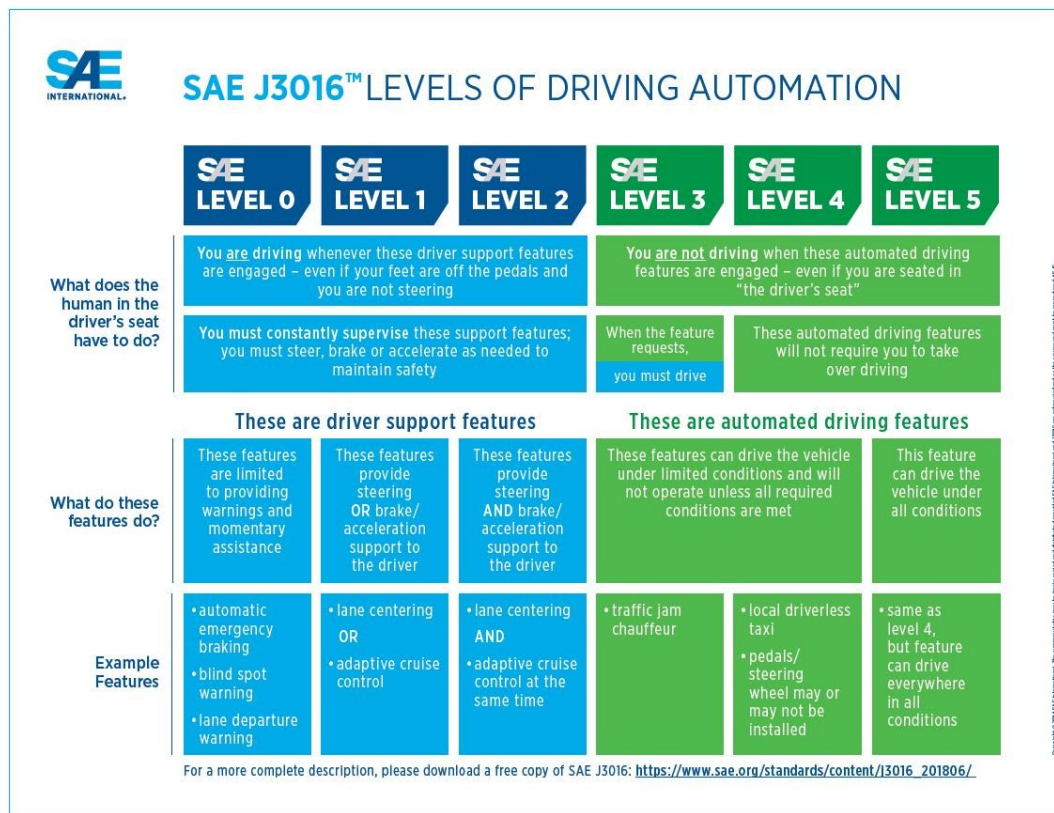


Figure 8 – Levels of driving automation (15)

In this context it is noted that Highways England is planning to continue with development work on CV/AV, funded by Designated Funds, through RP3. However, there is no current plan to provide input on investment requirement to support connected services CV/AV uptake for the investment programme planning for RP3.

Performance monitoring

Highways England's planning for future technology is not currently subject to any explicit requirements or performance targets. Rather, new technology is currently seen as an enabler for Highways England to meet its existing targets and improve its delivery of the operation and management of the SRN. However, it is important - to deliver continuous improvement and meet the needs and expectations of customers and stakeholders - that Highways England is proactive in this area. Decarbonisation of the vehicle fleet will contribute to the 2050 Net Zero target and the increasing connected and automated capabilities of cars, passenger transport and freight vehicles should contribute to improvements in road safety, with the potential to contribute to Highways England's zero harm by 2040 target.

Between DfT, as the intelligent client, and Highways England as its principal delivery agent, there is scope to clarify expectations of delivery and/or support in areas where there are no prescribed targets or outcomes. This should be a priority in areas of stated national interest and/or where there are strong Government policy drivers, i.e. decarbonisation of transport to support the Net Zero 2050 target.

On this basis, key issues for ORR to consider include:

- whether it has a role in brokering between DfT and Highways England in the space beyond that governed by explicit target requirements to ensure that expectations are clearly understood on both sides and that the appropriate resourcing to meet these alongside Performance Specification delivery targets is provided for in future RIS settlements.
- while Highways England is clearly developing plans and strategies for new technologies and has shown good progress, ORR should satisfy itself that Highways England is sufficiently active and timely in areas where it is not currently specifically charged with - and hence resourced for - delivery.
- whether ORR's monitoring regime should be extended to ensure that Highways England is focussed on supporting wider national initiatives and roles, particularly in areas where there is a clear and strong policy agenda and drivers, such as decarbonisation.

Assigning responsibility to Highways England for functions that are not core to its role as a strategic highways company is preceded through the use of protocols, which are already in place for national salt stocks, technical regulations etc.

