Digital Local Roads

Realising the full potential of local roads

ADEPT

Innovate UK

Jacobs

Ordnance Survey

RINGWAY

TRL THE FUTURE OF TRANSPORT

TRANSPORT TECHNOLOGY FORUM

VINCI HIGHWAYS

Contents

Foreword

Mark Kemp
President of ADEPT

As we look to strengthen our economy, in a sustainable way for both people and place, the role digital technology can play is becoming more obvious. Local road management is no different. But with over 160 local highway authorities, a partnered approach is a must.

Rising to the challenge, Ringway, Jacobs, Vinci Highways, Ordnance Survey, TRL, DfT, Innovate UK and ADEPT have come together to look at where we are and what we need to do to become ‘digitally’ fit for purpose by 2030.

As president of ADEPT, I was fortunate to chair the project steering group who kindly supported this work with their expertise. I also give thanks to those who completed one-to-one interviews, workshops, and questionnaires to help us gather the data underpinning our recommendations.

DfT have provided us with some clear direction over the last few years with Bus Back Better, Gear Change and, of course, Decarbonisation of Transport. These documents provide the backdrop for the work that Local Highway and Transport Authorities are doing across the country.

I hope this report helps highlight how ‘Digital Local Roads’ can support such aspirations. Thank you for your part in considering how we can put these recommendations into action, to optimise the contribution Digital Local Roads will make to a smooth-running local road network.

The Steering Group

Mark Kemp (Chair) — ADEPT

Karla Jakeman (Vice Chair) — Innovate UK

Darren Capes — Department for Transport

Greg Weingarten — Jacobs

Rollo Home — Ordnance Survey

Yogesh Patel — RINGWAY

Chris Lodge (Report co-author) — TRL THE FUTURE OF TRANSPORT

Warsame Mohamed — TRL THE FUTURE OF TRANSPORT

Alex Wright (Report co-author) — TRL THE FUTURE OF TRANSPORT

Rob Gillespie — VINCI HIGHWAYS

Executive summary

Challenges and benefits of Digital Local Roads

The transport industry is facing unprecedented challenges from climate change, budgetary pressures, and the pace of technological development. If action is not taken the backlog of current issues will continue to grow while Local Authority budgets continue to shrink and the demand for the critical services they provide increases. These challenges are therefore providing drivers for change across Local Authority road networks.

There is an opportunity to meet these challenges by harnessing the growth in connected digital technologies, for which the term Digital Local Roads has been adopted. This report examines the 'Digital Local Roads' concept and how we can begin to meet these challenges through Digital Local Roads.

Consultation with Local Authorities and wider industry stakeholders has explored the challenges being faced by Local Authorities (LAs) across the range of local transport activities, and the consequent drivers for the adoption of Digital Local Roads.

A wide range of potential Digital Local Roads solutions are highlighted, with key benefits including the ability to support greater collaboration and data sharing between authorities, improved asset management, social benefits, improving user experience, and supporting environmental improvements. However, a number of barriers to achieving these benefits are also identified – with Local Authority stakeholders highlighting funding for Digital Local Roads and the collaboration needed to implement solutions as particularly significant barriers.

A vision for Digital Local Roads in 2030

This report presents a Vision for the future of Digital Local Roads. This vision considers the environment that would ideally be in place by 2030, in which the barriers to implementing Digital Local Road solutions have been overcome, and where Digital Local Road solutions are able to flourish.

Strategy

There are established national and local strategies for the use of Digital Local Road solutions to overcome challenges

LAs are working collaboratively to implement solutions, which are becoming the 'business as usual' approach

Budget

LAs can establish robust business cases to support solutions which are affordable, reusable, and shareable

LAs are engaging with new commercial models made possible through Digital Local Roads

Solutions can be commercially exploited to add value

Skills

LAs have the skills and experience needed to understand, implement, and benefit from Digital Local Roads

Processes are in place to procure and exploit these solutions

Technology

LAs are working with industry to develop targeted, practical, transparent, and flexible technologies

Tools to analyse, share, report and visualise data are widely available and accessible

Data

Data is nationally referenced, accessible and shared across stakeholders in a way which supports LA's business cases

Legal, privacy, security, and technical issues are resolved

Action plan

To realise the benefits of Digital Local Roads there is a need for a strategic vision - both nationally and locally - and the fostering of collaboration with industry to demonstrate use cases for Digital Local Roads, with the longer term aim of them becoming business as usual. The key actions recommended for stakeholders to achieve this are:

National Government

Vision and Strategy
Develop a vision, strategy, and roadmap for Digital Local Roads and support the delivery of this roadmap

National Network and Data
Provide the foundations for Digital Local Roads solutions through a national network definition

Business case and funding
Support development of new funding models, concession models, and regional programs

Standards and regulation
Update the standards and regulations needed to enable Digital Local Roads

Training and skills
Support knowledge sharing, training and skills development, especially within LAs

Local Authorities

Strategy and action plan
Develop local Digital Local Roads strategies and action plans to support local goals and wider strategy

Implementation
Make successful solutions business as usual, simplify processes to enable innovation in the delivery of contracts

Collaboration
Participate in regional Digital Local Roads programmes to overcome scale related challenges

Develop collaborative skills and training
Deploy virtual teams in regional initiatives, which share expertise and experience and support training and skills development

Industry

Term contractors
Pro-actively bring Digital Local Road solutions to LAs, share the benefits and implement lessons learnt across contracts

Technology developers
Use centralised initiatives and funding to develop and deploy applications across larger numbers of LAs, focusing on co-development of business cases

Communications & OEMs
Collaborate with LAs and other industry partners to support standards and data exchange

Call to action

We are at the start of the journey towards Digital Local Roads becoming business as usual for local roads. Consistent and concerted support is needed to develop a strategy and roadmap, and to undertake the actions required. National government, Local Authorities, and industry need to take up the baton and collaborate to achieve the vision set out in this report. Progress will be demonstrated through the achievement of the benefits that Digital Local Roads will deliver across the wide range of areas identified in this work.

Introduction

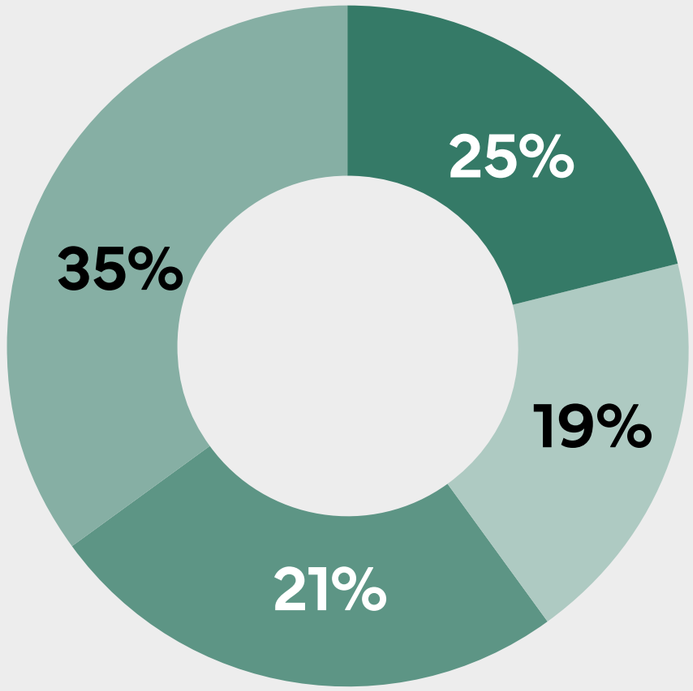
The transport industry, regardless of mode, is facing unprecedented challenges from climate change, economic pressures and the drive to zero road deaths. Simultaneously transport is becoming more connected, more digital, and more complex. There is an opportunity to meet these challenges by harnessing this connectivity and growth in digital technologies, for which the term Digital Roads has been adopted. In this report we consider this concept in the context of local roads – the Digital Local Road.

For the Strategic Road Network (SRN) National Highways have published a Digital Roads strategy *[1]* in which they describe the benefits that could be achieved through the creation of a more connected and intelligent road environment. However, the vast majority of roads in England are Local Roads, and it is on these roads that nearly all journeys start and end.

Digital Local Roads offer the potential for a step change in the approach to delivering the wide range of activities undertaken by Local Authorities (LAs) in the management of their networks, and the services provided. But there is no established strategy or plan to achieve this. This work has been undertaken to provide a better understanding of Digital Roads in the context of Local Roads and to show why wider adaptation of this technology could be of significant benefit. This report also seeks to understand the barriers to achieving these benefits, and present ideas on how progress could be made.

The work is the product of a cross industry partnership between business and government. To understand the scale of the opportunity and challenge presented by Digital Local Roads the project conducted stakeholder engagement with more than 80 organisations and individuals, including workshops, online surveys, and one-to-one interviews. This work was supported by a literature review of papers and strategies on Digital Roads. This report presents the results and recommendations of the work.

However, this study is only the starting point on the journey to realise benefits of Digital Local Roads for Local Authorities. Stakeholders should now take up the baton and collaborate to deliver these.



Motor vehicle traffic (driven distance) by road class in England, 2019 data

Why Digital Local Roads?

Of the ~190,000 miles of English road network ~185,000 miles are managed by LAs *[2]*. LAs also manage extensive cycle and walking networks. They provide services to a wide range of user types and have a greater interaction with utilities than the SRN.

Digital Local Roads have the potential to bring larger benefits to LAs than strategic roads. Yet there isn't a strategy to exploit digital transformation on Local Roads.

What this report will describe

Themes	Challenges and drivers for change	Benefits	Barriers	Solutions
What are the broad areas of Local Authority responsibility in the context of Digital Local Roads?	What wider political, environmental and social trends drive the need for change in transport?	What can Digital Local Roads provide and improve for Local Authorities?	What is stopping Local Authorities from realising the benefits of Digital Local Roads?	What specific Digital Local Road applications do stakeholders foresee in the near future?

The report presents a vision for Digital Local Roads and an action plan for key stakeholder groups (National Government, Local Authorities, and Industry) to accelerate the benefits of Digital Local Roads.

Reading this report

Who is this report for?

This report is aimed at anyone with a desire to understand the potential of Digital Roads at the local road level, and how national and local stakeholders could realise this potential. Actions plans have been developed for three core groups:

01

National Government

Central government bodies and departments, in this case often the Department for Transport

02

Local Authorities

Local government responsible for maintaining roads and providing key public services. Includes, city, country, and borough councils and unitary authorities

03

Industry

This includes all industry stakeholders who work with Local Authorities, from technology and data providers to term contractors

Quotations

"Throughout the report we have included quotations to emphasise key points raised by stakeholders. For privacy, these are not attributed to individuals or companies. Stakeholder quotations look like this"

Common abbreviations and terms

The report uses a number of abbreviations and terms:

Local Authority

(Shortened to LA), in particular those with a responsibility for transport

Digital Local Roads

Broadly, the harnessing of technology, data and communication to provide highway services on Local Roads – see section 3

Local Roads

The network of A, B, C and Unclassified roads that are managed by Local Authorities, and do not form part of the Strategic Road Network

Digital Twin

A virtual representation of a system or object used to collate data and improve decision making. In the context of this report this is a representation of the road network including asset data

New Mobility

New modes of transport or ways of accessing existing modes, examples include e-scooters

Electric Vehicle (EV)

Vehicles powered by electricity, typically refers to battery electric vehicles (or potentially plug-in hybrids) which are charged from an external power source

Connected and Autonomous Vehicle (CAV)

Broad category of vehicles which have elements of automation (or are fully autonomous) and/or the ability to communicate data with external parties (other vehicles, infrastructure etc.)