8 Recommendations

This review has identified a number of recommendations for ORR to consider, and these are presented below. The recommendations are derived from an overview assessment of Highways England's activities and planning in the areas covered by the scope and are focussed on issues and actions for ORR both in advising DfT and developing its monitoring regime for future Roads Periods rather than detailed aspects of Highways England's performance and delivery.

1. ORR should engage with both DfT and Highways England to determine how best to ensure delivery of DfT's objectives where Highways England does or could have a key role but are beyond the prescribed targets and outcomes defined in the Licence, Performance Specification or Protocols. Clarification of delivery and support in these areas must recognise:
 - Impact on current remit and scope of operation of Highways England beyond its core role as a strategic highways company; and
 - Interaction with prescribed targets and outcomes and impacts on resource need and planning.
2. Particular consideration should be given to those areas where strong national agendas and/or policy objectives exist, and agile and timely response is essential e.g:
 - Decarbonisation, where ORR should maintain liaison with DfT/OZEV/BEIS regarding the future role of Highways England/SRN in provision of infrastructure to support ULEV, to inform any future monitoring of Highways England in this area; and
 - Communications and connectivity, where ORR should maintain liaison with DfT regarding any future role in provision of infrastructure and/or development of standards/guidance for Highways England in this area, to inform its approach to future monitoring.
3. Recognising that Highways England has demonstrated significant investment and progress in most of the themes covered by this review in the absence of specific targets or outcomes, ORR should evaluate the merit of establishing a monitoring regime to address planning and preparation for future technology.
4. In the light of (1-3) above, ORR should investigate whether Highways England's strategies, plans, roadmaps etc represent a suitable baseline for assessing Highways England's delivery against its stated ambitions and specifically;
 - a. Evaluate whether the targets and milestones are sufficiently ambitious;
 - b. Evaluate quantitatively the potential contribution of the planned investment in technology to existing targets, e.g. expected benefit in terms of current safety KPI and PIs; and hence
 - c. Evaluate further development of existing targets to reflect and/or drive investment in and implementation of new technology.

The review has also identified a limited number of observations for Highways England to consider in its continued development in the areas addressed under the scope:

- As Digital Roads has a long-term horizon, refreshing of the roadmap for future Roads Periods would continue to provide ORR with similar insight into the detailed development and progress of Highways England's planning for the impacts and opportunities of future technology.

- It is important that Highways England recognises the importance of the decarbonisation agenda, which is very high priority for DfT, and is proactive about how it can contribute to this, e.g. the establishment of a dedicated Highways England lead for EV charging infrastructure would be welcomed by OZEV (11).
- In addition to static EV charging facilities, Highways England will have a key role to play in the provision and/or operation of infrastructure to support decarbonisation of freight. Although there are currently several competing technologies (e.g. in-road induction systems, on-road and above-road conduction systems for dynamic charging of HGVs) it is timely to start strategic planning for the joined-up provision of charging infrastructure to optimise the availability of static and dynamic charging facilities.
- It is recognised that it is still early in RP2, and that Highways England is still developing its connected services roadmap, but it would be helpful for external stakeholders to have visibility of/engagement on solutions that Highways England is considering for the SRN and how these will integrate with local authority multi-model network O&M requirements (11).
- Key stakeholders see Highways England as an important player in terms of scale, skills and resource in the management and governance of data and having a role in the sharing of data and information. While it is recognised that Highways England is underway with both the [Information Vision and Strategy](#) and [Digital for Customer](#) initiatives that will largely address these points, greater visibility of Highways England's activities and the provision of thought leadership in the management and exploitation of data, as a valuable asset for the improvement of highway network operation, would be welcomed by local authorities in particular (11).

Glossary of terms

5G	5th generation cellular network standard
AESIN	Automotive Electronics Systems Innovation Network
AI	Artificial Intelligence
ALKS	Automated lane keeping system
ANPR	Automatic number-plate recognition
APTR	All Purpose Trunk Road
ARRB	Australian Road Research Board
AV	Automated Vehicles
BAST	Bundesanstalt für Straßenwesen
BEIS	Department for Business, Energy & Industrial Strategy
BMVI	Bundesministerium für Verkehr und digitale Infrastruktur
CAP	Connected and Autonomous Plant
CAV	Connected and Automated Vehicles
CCAV	Centre for Connected and Autonomous Vehicles
CEDR	Conference of European Directors of Roads
CtC	Connecting the Country: Planning for the long term
CV	Connected Vehicles
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
DoT	Department of Transportation (US)
DP	Delivery Plan
DR	Digital Roads
ERS	Electric Road System
EV	Electric Vehicle
HE	Highways England
HGV	Heavy Goods Vehicle
ICE	Internal Combustion Engine
ITD	(Highways England) Information Technology Directorate
KPI	Key Performance Indicator
LA	Local Authority
LGA	Local Government Association
MNO	Mobile Network Operator
MSA	Motorway Service Area
NRTS	National Roads Telecommunications Services
O&M	Operation & Maintenance
OEM	Original Equipment Manufacturer
OFCOM	Regulator for UK communications services
OLEV	Office for Low Emission Vehicles
ORR	Office of Rail and Road
OZEV	Office for Zero Emission Vehicles
RACI	Responsible, Accountable, Consulted, Informed
RIS	Road Investment Strategy
RP	Roads Period
RP	Roads Period
RTCC	Regional Transport Coordination Centre