Vision Zero

Road safety initiative aimed at reducing the number of people killed or seriously injured to zero

Appendices

Appendices are provided at the end of the report to provide further information:

Appendix A

The methodology used to produce this report

Appendix B

Twelve Digital Local Roads solutions proposed by stakeholders (for which outlines are provided in section 8)

Appendix C

The contributors whose knowledge and expertise enabled the creation of this report

Appendix D

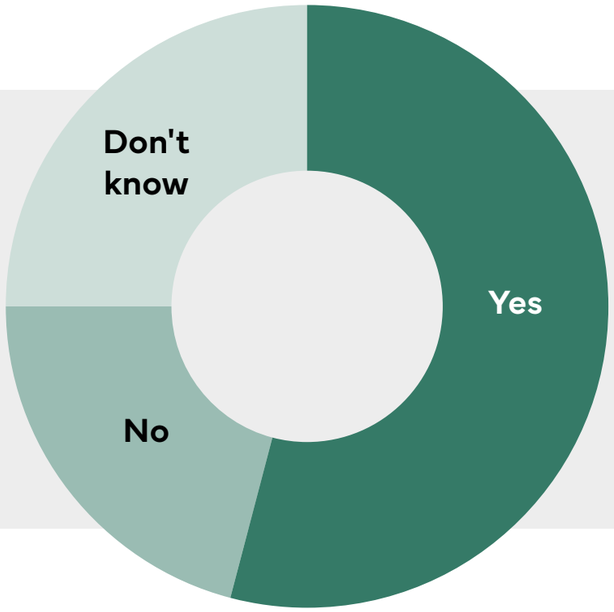
The references used in the report. Within the report these are styled like this *[1]*

What is a Digital Road?

The term ‘Digital Road’ does not have the same meaning for all groups. Our stakeholder engagement sought views on the concepts that come to mind when the term Digital Road is used. We can broadly split the views between Local Authority (owner) and technology (provider) groups.

For LAs, Digital Roads relates to technology that enables connectivity and real-time data exchange, which in particular can be used improve decision-making – e.g. in assets and traffic management, and to deliver better outcomes for residents, businesses, and local communities. LAs also discussed Digital Roads in the context of a digital representation of the network, but a greater proportion of technology providers believe Digital Roads to have more of focus in this area – the ‘Digital Twin’, along with related components such as data specifications and standards.

However, both LAs and providers believe Digital Local Roads will involve the use of sensor and communication technologies to establish a connected network, and that this network could provide data to support technologies that will enable authorities to better manage traffic and emergencies, support connectivity, and enable better interaction between road users, vehicles and infrastructure. Views of stakeholders who didn’t fit in either group were broadly similar.



Is Digital Roads the right term?

The majority of stakeholders believe the term ‘Digital Roads’ is appropriate.

Among those who disagree, they either believe the term doesn’t effectively describe network connectivity or feel the term causes confusion.

Digital Roads Cycle

The slight difference between views on the definition of Digital Roads expressed by LAs and providers could highlight differing ways Digital Roads data is used and visualised.

The concept of a ‘Digital Twin’ is part of the Digital Roads Cycle. It supports visualisation of data and could form the backbone for data structure and decision-making. However, the processes required to populate, manage, share and visualise Digital Twin concepts are not yet fully embedded within LAs.

How does Digital Local Roads relate to Local Authority responsibilities?

It is important to develop a broad definition of the activities Local Authorities carry out, as this is key to understanding the benefits of Digital Local Roads for Local Authorities.

Digital Local Roads can potentially provide benefits across all areas of Local Authority activities. However the areas which will see the most immediate benefit will create the business case for further applications. As it would be impractical to delve into the complete array of activities and services provided by Local Authorities, we instead reviewed activities which relate directly and indirectly to the management, operation and use of the local road networks.

Local Authority Activity Themes, for the application of Digital Local Roads solutions

Four key activity themes that could be influenced by Digital Local Roads solutions were identified. These themes are interdependent with each other, but are often delivered in isolation currently. We will revisit these themes at various points in this document to place Digital Local Roads solutions into the context of Local Authority delivery. These themes focus on roads and transport (and directly adjacent services). However, it is important to remember that Digital Local Roads can provide benefits beyond these themes, and the wider strategy should consider how to capture the benefits of Digital Local Roads to other services and needs.

Managing Local Road Assets

LAs manage and maintain the local road network, including asset management activities such as: condition and safety inspections, routine, reactive and planned maintenance, upgrade and servicing

Traffic Activities

LA services associated with use of the highway asset: traffic management, responses to incidents and emergencies, kerbside management, parking, traffic regulation orders (TRO) and others

Providing Public Services

Public transport is the clearest public service provided through local roads. However further services dependent on the road network include waste collection, emergency services, social services

Enabling Services

Actions that enable residents and organisations to carry out activities associated with transport e.g. town planning, network upgrades. The provision of charging equipment for electric vehicles is an emerging challenge

To what extent do local roads already engage with Digital Roads?

Before exploring future potential it is important to explore how Local Authorities are already engaging with Digital Roads. Our consultation asked stakeholders whether and how they were deploying different types of technology on their networks.

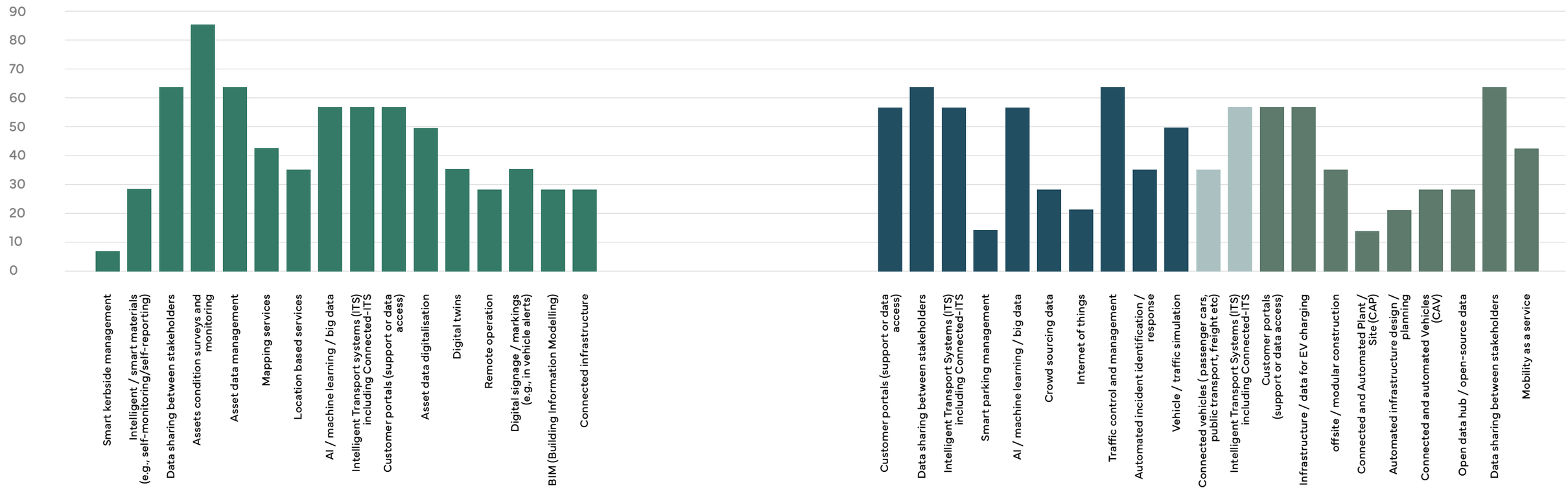
We have grouped their responses on the next page by our Local Authority activity themes, to show the percentages of Local Authorities in our consultation already engaging with a range of Digital Roads Technologies. We found that LAs currently use digital technologies to manage local road assets (asset management systems drawing on new types of survey), manage traffic activities (ITS, UTMC traffic systems, traffic modelling and via ATC) and enhance construction projects (using BIM and Digital Twins). In addition, LAs are also involved in trialling technologies such as Connected and Automated Vehicles (CAV), AI and the Internet of Things.

> **Our CMS enables us to monitor and manage our street lights remotely**

> **AI – linked to CCTV cameras to monitor and understand interactions at junctions and on key routes**

> **As a highway authority we are trialing AI for network condition, manage our traffic signals via ATC, have extensive traffic modelling and various digital asset management systems**

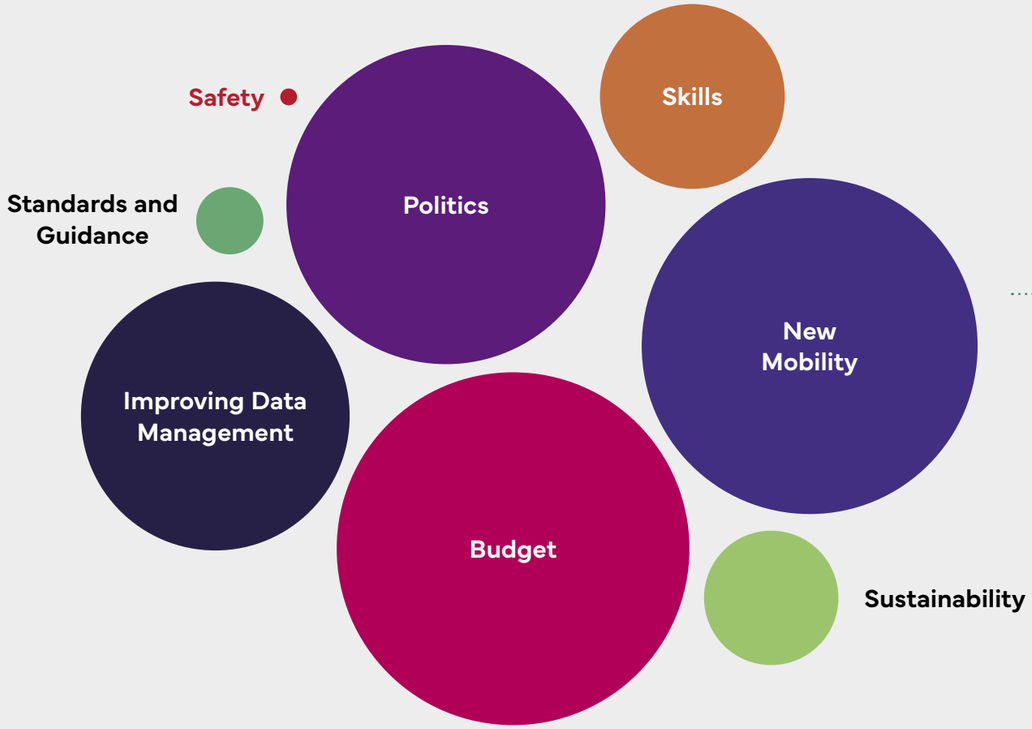
Percentage of LAs already engaging with Digital Technologies, by Activity theme



Challenges and drivers for change

The consultation sought to understand the challenges that Local Authorities are facing, and how these are influencing practice and policy. Eight key challenges were highlighted that strongly influence actions and decisions. In this report we describe these as the drivers for change.

Drivers for change



The ability of Digital Roads solutions to address these challenges may set the pace of Local Authority adoption of Digital Local Roads.

A relatively low proportion of stakeholders raised safety as a factor. This reflects the fact that safety is embedded within Local Authorities and, whilst driving current practice, is not seen as a driver for change. Conversely the four major drivers for change raised by stakeholders were Budget, New Mobility, Politics and Data Management.

Unsurprisingly, budget dominated many discussions, whilst it can be a barrier to achieving current objectives, ever increasing pressures on budget will drive a need to adopt practice that enables current (and new) services to be delivered more efficiently. Digital Local Roads will need to enable new business models and generate revenue.

Residents have a growing range of new mobility options, which Local Authorities are trying to support, in particular because of the social, environment and health benefits they bring. Traditional approaches to deliver and manage these are unlikely to meet the need. In addition, CAVs may drive a step change in the way highway assets are designed and managed. However, there were few strong drivers raised by LAs associated with CAVs, which may suggest that LAs are not yet thinking strongly about the implications of CAVs.

Politics covered both local and national policy. Discussions tended to see politics as a challenge that could stifle innovation. There was a perception of a lack of long-term vision and cooperation.

Stakeholders considered that an improved approach to acquiring, managing, sharing and using data could provide a powerful means of delivering improvement and efficiency to local services. However, LAs do not currently have a clearly defined responsibility with respect to data.