S&P	(Highways England) Strategy and Planning directorate
SAE	Society of Automotive Engineers
SBP	Strategic Business Plan
SES	(Highways England) Safety, Engineering & standards directorate
SMMT	Society of Motor Manufacturers and Traders
SRN	Strategic Road Network
TfL	Transport for London
TfWM	Transport for West Midlands
TO	Traffic Officer
ULEV	Ultra-Low Emission Vehicles

References

1. Highways England: Licence. DfT, 2015.
2. Road Investment Strategy 2: 2020–2025. DfT, 2020.
3. Strategic Business Plan 2020 – 2025. Highways England, 2020.
4. Delivery Plan 2020 – 2025. Highways England, 2020.
5. Connecting the Country: Planning for the long term'. Highways England, 2017.
6. What Highways England means by Digital Roads. Highways England presentation to Highways UK, November 2020.
7. DRAFT Digital Roads Draft Interactive Roadmap 2025. Highways England, November 2020.
8. DRAFT Ambition statements 2025: Building a platform for Digital Roads v3.0. Highways England, November 2020.
9. OE2025: Operational excellence transformation programme in RP2. Highways England.
10. Road Investment Strategy 1: 2015–202. DfT, 2020. Investment Plan. DfT, 2015.
11. ORR CT 20-09 Future Technology Preparedness. INITIAL Evidence base. 2020.
12. DRAFT Connected Services Roadmap. Highways England, 2020.
13. Information vision and strategy. Highways England, 2020.
14. Data Valuation Paves the Road to the Future for Highways England. DB Laney. Forbes Magazine. February 2021.
15. Surface Vehicle Recommended Practice J3016™ Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles. Society of Automotive Engineers, June 2018.

Annex 1 – Progress against expectations/commitments

Source	Expectation of/Commitment by Highways England	Status/Evidence
RIS2 Strategic vision	Have a role in the development of regulations and infrastructure standards for connected vehicles and automated vehicles and will provide guidance for local authorities.	See Section 5. HE recognises and accepts this role, but requirements not yet defined. HE is actively keeping abreast of developments in this area.
	Work with manufacturers of CV/AV and other stakeholders to create the right flows of data and information to and from CAVs.	See Section 5. Since RP1 HE has engaged, and continues to engage, with industry stakeholders
	Will ensure that both motorways and trunk ‘A’ roads are suitable for regular use by automated vehicles - without the need for major upgrades to their physical infrastructure in the case of the latter.	See Section 5. HE has adopted a Connected Services approach which aims to deliver smart motorway levels of information provision across the SRN within 2 years.
	Will continue with existing provision of data and ensure an open architecture that allows software developers to provide users with new services.	See Section 6. This is being addressed under the Information Vision and Strategy and the Digital for Customer initiative.
	Will continue to invest in connectivity, fitting cabling alongside the SRN and evaluating 5G.	See section 5. NRTS2 is scheduled for completion in June 2022 – provision for CV/AV can be considered from that point. There is no current or planned fibre provision for the APTR network.
	Will Invest in staff and skills “to become one of the world’s most tech-savvy highway operators.”	See Section 6. HE has recruited specialist data resources.
RP2 Strategic Business Plan	“Engage with car manufacturers by November 2020 to understand how we can help build greater awareness and understanding of ‘eCall’ or SOS buttons”, and	There are currently gaps in coverage for the Emergency Services Network (ESN) – dialogue with Govt required on provision.
	Further develop its Rapid Engineering Model – a digital, automated design tool developed in RP1 initially to support smart motorway design.	Not in scope.
RP2 Delivery Plan	Look to using EV/Ultra-low emission vehicles (ULEV) for its own fleet subject to meeting Traffic Officer (TO) towing requirements.	Not in scope.
	Complete NRTS transformation programme in RP2; fit cabling alongside network and use fibre optic cables and digital technology to improve and future-proof services.	See section 5. NRTS2 is scheduled for completion in June 2022 – provision for CV/AV can be considered from that point. There is no current or planned fibre provision for the APTR network.

Source	Expectation of/Commitment by Highways England	Status/Evidence
	Improve its data analytics capability in RP2 Invest in building data-to-intelligence services and building an open-data architecture. Improve data and information governance Make data and insights accessible and share this information, e.g. with local authorities. Refresh data at greater rate and make better use of data to understand & predict maintenance requirements.	See Section 6 & Information Vision and Strategy – in process.