Other drivers which are important to consider:

Data protection and privacy

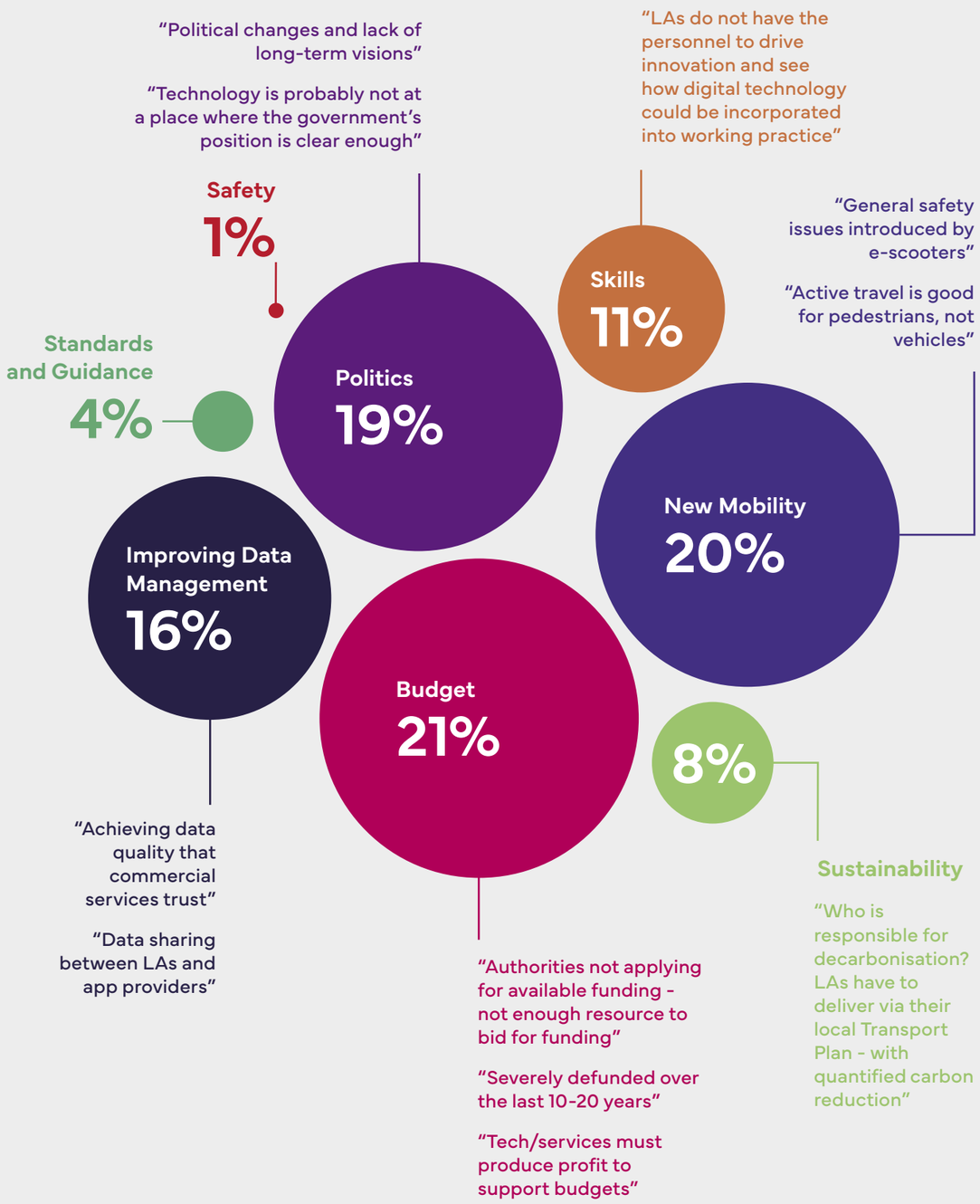
Legislation and public opinion is increasingly focused on privacy in an ever more connected world

Technology and societal change

Technological progress is rapidly changing the way we consume services and enabling new business models

> **"The attractiveness of delivering something through a digital solution from a commercial perspective means that there are only certain areas in the country where people are interested in going digital"**

Challenges for Local Authorities – Which are the most important Drivers for Local Authorities?



Challenges and drivers for change

Sustainability

Drivers

- Improved information requirements to manage ageing infrastructure
- Addressing reducing emissions targets and need to improve air quality
- Providing EV charging *[5]*
- Meeting the demand for increased recycling and the need to engage with the Circular Economy
- Meeting decarbonisation and Net Zero targets *[3]*

Challenges

- **Delivering the Local Transport Plan (LTP)**
- **Incorporating new materials and technologies**

> **"Who is responsible for decarbonisation? LAs have to deliver this via the LTP - with quantified carbon reduction"**

New Mobility

Drivers

- Increasing active travel, and improving the balance between active and traditional travel modes, in both urban and rural areas *[6,7]*
- Providing the ability to encourage multimodal travel and Demand Responsive Transport *[4]*
- Providing the ability to manage new micromobility modes and their safety
- Resolving the potential loss of revenue resulting from modal shift (e.g. Loss of parking income)

Challenges

- **Challenges posed by Automated Vehicles (AVs) - understanding of AVs by Local Authorities is limited**
- **The need to better communicate the benefits of new mobility and overcome resistance from drivers**

Budget

Drivers

- Providing the ability to meet an increasing need for new services to be self funded
- New types of partnering, contracts and concessions (e.g. concession models for EV charging *[18]*)

> **"LAs are strapped for cash and need third-party organisations to trial technology"**

Challenges

- **Difficulties establishing the understanding required to generate the business cases**
- **Pressure resulting from lack of funding**
- **The ongoing costs of bidding for additional funding**
- **The imbalance between Capex and Opex**
- **Challenges around budget make it hard to take any risks in the public sector**

Politics

Drivers

- Increasing public awareness of digital technologies and the pressure to innovate
- The need to take a consistent approach to Digital Local Roads and other innovation between different Local Authorities

Challenges

- **The lack of coordination between Local Authorities, which often act independently**
- **A reluctance to handle risks of innovation, especially if these must be carried by a single Local Authority**
- **Central government strategy – changing the environment to encourage innovation and/or take up of Digital Local Roads**
- **Electoral politics preventing investment in 'long term' vision**

Challenges and drivers for change

Data Management

Drivers

- Increasing need to improve access to data and information across all LA services *[8]*
- Meeting the need for a single source of the truth to support policy, reporting and decisions
- The need to make data available to the public to promote activities and defend LA decision making
- Meeting the growing challenges of data sharing between connected vehicles and infrastructure
- Using data sharing and real-time communication to open up new business models

Challenges

- **Lack of clarity over ownership, responsibility of control of data**
- **Concern over cyber security, which could disrupt services and threaten safety**
- **Data quality and validation concerns**
- **Data protection legislation and privacy issues with data sharing, e.g. GDPR**

Standards and Guidance

Drivers

- New standards could unify Local Authorities' digital activities
- Need to reduce the overall burden on Local Authorities through common guidance
- The need to develop a strategic vision, with an end point and the practical steps to get there
- Need to overcome the barriers that prevent and complicate the sharing of data between stakeholders
- Need to enable interoperability between systems

Challenges

- **Top Level Guidance is required to shape Digital Local Roads**
- **Standards can be a barrier to innovation**

> **"...standards and guidance for ruling out new technologies"**

Skills

Drivers

- Meeting the need to increase knowledge sharing between Local Authorities and between Local Authorities and National Highways, to improve the experience of users of the network

Challenges

- **Skills gap. There are missing digital skills and a lack of budget to hire skilled staff or provide training in the new skills**
- **The ageing Local Authority workforce**
- **Succession planning when most knowledge is centered on individuals**

Safety

Drivers

- Continuing to deliver a safe network for all users
- Meeting the ongoing need to address 'Vision Zero' targets
- Providing the ability to ensure or improve the safety of active travel
- The potential to exploit information so that proactive, rather than reactive, decisions can be made on safety interventions
- Driving health and wellbeing improvements through active travel
- CAV have the potential to improve road safety

Challenges

- **New modes of transport disrupting established road safety practice**

> **"Stats19 is a lag indicator for risk"**

The cost of inaction

Investment and strategic change will be needed to achieve the benefits of Digital Local Roads, but Local Authorities are already under significant pressure from reducing budgets. However, it is likely that many of the problems facing Local Authorities will continue to get worse, with backlogs and costs steadily increasing. Here are some examples of the cost of inaction under local authority activity themes:

Managing Local Road Assets

Funding for local road maintenance is reducing – by £400 million pounds (22%) in 2021/22 *[10]*

Local Authorities have a £10 billion backlog of local road repairs *[10]*

Providing Public Services

Distance travelled on buses continues to decline year on year *[11]*

£2 billion of public money was needed over 2020-22 to support the bus industry through the COVID-19 pandemic *[12]*

58% of county councils describe the pressure on local infrastructure from housing development as 'excessive' *[13]*

Traffic Activities

By 2030 congestion will cost the UK economy £21.4 billion *[14]*

Traffic related pollution kills 5,000 people a year in the UK *[15]*

Enabling Services

Government strategy is for 300,000 public EV chargers by 2030, a 10 times increase over today *[16]*

Sales of new Petrol and Diesel vehicles will be banned by 2030 (and hybrids by 2035) *[17]*

Benefits of Digital Local Roads

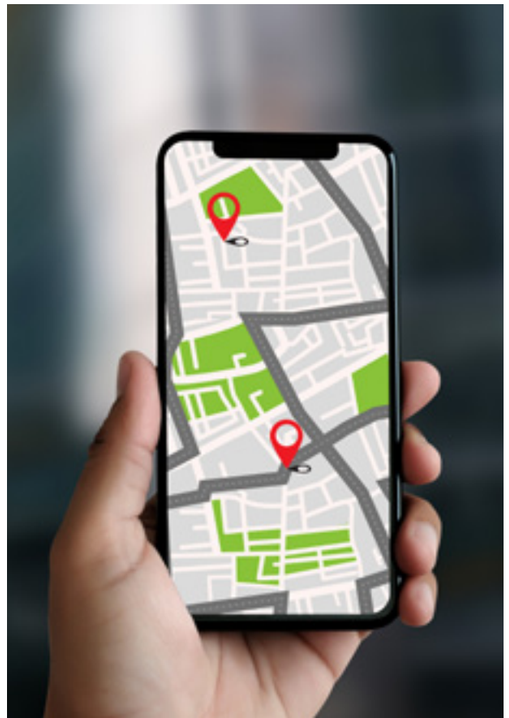
Overview

Stakeholders were asked their views on the benefits that Digital Local Roads would deliver for them. The responses spanned the wide range of services and activities provided by Local Authorities. The benefits were allocated to broad groups to reflect the key content of the comments.

Local Authorities and those providing digital services to Local Authorities, saw direct benefits in the environmental, user experience, and asset management categories. However only a few Local Authorities highlighted the potential economic benefits. This may reflect concerns by authorities over the investment needed to realise the benefits, or a lack of clarity on the savings that might be achieved through digital solutions. This highlights the need to clarify the business case for all stakeholders when considering Digital Local Roads solutions.

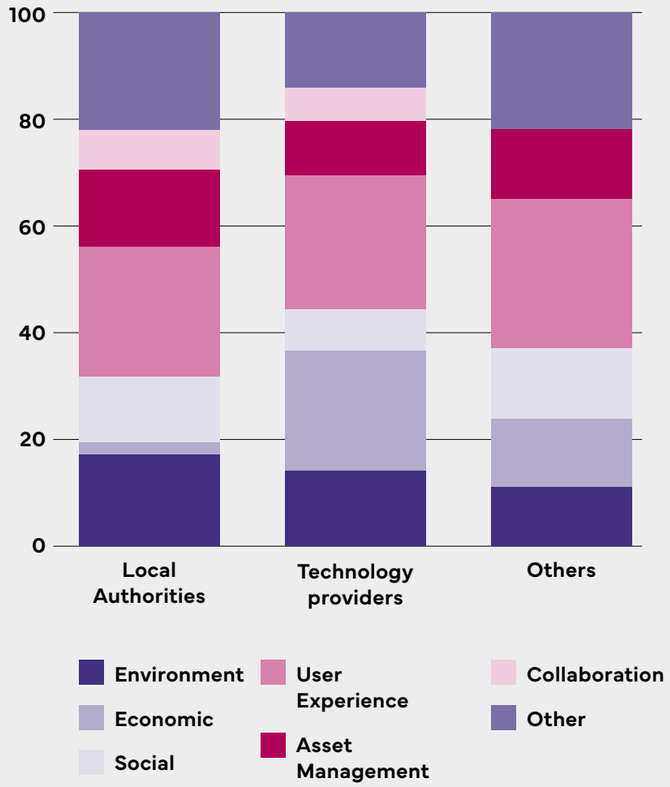
All stakeholder groups, in particular Local Authorities, see strong benefits from improving asset management. Higher levels of content, quality, and timeliness of data were highlighted. This could remove the need for manual inspections of assets, apart from where detailed information is required. These benefits were linked to the ability to make better and more informed decisions on asset maintenance, extending the useable lifetime of assets, increasing asset reliability and, importantly, providing a safter road network *[9]*. Richer asset data will enable effective predictive maintenance using real data on asset deterioration. There is potential for machine learning to apply these data sets to predict future outcomes.

> **Greater understanding of the condition of the asset may well identify that there is a greater backlog than currently estimated**



What are the greatest benefits?

Stakeholders were also clear on the potential benefits across the other grouping areas summarised here.

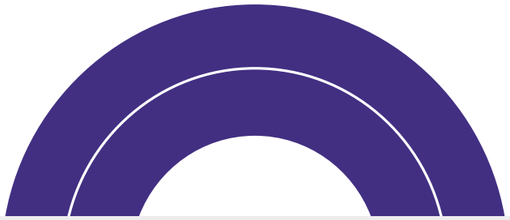


> **Efficiency - through better management and control**

Accurate, up to date and accessible information on the state of the highway to support road safety and maintenance

The ability to make remote decisions/ changes in response to events, The ability to gather consistent, timely data

Safety from providing clearer information to drivers or helping them make better driving decisions



DR will unlock collaboration and create new business models, turning the kerb into a positive revenue engine

Social

The availability and sharing of information will help Local Authorities to determine the need for, and provide, travel services that are better focussed on residents' needs - in particular more vulnerable members of society (e.g. transport for schools, adult social care etc.).

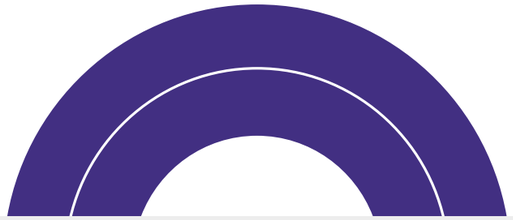
New uses of highway assets could provide positive social impact, for example using lighting columns to augment communication networks and add systems to assist vulnerable people. Making data publicly available will help businesses to improve efficiency and performance, and will help residents and road users make informed travel decisions - for instance understanding the cost and carbon impacts of their travel choices.

Collaboration

Collaboration in Digital Local Roads is primarily associated with the wide scale availability of data and the ability to share data, both within the Local Authority and across authority boundaries.

This could support private and public transport and help residents select practical active travel options. There will be better ability to coordinate multi-agency responses - especially to major incidents. The efficiency and coordination of services across different departments within Local Authorities would be improved (e.g. waste collection). Increased availability of rich data will support more informed decisions on investment and help focus budgets on the most cost-effective interventions.

Information and data can be used to help make other services more efficient



Data availability will enable better journey planning for road users and network planning for LAs

Environment

The tools provided through Digital Local Roads will help LAs meet their decarbonisation objectives and support Net Zero.

This will draw heavily on the combined ability to stimulate the use of alternative travel modes and improved traffic flows, which together will lower vehicle emissions and improve air quality. The ability to share consistent data across Local Authority boundaries can support the adoption of cleaner transport modes by providing transport users with a wider range of choices and evidence to help support modal shift.

User experience

Advanced traffic management techniques enabled by Digital Local Roads will reduce congestion and enhance road safety through predicting and reducing incidents and providing real-time data to users on traffic conditions and route choices.

Journey disruption will be reduced as digital technologies begin to reduce human operation and enable remote decisions to be made in response to events on the local road network.

LAs have to do a lot of driving to deliver services, and so if a digital solution could aid service delivery, it would cut mileage and pollution

CASE STUDY

Rapid Growth

A review of the literature showed the rapid growth in applications of, and use cases for, Digital Local Roads solutions. Case studies were identified that deploy sensors, vehicle fleets, phones and even bicycles to provide data to support management of the road network. This data is applied in areas from intelligent asset management through to traffic monitoring, pollution control, waste management, noise monitoring and journey information systems.

In this section we firstly highlight a selection of use cases that demonstrate in greater detail how data is being used by road administrations, service providers and Local Authorities in specific applications.

We then provide a summary of further case studies from our review, and highlight how these link to the benefits to Local Authorities identified above.

> **We have millions of vehicles collecting data for us: Road state, Winter condition, Road hazards. We have a service we provide for OEMs and public sector all around Europe**

> **Digital technology is currently applied for gully emptying to drive good decision-making on which gullies need emptying**

CASE STUDY

Bus Open Data Service

Initiated by the Department of Transport, the Bus Open Data Service (BODS) requires operators of local bus services to publish data, including timetables, bus location and fares. BODS has created a system to support intermodal transport that is enabled by open data available to everyone to access, use and share.

As the availability of this data reduces uncertainty, it helps consumers make decisions that they can expect to be reliable. This can stimulate higher levels of bus use and increase revenue for operators.

BODS is helping Local Authorities to innovate through multi-modal, integrated journeys and a 'predict and provide' approach to transport.

BODS, and open data in general, enables businesses to develop new services for passengers. For example, Citymapper, one of the first journey planning apps in London, was born through such open data, and in turn provides data for other users.

CASE STUDY

AI based asset surveys

Asset surveys are critical for LAs to maintain and improve infrastructure, but traditional manual or dedicated driven surveys are increasingly expensive. Several companies offer AI based asset surveys, which allow asset data to be captured by vehicles conducting other tasks rather than dedicated survey vehicles or teams.

One example of this is the Mobileye camera-based ADAS technology to survey road condition and provide asset management data. The technology has been used in collaboration with Transport for West Midlands (TfWM) on a pilot project to digitise roadside assets and infrastructure. Mobileye cameras are retrofitted onto Local Authority waste and recycling trucks in the pilot area. The cameras continuously scan roadside infrastructure and markings as the vehicles go about their regular business.

The data obtained is used to:

- Improve reactive and planned maintenance programmes by clearly mapping assets
- Provide data on asset condition which informs policy and infrastructure investment
- Identify immediate or likely safety risks
- Build up a large data set on asset deterioration to help develop better predictive maintenance methods

CASE STUDY

Talking Traffic Partnership

In the Dutch Talking Traffic Partnership 60 regional and Local Authorities, and national and international private companies have worked together to share traffic light data in real-time to smartphones and in-car systems. The program is improving the availability of data for a wide range of road users to improve safety and improve travel times.

For example, the Talking Traffic service has been implemented by the Dutch ambulance sector. Ambulances on their way to an emergency (with siren and lights flashing) are 'connected' and hence 'digitally 'visible', so that smart traffic lights can give them the green light as they move through intersections. Other road users are provided with information that enables them to take timely and appropriate action when an ambulance approaches. There are plans for other emergency services such as fire, police, and defence to be connected via Talking Traffic.

CASE STUDY

Monitoring air quality

Traffic related pollution kills 5,000 people a year in the UK *[15]*. Particulate matter, thirty times smaller than human hair, are a major factor in respiratory and cardiovascular infections.

Whilst fixed sensors are typically deployed to measure air quality at selected locations, these do not provide a detailed or complete picture of the network. The delivery firm DPD has announced the roll-out of a major new air quality monitoring programme across London, Birmingham, Leeds, Manchester, Glasgow and Cardiff. The programme involves using sensors on DPD vans and specific PickUp shops to provide air quality information based on real measurements to aid Local Authorities in their policy making.

The sensors take readings every 12 seconds and focus on the most critical health impactor, fine particles PM2.5 at breathing level, to provide real-time data designed to help visualise the air quality issue and identify hotspots. The initiative will create a network of over 400 sensors, delivering 1.5m pollution readings daily.

CASE STUDY

Smart parking and kerbside management

Local Authorities have limited parking infrastructure, and as demand continues to increase and change there is a need for innovative ways to manage and optimise kerbside space. A Digital Local Roads solution to this is smart parking and intelligent kerbside management.

AppyWay worked with Harrogate Borough Council (HBC) and North Yorkshire County Council (NYCC) to launch a smart parking solution in 2019. This included the installation of 2,156 smart sensors and the consolidation of digitised parking data, parking sensors, parking payments, ANPR barriers and pricing into a single solution for the two authorities and for end users through a mobile app.

The two Local Authorities have access to comprehensive data on parking utilisation to support evidence-based decisions on parking policy. The data also enables them to optimise the pricing and operating hours, based on demand and traffic management needs. End users can find and pay for on street parking easily, via the real-time data on availability and price.

FURTHER CASE STUDY EXAMPLES

Project / Initiative	What's it doing?	Who benefits?						
		Users	Environment	Economic	Social	Assets	Collab.	Reference (appx. D)
3D Laser Mapping Crash Investigations	The use of laser scanners for crash investigations							1
AI technology	Using AI technology to spot potholes							2
ATRAIL	Consumer technology to measure cyclepath condition							3
Management of Tourist/Day-Visitors	An app to identify parking spaces in real-time							4
Citymapper	A platform to present transport options with live timing							5
Connected Roadworks	A platform to identify collaborative works opportunities between providers undertaking maintenance and construction							6
Crowdsourced data	Using crowdsourced incident data to reduce delays caused by congestion							7
Demand Responsive Transport (DRT)	Enabling vehicles to adjust their routes and schedules based on passenger requests							8
Digital Rehearsals	Using digital tools to plan work							9
Drones for asset surveillance	Using drones to detect road defects							10
Feasibility of an automatic crack-filling system	Using autonomous robots to repair roads							11
GoGreen	A platform for LAs to track commuting and business travel							12
Household Waste and Recycling Support	An app to improve waste collection services by providing communication between councils and residents							13
Smart Communication Sensors	Sensors on light columns to control/understand the network							10
Intelligent flood alert system	Using sensors to detect flooding in drainage systems							14
Acoustic Sensors	Acoustic sensors to monitor traffic monitoring and estimate emissions							15
Mapping of waste collection services	Technology to optimise routes for waste collection services							16
National Parking Platform (NPP)	Supporting digital payments and better parking services							17
Optimising Electric Vehicle charging	Geospatial data providing data on available charge points							18
Real-Time Air Quality and People Movement	Mapping people's movement against pollution levels							19
Real-time data to drive sustainable travel	A tool to identify when buses are running out of sync with the timetable							20
Roadworks planning	A digital replica of transport infrastructure to plan roadworks							21
Scaling on Street Charging Infrastructure	Improvement to the availability of EV charge points							22
Smart Traffic Lights	Traffic lights able to detect vehicle type							23
Trafi	A MaaS platform to connect the UK's Solent Region							24

Example solutions identified by LAs

Building on the progress already made and demonstrated in the case studies, the workshops and wider engagement asked stakeholders to suggest the types of Digital Local Roads solutions that might be implemented in the near future to address some of the challenges they had identified. This 'road-mapping' exercise helps us to see how stakeholders currently see the benefits of Digital Local Roads being realised within each of the Local Authority activity themes identified in the consultation. We summarise these below as examples of specific solutions within the four activity themes.

Further details on the steps that might need to be taken to develop these solutions are given in Appendix B, highlighting the wider thinking and understanding that is established in the stakeholders that are already engaged with Digital Local Roads.

Managing Local Road Assets

Aim:	Aim:	Aim:
Better understanding of asset condition using crowdsourcing data	Intelligent and predicative decisions on asset maintenance	Better understanding of active travel use and ability of the network to support it
Outcome: Real-time frequent data on network performance for improved asset management that better reflects user experience	**Outcome:** Large scale "big" data to enhance predictive and planned maintenance	**Outcome:** Data on active travel use helps determine how the network asset can be adapted to optimise active travel and support decarbonisation

Providing Public Services

Aim:	Aim:	Aim:
Dynamic pricing to support public transport funding and growth	Unified public transport ticketing to encourage shift from single occupancy cars and generate revenue	Improve public transport punctuality
Outcome: Data to model and predict demand for public transport and to enable pricing models to support LA aims such as decarbonisation	**Outcome:** Data and ticketing platform which collates and distributes data	**Outcome:** Traffic data and bus data matched to traffic management actions to improve public transport

Traffic Activities

Aim:	Aim:	Aim:
Improve road safety through the prediction of accidents and proactive intervention	Improve volume, effectiveness, accessibility and efficiency of streetside parking	Establish robust evidence-based policy for transition to new modes of mobility
Outcome: Data to enable LAs to better predict accident risk and undertake real-time/ proactive interventions	**Outcome:** Quantified demand for street side parking, leading to an objective and efficient programme of provision by LAs	**Outcome:** Objective data on the volume, types/routes and safety of any given form of new mobility to support strategic planning

Enabling Services

Aim:	Aim:	Aim:
Intelligent expansion of the EV charging network to meet expanding needs	Overcome current cumbersome management processes via digitisation of TROs	Open data platforms to share and ingest transport data
Outcome: Spatial and demand data on EV journeys and kerbside/ charging usage to support selection of charge point locations	**Outcome:** Standardised, open, and centralized platform to store digital TROs, accessible by all relevant stakeholders	**Outcome:** Standard data formats and APIs to allow LAs to distribute data to the wider public and industry, allowing new Digital Local Roads applications to be developed

Barriers to Digital Local Roads

Overview

Stakeholders were asked about the barriers they see to implementing Digital Roads solutions on local road networks. Again, stakeholders shared a wide range of views which were collated into broad groups.

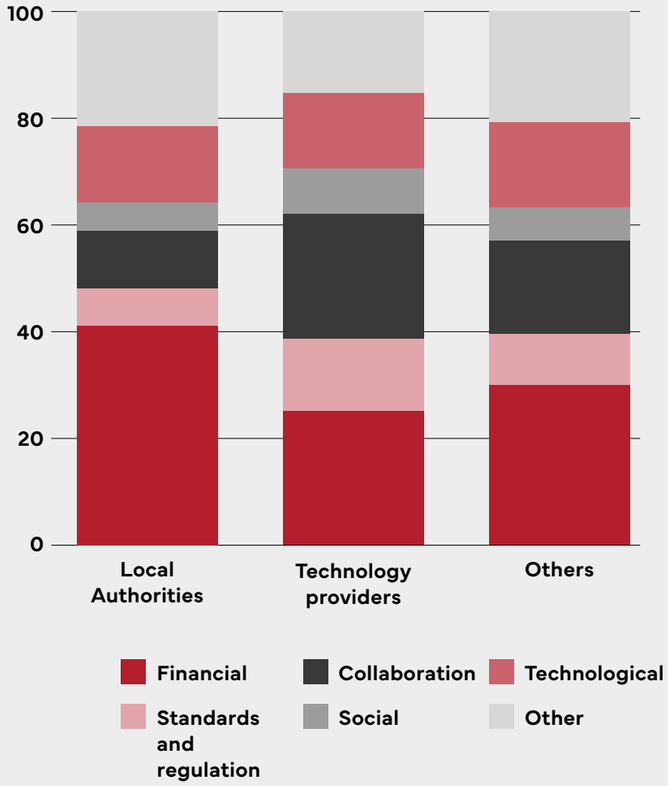
It is clear from the responses that, while technology forms part of the challenge, the main barriers seen by stakeholders are not technological - they are associated with finance, standards and collaboration.

When discussing finance in more detail the business case was again raised - LAs will be reluctant to pay for services if they don't perceive that they will bring value. This problem is likely to be deepened by reductions in government spending, increases in inflation and diversion of funding to other areas.

Industry also highlighted that LAs are risk averse, and reticent to take on untried technologies or ways of working, especially where it comes to the procurement of new technology from new providers. However, regional concession models were highlighted as potential routes to wider investment over larger areas, introducing scale that would be more attractive to industry. Stakeholders also highlighted some of the challenges in working with Local Authorities, who have small budgets, difficult procurement cycles, and a preference for 'business as usual'. The commercial barriers will need to be addressed to reduce the risk of a delayed, disjointed implementation of Digital Local Roads.

What are the greatest barriers?

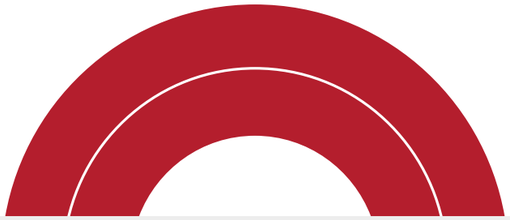
Stakeholders also expressed clear views on the potential barriers to Digital Local Roads across the other grouping areas as summarised here.



Cost will be the biggest barrier, followed by the huge amount of infrastructure change required to implement this. Public adoption may also be slow as they fail to recognise benefit

Digital Local Roads need to result in lower costs otherwise they'll never happen

Money, money, money (and expertise)



> **The UK makes it very difficult to have single point of truth currently, too many agencies in play**

Social

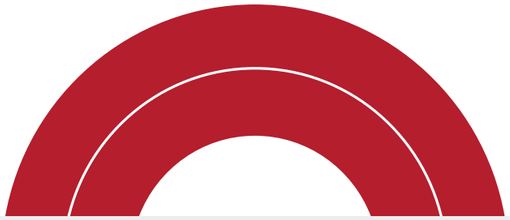
Knowledge and expertise in digital technologies within LAs is a key barrier. The ever-changing technological landscape makes it difficult for LAs to decide which solutions will provide the best benefits.

Without the skills to derive insights from data a Digital Local Roads environment won't benefit LAs. LAs are also concerned that constantly evolving technology could render implemented technology obsolete after significant investment. Technology procurement and cyber-security concerns were also highlighted. There is a general concern over taking risks when making investment decisions - all money spent must deliver value for the public.

Collaboration

Local Authorities highlighted the risks of siloed working and duplicating work when innovating within an authority.

Without efficient collaboration there is a significant risk that Digital Local Roads solutions won't translate across authority boundaries. Many LAs simply cannot afford to risk the budget and time on innovation activities. Without wider collaboration there is a risk to innovation as it limits the ability to spread the costs (and benefits) across wider partnerships. A lack of clear strategy can mean that LAs don't have a clear view on what outcomes they want from a Digital Local Roads solution – this undermines the business case for investing in these solutions.



> **Policy and data governance is the blocker - there are no technical blockers**

Technology

Local roads are more diverse, dispersed and sparsely used than the strategic network, with lower connectivity and proportionally lower management resources. This leads to greater investment in technology for lower benefit.

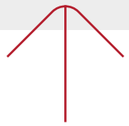
There is a larger diversity of vehicles present on local roads than on strategic roads, which are likely to be slower to adopt connected vehicle technologies. The scale of the local roads network makes it challenging to roll out and maintain technology in a way that keeps pace with demand.

Standards and Regulation

A lack of clear guidance on the creation of data platforms remains a major barrier. Guidance from central Government is often slow to arrive and can be out of pace with technology by the time it does.

Existing standards are designed for business as usual and can actively stifle innovation. For example, for a number of asset management standards the requirements are built around manual data collection methods which discourage industry and LAs from adopting digital techniques.

More use would be made of data if there was clearer more up to date guidance on how to start the Digital Local Road journey.



> **LA does not have the personnel to drive innovation and see how digital technology could be incorporated into working practices**

> **The continued advance of innovation - as soon as we install it, there will be something else/better**

A vision of Digital Local Roads in 2030

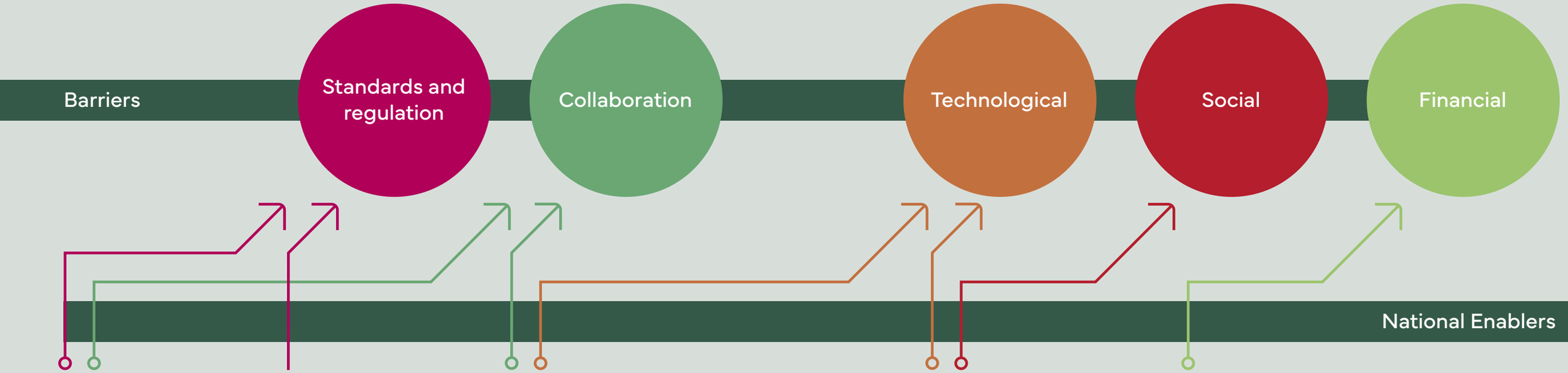
This section presents a Vision for the future of Digital Local Roads which describes the environment that would ideally be in place by 2030 to overcome the barriers to implementing Digital Local Road solutions.

The vision is based on the findings of our engagement. However, our action plan, below, recommends that national government builds on this to establish consensus on a national vision for Digital Local Roads.

Achieving the vision will require action by all stakeholders – national government, Local Authorities and industry. Many of the barriers to implementation of Digital Local Roads cannot be overcome by Local Authorities working alone. Some barriers result from the need for greater levels of collaboration, standards and data complexity, so that cost effective and robust solutions can be delivered. The consultation identified several high level activities required to underpin the successful adoption of Digital Local Roads, which would need to be implemented at the national level. We describe these as National Enablers. Because of their importance, we discuss these separately on page 52.

Skills	**LAs have the skills and experience to understand the Digital Local Road solutions they need, how to implement them, and fully benefit from the outcomes** **LAs have the contractual and commercial processes in place to procure and exploit these solutions**
Strategy	**LAs have well established strategies to apply solutions to overcome their challenges** **LAs are working collaboratively to implement solutions across their networks, which are becoming the business as usual approach** **There is a joined up strategy with Digital Roads for strategic roads** **Sharing of data and information inside and outside LAs results in more effective delivery of services and cross-department working**
Technology	**A wide range of robust, demonstrated solutions can be drawn upon to meet the specific needs of LAs** **LAs are collaborating with each other and with industry to develop targeted, practical, transparent and flexible technologies** **Tools to analyse, share, report and visualise data are widely available and accessible**
Budget	**LAs are able to establish robust business cases to support implementation of solutions - which are affordable, reusable and shareable** **Solutions can be commercially exploited to add value** **LAs are engaging with new commercial models made possible through Digital Local Roads**
Data	**Data is nationally referenced, accessible (in real time where needed), and can be shared across stakeholders in a way which supports LA's business cases** **Legal, privacy, security and technical issues preventing the use and sharing of data have been minimised** **Data is joined up with strategic roads** **LAs and industry share data for mutual benefit to improve user experience**

National enablers to unlock the vision



Strategy and Vision

- A national vision and strategy would assist LAs in the establishment of local strategies that overcome political barriers and encourage greater collaboration between LAs
- Case studies highlighting the benefits of Digital Local Roads, to support authorities in selecting solutions

Standardisation and Guidance

- Updated standards for data capture, exchange and sharing would support collaboration between LAs and industry. They would also improve the lifetime of solutions by reducing the risk of obsolescence and hence reduce risks and barriers to investment
- Guidance for Local Authorities on how to implement Digital Local Roads as a data gathering and decision support tool

Data and technology

- A national digital representation of the road network (including assets and other services). This would build on the work of the Centre for Digital Built Britain which is defining an information management framework to enable digital twins to gradually unify data
- A national initiative to drive the creation and usage of data frameworks, and to increase the aggregation of data onto platforms which are accessible by all
- A national initiative to support the communications technologies required for (real-time) delivery of data to/ from the road network

Digital skills

- National level investment in training and qualifications, to reflect an increased recognition of the vital role technology and digital skills play in managing road networks

Financial

- New financial models to overcome the barriers to investment (capex and opex)
- Support and guidance for LA business case development
- Support the ability to monetise data assets held by local and regional authorities

Action plan

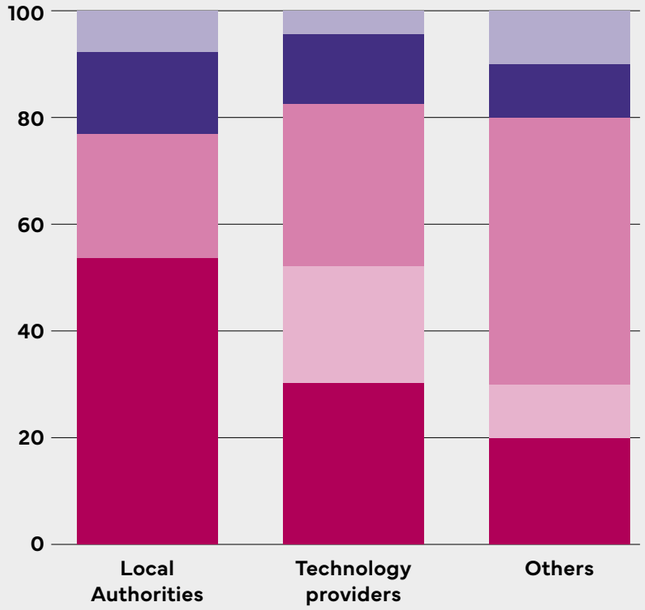
Our action plan for stakeholders focusses on the strategic actions for national government, Local Authorities, and industry that would support Digital Local Roads and the delivery of the vision for 2030.

The action plan builds on the feedback from stakeholders. The actions are not focussed on technology or performing specific projects. It is considered that Digital Local Road solutions, including those suggested by our stakeholders above, could be developed where there is motivation and the right environment for their successful delivery.

The action plan instead suggests the actions that could be taken by the three key stakeholder groups to establish the environment and motivation for implementing Digital Local Roads solutions, and hence deliver the vision for 2030:

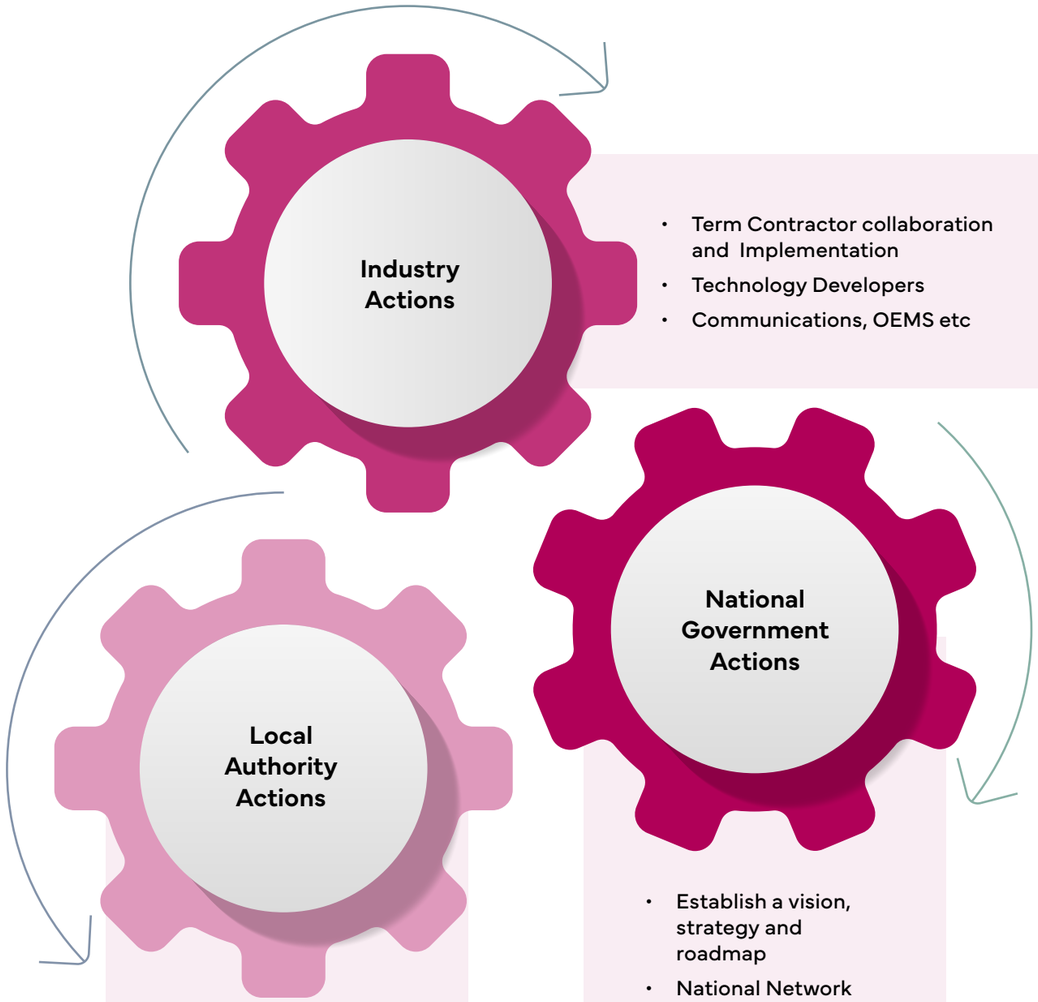
- National government actions will help reduce the barriers to advancing Digital Local Roads within Local Authorities. This includes clarifying the vision and direction of travel, helping to resolve financial challenges, providing support to the centralisation of network definitions and data provision, and resolving questions over standards. As many Digital Local Roads solutions should not be 'localised' solutions, collaborative development programmes are proposed, to make them more efficient and increase the likelihood of implementation.
- For Local Authorities, the actions stimulate the development of local strategies that build on the national vision, implementing solutions that meet local needs, and collaborating to improve their resilience (preparedness), skills and capability, participation in and take up of Digital Local Road solutions.
- For industry, the actions encourage providers to collaborate to efficiently implement solutions across their client base, and to overcome barriers to the delivery and sharing of data.

What needs to happen to help you adopt or support Digital Local Roads?



> **Without a (common) framework, the risk is that a patchwork develops with differing requirements, making management all but impossible from a manufacturer's point of view**

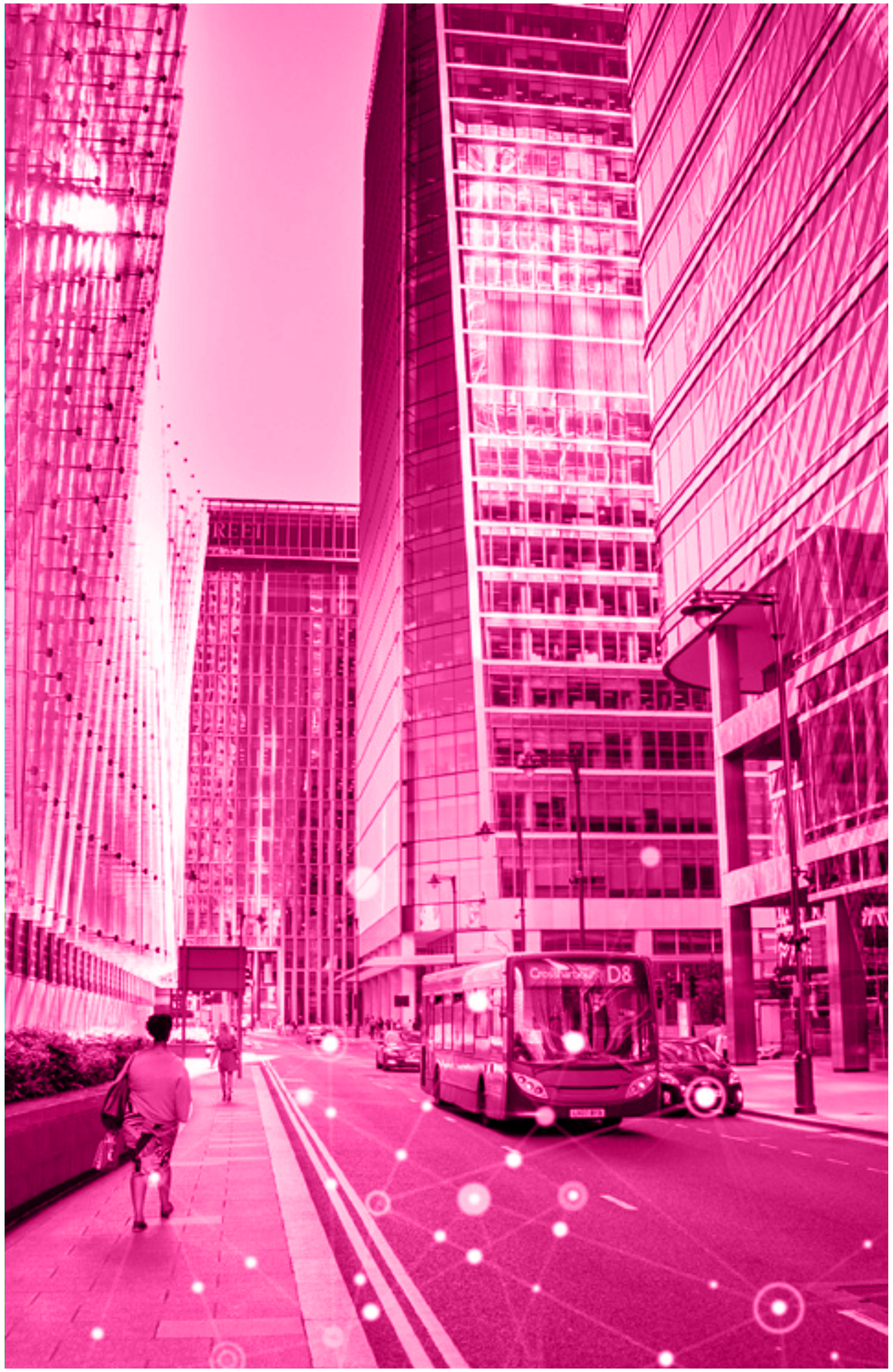
Action plan ...to accelerate Digital Local Roads



- Term Contractor collaboration and Implementation
- Technology Developers
- Communications, OEMS etc

- Establish a vision, strategy and roadmap
- National Network and Data Framework
- Funding and Business Case
- Standards and Regulation
- Training and Skills Programme

- Strategy and Action Plan
- Implementation of solutions
- Collaboration
- Skills and Training



Action plan ...for National Government

Actions by National Government support the enabling activities to lower the barriers to the implementation of Digital Local Roads solutions by Local Authorities.

Vision and Strategy

- Establish a Digital Local Roads steering group to drive progress
- Undertake a benefits and needs analysis for Digital Local Roads. This should (e.g.) establish how Digital Local Roads can support national initiatives such as Vision Zero and Net Zero
- Hence develop a vision, strategy and roadmap - with timings, priorities, actions and measures of success
- Support the roadmap delivery

National Network and Data

- Develop a definition of the transport network, taking a holistic approach to transport (rail, road etc.) and its users
- Establish central responsibility for the ownership of the data that supports the network definition. Stimulate collection and sharing of this data
- Provide support for the evolution of the national network into a transport Digital Twin
- Direct an LA and Industry open data initiative

Funding and Business Case

- Develop financial models to help LAs invest in Digital Local Roads, such as revised revenue support grants and concession models
- Continue support for Digital Local Road R&D through schemes such as LiveLabs
- Create regional programmes, to stimulate collaboration and improve the practicality / efficiency of initiatives through scale
- Improve the tools available to help LAs establish business cases for Digital Local Roads solutions

Standards and Regulation

- Understand the standards and regulations that influence Digital Local Roads
- Establish a Digital Local Roads Technical Working Group to implement a programme of updates to these standards, focussing on those that will enable the best value to be delivered within each of the LA themes

Training and Skills

- Establish a knowledge sharing facility to support learning across LAs
- Provide advice to Authorities on how to understand their “Digital Resilience” and the actions needed to improve this
- Work with LAs, technology providers and training councils to understand the gaps and skills needs for Digital Local Roads
- Identify/develop training, guidance and qualifications
- Provide funding to support a regional upskilling programme

Action plan ...for Local Authorities

Actions by Local Authorities will help them to better understand what Digital Local Roads will mean for them. They will increase their participation in Digital Local Road solutions and, by developing collaborative teams, maximise their resilience to the rapid changes in technology.

Strategy and Action Plan

- Develop a strategy that defines how Digital Local Roads solutions will be exploited to deliver local goals and outcomes (e.g. economic, environmental)
- Develop an action plan to deliver the strategy
- Set targets for the delivery of the plan and establish measures to assess the success in achieving local goals
- Review Digital Resilience and develop action plans to fill gaps

Implementation

- Identify the Digital Local Road solutions that have been successful and bring them to business as usual
- Engage proactively with industry and providers (including term contracts) to explore, evaluate and understand new methods – implementing those that work
- Develop processes to simplify contractual change to assist the implementation of new/ alternative approaches that could improve delivery

Collaboration

- Participate in regional collaborative programmes to implement more advanced solutions (to overcome issues of scale and data sharing)
- Develop internal collaboration and sharing processes to better exploit data across departments
- Proactively share experience with other Authorities and support them in the implementation of solutions (via collaborative skills and training)

Skills and Training

- Establish regional virtual Digital Local Roads teams to support initiatives across LAs
- Develop formal processes to share experience and expertise within these teams. Also use these to provide contingency for when resources leave the authority
- Draw on central training programmes to upskill these teams

Action plan ...for Industry

Industry actions encourage providers to efficiently implement solutions across their client base, and to overcome barriers to the delivery and sharing of data.

Term Contractor collaboration and Implementation

- Work with Local Authorities to accelerate uptake of Digital Local Roads solutions
- Share the benefits (e.g. where there are cost reductions) with Local Authorities to help overcome risk averseness and encourage wider take-up
- Promote experience and benefits across Authorities, including experience gained internationally
- Cost effectively implement lessons learnt in one contract/ Authority over all contracts

Technology Developers and data providers

- Work at the regional level to overcome data sharing issues across Authorities
- Collaborate with, encourage and support standards development
- Use central initiatives to proactively expand the application across greater numbers of Authorities. Focus on minimising costs to Authorities and help Authorities establish business cases.
- Identify and share experience gained internationally

Communications, OEMS etc.

- Collaborate with, encourage and support standards development
- Engage in cross industry and cross sector collaboration to encourage and drive data access
- Collaborate with Authorities to establish processes for real time mutual data exchange

Summary

If action is not taken to address the challenges facing transport, then the backlog of current issues will continue to grow, whilst Local Authority budgets will continue to shrink and the demand for the critical services they provide will increase. Digital Local Roads provides a solution that could help resolve these challenges, but there is a lack of clarity on how Digital Local Roads solutions could be successfully applied.

This study aimed to provide a better understanding of the concept of Digital Roads technologies for local roads. We have engaged with stakeholders from across the sector to understand their challenges, the potential benefits and barriers to Digital Local Roads, and to establish a future vision for Digital Local Roads.

This engagement found that, in addition to the well-known challenges associated with managing networks with restricted budgets, stakeholders are facing challenges in sustainability and new mobility, and the increasing expectations of users regarding the reliability of local road networks and public transportation systems.

Local Authorities are becoming familiar with the Digital Local Roads concept and its ability to deliver better outcomes for residents and better decision-making by road operators. However, alongside the benefits they identified a corresponding range of barriers that could delay or prevent the benefits being realised.

Nevertheless, even with these barriers, stakeholders contributing to this work were positive about the potential outcomes and identified a wide range of specific Digital Road solutions that could provide benefits across the service areas provided by Local Authorities.

To overcome these barriers and accelerate take up of Digital Local Roads, this report outlines a vision for a flourishing local Digital Local Roads ecosystem by 2030.

We have outlined an action plan for stakeholders focused on strategic actions that national and local government, and industry could carry out now to help deliver this vision. This plan draws on the four key areas that stakeholders stated would accelerate the adoption of Digital Local Roads:

Consistent and concerted support is needed to develop a strategy and roadmap, and to deliver the action plan. Progress must be demonstrated through the achievement of tangible benefits for Local Authorities, road users, residents, and businesses. This progress should be actively tracked to drive the delivery of the vision.

We are at the start of the journey to Digital Local Roads as business-as-usual. There is an opportunity to harness these technologies to enable new business models which offset shrinking budgets, to improve road safety and air quality, and transform how local roads are used and managed. However, national government, Local Authorities, and industry need to take up the baton and collaborate to achieve the vision set out in this report.

Appendices

A | Methodology

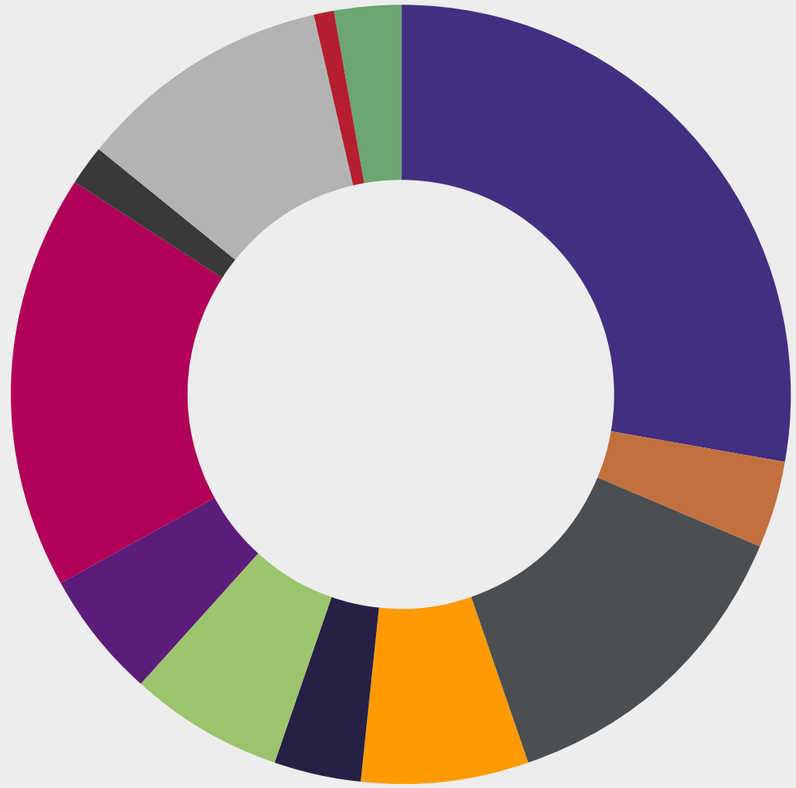
The work presented in this report has drawn on a literature review and a consultation with a wide range of stakeholders across the transport sector, as summarised on Appendix B and to the right. The consultation deployed:

- An online survey seeking views on the definition of Digital Roads, on the perceived benefits and the barriers to their implementation and how these may be overcome. The survey was sent out to groups of stakeholders identified by the project team and open invitation advertised via routes such as social media and press release.
- A set of workshops (online and a face to face workshop in London). Each workshop included three interactive sessions. Stakeholders' views were sought on the challenges faced by Local Authorities, the barriers and benefits of Digital Local Roads and their ideas/examples of specific applications of Digital Local Roads solutions. These ideas were discussed in more detail to identify the stages required to realise these ideas.
- Face to face interviews with selected stakeholders to seek their views on their involvement in Digital Local Roads, the technologies deployed, challenges and future trends in this field.

The feedback from the consultation was collated into the areas described in this report. In some sections the views and comments have been collated by 'theme', for example the Local Authority Activity Themes, Challenges and Drivers, Benefits and Barriers and Action Plan. We also collated the stakeholders into groups for the purposes of presenting the results quantitively. These groups are:

- **Local Authorities:** This includes all types of Local Authority and also other owners of highway assets (e.g.. National Highways).
- **Technology Providers:** Stakeholders directly involved with the development, deployment or sale of Digital Road hardware and software solutions, including communications providers and OEMs.
- **Others:** Neither of the above. Future mobility (e.g., academia, research, consultancy), Investment and Finance , Industry bodies (e.g., advisory groups, professional associations) and Public representation bodies (e.g., motorist body, vulnerable road user body).

Distribution of contributors (totalling ~80), by sector



- Local or regional authority
- Other assets owners (e.g., National Highways, private land owners)
- Service provider
- Operations and maintenance (e.g., asset services, traffic signal providers, asset surveys)
- Manufacturers (e.g., vehicle, connected equipment)
- Connectivity and communications
- Design and construction
- Future mobility (e.g., academia, research, consultancy)
- Investments and Financing
- Industry bodies (e.g., advisory groups, professional associations)
- Public representation body (e.g., motorist body, vulnerable road user body)
- Legal and Regulatory

Appendices

B | Digital Local Road Solutions for LAs – examples for **Local Road Asset theme**

	Benefit Area	Asset Management Practice	Asset Management Practice	Social and Environmental
	Vision	**Aim:** Better understanding of asset condition in real-time, using crowdsourcing data **Digital Local Roads Outcome:** Real-time frequent data on network performance for improved asset management that better reflects user experience	**Aim:** Exploit large scale 'big' data to enhance predictive and planned maintenance **Digital Local Roads Outcome:** Data to support intelligent / predicative decisions on asset maintenance	**Aim:** Better understanding of how the network asset can be adapted to optimise active travel and support decarbonisation **Digital Local Roads Outcome:** Data on active travel use, strengths and weaknesses of the network, to support planning and design
	How could this be achieved?	• Multilateral data sharing arrangements agreed with vehicle OEMs / dash cam / phone providers to support the delivery of telemetry data and footage. • Implementation of routine telemetry data provision from LA public service fleets. • Establish a data pipeline to convert crowdsourced data into road condition measures. This would build upon a detailed road network definition, guidance/research on the interpretation of data, and off the shelf software to perform analysis and deliver the outcomes to LAs as Digital Twin data or to Asset Management Systems.	• Deploy "big" data techniques to better evaluate and improve the effectiveness of maintenance planning. These will draw on the collation of large volumes of data on asset condition and maintenance history provided from remote condition monitoring, crowd sourced data, digital asset management systems, weather data, traffic volumes etc. • Develop decision tools that exploit the improved deterioration rates determined from the enhanced condition data, and the wider information on external degradation factors – flooding, level of traffic etc.	• Deploy apps for local residents to collect data on local attitudes towards active travel. • Deploy CCTV networks and computer vision software to track active travel . • Exploit multilateral data access to providers (e.g. Strava, Komoot) to procure data on active travel journeys. • Deploy AI and Decision Support Tools to identify areas of highest active travel demand to prioritise adaptation and develop route proposals. Integrate proposed routes into predictive pollution and traffic management systems to estimate wider effects on the environment and carbon, to prioritise schemes that would deliver the highest social and environmental benefits.

Appendices

B | Digital Local Road Solutions for LAs – examples for **Traffic theme**

Benefit Area	Social and User Experience	Social and Economic	Social and Environmental
Vision	**Aim:** Improve road safety through the prediction of accidents and proactive intervention, to support vision zero **Digital Local Roads Outcome:** Data to enable LAs to better predict accident risk and undertake real time/ proactive interventions	**Aim:** Improve volume, effectiveness, accessibility and efficiency of streetside parking **Digital Local Roads Outcome:** Quantified demand for street side parking, leading to an objective and efficient programme of provision by LAs	**Aim:** Establish robust evidence-based policy for transition to new modes of mobility **Digital Local Roads Outcome:** Objective data on the volume, types/ routes and safety of any given form of new mobility to support strategic planning and road user choices
How could this be achieved?	• Implement a real-time traffic monitoring network to track accidents, near misses and locations of higher risk. Enabled through cellular network coverage, data sharing arrangements with OEMs (building on updated standards and formats) and embedded sensor installations. Develop risk prediction software (e.g. deploying AI) to learn and predict accident risk in real-time, and upskill LA staff in operating this software. Deploy for proactive risk management, including real-time messaging (VMS or to on-board units / smartphones), to improve CAV performance, and to identify maintenance schemes.	• Establish a digital twin of streetscape ‘parkable’ locations. Through multilateral data sharing arrangements with kerbside business stakeholders (e.g. Uber, Deliveroo, logistics companies), CCTV networks, cellular comms and computer vision analysis, collate kerbside occupation data. Use this to improve the digital twin of streetscape ‘parkable’ locations (this would augment the national road network definition). Use to support allocation of parking, and an open portal for booking access, billing for access and viewing of occupation data, including access to CAVs for (semi) autonomous parking.	• Confirm the data sources for a standardised approach to data collection on new mobility through the establishment of guidance and standards from DfT on what data should be collected (e.g. data dictionaries defining content and format). Collect, collate and share data amongst LAs. • Develop analysis tools for LAs to interpret the data and build the outcomes into transport planning tools. Share the data and tools with users so they can make the best journey choice based on time, carbon, wellbeing etc.

Appendices

B | Digital Local Road Solutions for LAs – examples for **Public Services theme**

Benefit Area	Social and Economic	Collaboration and Economic	Environment and User Experience
Vision	**Aim:** Dynamic ticket pricing to support public transport funding and growth **Digital Local Roads Outcome:** Data to model and predict demand for public transport and to enable pricing models to support LA aims such as decarbonisation	**Aim:** Unified ticketing for public transport to encourage modal shift away from single occupancy cars and generate increased revenue **Digital Local Roads Outcome:** Data and ticketing platform which collates and distributes data	**Aim:** Improving public transport punctuality **Digital Local Roads Outcome:** Collating traffic data and bus data and matching this to traffic management actions to improve public transport
How could this be achieved?	• Collect data on public transport ridership levels, via CCTV, ticketing, other sensors. Develop business case for dynamic pricing and (e.g.) models to enable ticketing to be valid across a wider range of providers/modes. • Incorporate other data sources including real-time traffic and pollution data. • Procure or develop software to manage dynamic pricing/ticketing. • Push information to public transport users and make data freely accessible.	• Define ticketing regions and requirements. • Develop business case for unified ticketing. Establish data sharing standards and agreements between public transport providers. • Standardise ticket sales data storage and retrieval. • Create a unified payment system which also distributes revenue amongst providers. • Capture data on where tickets were sold, the services used and the demand to inform changes.	• Collect, process and store real-time data on bus positions on the network using BODS. Empower users by sharing real time bus progress and positions. • Synthesise BODS with traffic demand data and forecasting to predict bottlenecks and delays. • Adapt bus service plans and priority to reduce delays and their impact. • Focus investment on bottlenecks for public transport on the network. • Deploy bus priority and other preventative traffic management techniques.

Appendices

B | Digital Local Road Solutions for LAs – examples for **Enabling Services theme**

Benefit Area	Environmental and Economic	User Experience and Collaboration	Collaboration
Vision	**Aim:** Intelligent expansion of the EV charging network to meet expanding needs **Digital Local Roads Outcome:** Rich spatial and demand data on EV journeys and kerbside/charging usage to support selection of locations	**Aim:** Overcome current cumbersome management processes via digitisation of TROs **Digital Local Roads Outcome:** Standardised, open, and centralised platform for digital TROs, accessible stakeholders. Will support planning and design, the operation of CAVs, enforcement, etc.	**Aim:** Establish open data platforms to share and ingest transport data **Digital Local Roads Outcome:** Standard data formats and APIs to allow LAs to distribute data to the wider public and industry, supporting CAVs and allowing new Digital Local Roads solutions to be developed
How could this be achieved?	• Capture data on EV journeys and usage from crowd sourcing and existing charge points. Multilateral data sharing arrangements with charging companies and OEMs to secure further, richer, data. Collation with digital twin information related to the power network, highway asset locations etc. Apply usage, journey data and asset data to create focussed business cases for investment in EV charging and the expected return on investment. • LAs work with Industry to use information to optimise location of EV chargers to meet demand. Also push the information on unoccupied local chargers to EV users to support improved confidence and proactive sales.	• Establish platform to store TROs. Ensure platform follows Open Data principles and has APIs for others to make use of the data. During the design ensure content addresses needs of “emerging” users such as CAV, autonomous parking etc. • Digitise historical TROs. Integrate TRO data into LA information services (e.g. roadworks). • Establish national TRO database, open to stakeholders, including other providers (e.g., journey planning apps developers, OEMs etc.). • Work to ensure the wider benefits of the data can be exploited, e.g. for efficient use of road closures by multiple stakeholders.	• Understand the scale of the challenge for different LA applications and environments. • Understand ownership and security/ privacy issues with data. Implement approaches to encourage data supply – e.g. gamifying data collection to encourage the public to participate. Identify initial use cases which are scalable and build a business case for sharing this data. • Develop data standards and APIs with support from DfT. • Procure or develop a suitable platform and share data. • Provide the public and industry with access to data and to help them make informed decisions and develop applications using this data.

Appendices

C Contributors

Alchera Technologies

AppyWay

Association of Directors of Environment, Economy, Planning & Transport

Atkins

Bracknell Forest Council

British Standards Institution

Cabinet Office

CECA

Cheshire West and Chester Council

CIHT

Connected Places Catapult

Crown commercial service

Department for Transport

DG Cities

dRISK

Dundee City Council

Ealing Council

Eloy

Enfield Council

Essex Highways

Eurovia UK

Exeros Technologies

Gaist Solutions Ltd

Gloucestershire County Council

Google

Grid Smarter Cities

Hackney Council

Haringey Council

Harrod Booth Consulting Ltd

Hertfordshire County Council

Hillingdon Council

Honda R&D Europe (UK) Ltd.

InnovateUK

ITS UK

Jacobs

Jenoptik UK - Smart Mobility Solutions

KL Systems

LCRIG (Local Council Roads Innovation Group)

Leicestershire County Council

Lincolnshire County Council

Liverpool John Moores University

London Legacy Development Corporation

Loughborough University

Mobileye

Mott MacDonald

National Highways

Navtech Radar

Nicander

NIRA Dynamics AB

One.network

Ordnance Survey

Oxfordshire County Council

Paua Tech Limited

Phil Jones Associates

Portsmouth City Council

Reed Mobility

Ringway Infrastructure Services Ltd

Ringway Jacobs

Royal College of Art

See.sense

South Gloucestershire Council

Surrey County Council

Techworks AESIN

Teragence

The Floow Limited

The RAC Foundation

The Road Haulage Association

TollPlus

Tower Hamlets Council

Transport for Greater Manchester

Transport for London

Transport for West Midlands

Transport Technology Forum

TRL

TRL Software

UK Research & Innovation (Innovate UK)

UTAC

Vinci Construction

VINCI Highways

White Willow Consulting

ZF Services UK Ltd.

Appendices

D References
General

[1] National Highways Digital roads (2021) Digital Roads - National Highways

[2] DfT Transport and Environment Statistics (2021) Annual report. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/984685/transport-and-environment-statistics-2021.pdf

[3] LGA. (2021). Councillor workbook: The local pathway to net zero. https://www.local.gov.uk/publications/councillor-workbook-local-pathway-net-zero

[4] Intelligent Transport. (2021). Delivering Demand-Responsive Transport in the West Midlands. https://www.intelligenttransport.com/transport-articles/128710/demand%E2%80%91responsive-transport-west-midlands/

[5] Transport & Environment. (2020). Recharge EU: how many charge points will Europe and its Member States need in the 2020s. European Federation for Transport and Environment AISBL.

[6] DfT. (2019). Future of mobility: urban Strategy. London: Department for Transport.

[7] DfT. (2021). Future of transport: Rural Strategy Call for Evidence. Summary of Responses. London: Department for Transport.

[8] EY. (2020). Highways England and Local Authority - Data Discovery. https://www.gov.uk/government/publications/highways-england-and-local-authority-data-discovery

[9] Wright, A., Sanders, P., Proust, J., Workman, R., Andriejauskas, T., & Ye, H. (2021). The new toolkit for highways asset management. Wokingham: TRL. TRL | A new toolkit for highways asset management

[10] https://www.local.gov.uk/about/news/lga-funding-almost-10-million-pothole-repairs-year-lost-council-budgets

[11] https://www.gov.uk/government/statistics/transport-statistics-great-britain-2021/transport-statistics-great-britain-2021

[12] https://www.gov.uk/government/news/130-million-to-protect-bus-services-across-the-country

[13] https://www.countycouncilsnetwork.org.uk/report-calls-on-government-to-implement-a-new-planning-model-as-two-thirds-of-councils-say-the-pressure-on-their-infrastructure-is-excessive-due-to-housing/

[14] https://inrix.com/press-releases/traffic-congestion-to-cost-the-uk-economy-more-than-300-billion-over-the-next-16-years/

[15] https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution

[16] https://www.smarttransport.org.uk/news/latest-news/local-authorities-receive-extra-funding-to-deliver-government-s-plan-for-300-000-ev-chargers

[17] https://www.gov.uk/government/consultations/consulting-on-ending-the-sale-of-new-petrol-diesel-and-hybrid-cars-and-vans/outcome/ending-the-sale-of-new-petrol-diesel-and-hybrid-cars-and-vans-government-response

[18] EIB (2022), Electric vehicle charging concessions, A contract guide for public authorities, Electric vehicle charging concessions - A contract guide for public authorities (eib.org)

Appendices

D References
Case studies

[1] Police Life (2011): http://www.police-life.co.uk/products/3d-laser-mapping-crash-investigations-help-reduce-motorway-congestion

[2] Surrey County Council (2022] https://news.surreycc.gov.uk/2021/03/16/major-changes-announced-to-improve-surreys-roads/

[3] ITEN (2021). https://www.iten.global/projects/atrail/

[4] UKRI (2022). https://gtr.ukri.org/projects?ref=76829

[5] Citymapper (n.d.). https://citymapper.com/company

[6] ADEPT (2017). Digital innovation: The route to the highways systems of the future. Report dated October 2017

[7] National Highways (2021). Digital Roads. Report dated August 2021

[8] Collins M (2021). Intelligent Transport https://www.intelligenttransport.com/transport-articles/128710/demand%E2%80%91responsive-transport-west-midlands/

[9] Water Power Magazine (2020). https://www.waterpowermagazine.com/features/featuredigital-rehearsal-could-be-the-new-normal-8066092/#:~:text=Cutting%20costs%2C%20cutting%20carbon&text=Digital%20rehearsal%20tools%20like%20this,and%20ultimately%20the%20bottom%20line.

[10] ADEPT (2020). ADEPT SMART Places Live Labs Programme

[11] UKRI (2022). https://gtr.ukri.org/projects?ref=83503

[12] UKRI (2022). https://gtr.ukri.org/projects?ref=80160

[13] UKRI (2022). https://gtr.ukri.org/projects?ref=59166

[14] National Highways (n.d.). https://nationalhighways.co.uk/our-work/innovation/case-studies/

[15] UKRI (2022). https://gtr.ukri.org/projects?ref=10003095

[16] HM Government (n.d.). https://www.local.gov.uk/sites/default/files/documents/mapping-and-geolocation-t-26a_0.pdf

[17] NPP (2022). https://npp-uk.org/

[18] UKRI (2022). https://gtr.ukri.org/projects?ref=97751

[19] UKRI (2022). https://gtr.ukri.org/projects?ref=133631

[20] UKRI (2022). https://gtr.ukri.org/projects?ref=80111

[21] Immense (2022). https://immense.ai/case-study/how-immense-is-helping-london-reimagine-roadworks/

[22] UKRI (2022). https://gtr.ukri.org/projects?ref=105425

[23] Partnership Talking Traffic (2022). https://www.talking-traffic.com/en/

[24] Trafi (2021). https://www.trafi.com/solent/

Contact information

For report content questions, please contact TRL **enquiries@trl.co.uk**

For questions about the future of Digital Local Roads please contact TTF **events@ttf.uk.net** or ADEPT **secretariat@adeptnet.org.uk**

ADEPT | Innovate UK | Jacobs | Ordnance Survey

RINGWAY | TRL THE FUTURE OF TRANSPORT | TRANSPORT TECHNOLOGY FORUM | VINCI HIGHWAYS