Areas of Research Interest
2019

Research and Evidence

Moving Britain Ahead

May 2019
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Foreword by DfT Minister of State

The way people, goods and services move is changing rapidly driven by extraordinary innovations in transport technologies and business models and changes in public needs and expectations.

There is an opportunity for this change to drive profound benefits for the UK in terms of developing a cleaner, safer, more efficient and more responsive transport system and for the UK to be world-leaders in transport innovation and delivery.

Such change requires a strong evidence-base. The Department for Transport (DfT) has an excellent reputation for evidence-based decision-making and delivery, and it is important we continue to develop and use research and analysis in our thinking. Such evidence cannot be delivered by DfT alone: we must work collaboratively with the broadest range of players in transport research and innovation to build a vibrant community and influential evidence base.

From my perspective, it is also essential that DfT generates the evidence to support the delivery of our Single Departmental Plan objectives:

1. Support the creation of a stronger, cleaner, more productive economy
2. Help to connect people and places, balancing investment across the country
3. Make journeys easier, modern and reliable
4. Make sure transport is safe, secure and sustainable
5. Prepare the transport system for technological progress, and a prosperous future outside the European Union (EU)
6. Promote a culture of efficiency and productivity in everything we do.

A current priority for the UK Government is the Industrial Strategy, and from DfT’s perspective the Future of Mobility Grand Challenge. This is an opportunity to corral activity across Government and the transport system to put the UK at the forefront of the industries of the future, ensuring that the UK takes advantage of and helps lead major global changes, improving people’s lives and the country’s productivity.

My ambition, aided by the publication of these Areas of Research Interest, is to improve the engagement between DfT and the wider research and innovation community; ensure that DfT has access to and uses the highest quality research; achieves value for money; and consolidates the UK’s position at the forefront of the future of transport.

Jesse Norman MP
DfT Minister of State
Foreword by DfT's Chief Scientific Adviser and Chief Analyst

Science, analysis and innovation are central to the DfT’s ability to deliver our wide ranging, ambitious objectives.

The Government is undertaking an ambitious programme of infrastructure and transport system improvements at both the local and national level, including providing significant investment in areas such as electrification, automation and large-scale infrastructure development. Our aim is to achieve a more accessible, greener, safer, and more efficient transport system.

Given the scale of change, and the range and pace of innovation in the transport system, we need to be able to embrace the opportunities that this will bring, and anticipate and mitigate any risks. Science, innovation, research and analysis are essential to achieving this, and need to be at the heart of DfT’s decision-making to enable us to deliver our ambitious programme of work effectively.

The main aim of publishing our updated Areas of Research Interest is to provide an overview of DfT’s research priorities and evidence needs over the coming years: our immediate needs alongside our more strategic evidence priorities. This ARI covers the breadth of our evidence needs, including innovation, science, social science, analysis and economic analysis.

We have jointly led the development of this document to ensure that DfT’s scientific and analytical activities are well directed and provide evidence that informs DfT’s priorities. To support our work, we continually seek to engage with the external transport research and innovation community and improve our ways of working to better build relationships with both existing and new partners.

This document is a vital instrument for DfT to communicate our priority evidence and research needs. We invite the UK’s research community to actively engage with us and align your research programmes with the priority areas outlined in this document.

Professor Phil Blythe CEng FIET

DfT Chief Scientific Adviser

Amanda Rowlatt

DfT Chief Analyst
1. Introduction

1.1 This document provides a summary of DfT’s research priorities: setting out our immediate priorities for 2019 and our more strategic medium and longer-term needs. These research priorities cover the full breadth of policy areas, organised by DfT’s Directorate groups, providing an overview of the research priorities in:

- Aviation
- Energy, Technology and Innovation
- Maritime
- Transport Security, Resilience and Response
- Local Transport
- Regions, Cities and Devolution
- Road Safety, Standards and Services
- Strategic Road, Economics and Statistics
- Analysis and Science
- Rail
- High Speed Rail
- Communications.

1.2 This document builds upon the Department’s 2016-2017 Areas of Research Interest and provides an updated account of our evidence needs. The document is not intended to be a list of projects or invitations for contracts, but a list of research themes and priorities for DfT.

Purpose

1.3 The purpose of this document is to communicate DfT’s programme of research interest with researchers outside the Department, providing transparency and clarity and inviting collaboration. This will enable:

- the alignment of external research with DfT’s priorities, maximising the opportunity for research impact and encouraging research capacity to grow in our areas of interest;
- an increase in the number and diversity of the delivery partners DfT work with;
- the facilitation of partnerships with other funders and research programmes, enabling research to be delivered more collaboratively and efficiently, and identifying ways we can better work together towards shared goals; and
• the development of a more robust evidence base, strengthening DfT’s ability to make well-informed decisions, ensuring public money is spent efficiently, policies are well-targeted, uncertainty is reduced and anticipated benefits are achieved.

Generating DfT’s Research Priorities

1.4 There is an annual internal process in DfT to identify research priorities within each policy area. This sets out the purpose of each research programme; the objectives of specific areas of research; and the gaps proposed work is trying to fill. This covers all evidence needs, and is supported by internal economists, transport modellers, social researchers, operational researchers, statisticians, scientists and engineers.

1.5 This process is overseen by the Chief Scientific Adviser and the Chief Analyst and is supported by DfT’s analytical and scientific professions: Government Economic Service, Government Statistical Service, Government Social Research profession, Government Science and Engineering profession, Government Operational Research Service, the Transport Modelling profession and the Department’s senior analysts. Ministers have reviewed and agreed the priorities.

1.6 These agreed priorities were used to develop this document.

DfT’s Evidence Collection

1.7 DfT’s research and analysis needs are met in a variety of ways to ensure the most timely, focused and cost-effective evidence generation.
1.8 The majority of the evidence needs set out in this document relate to work DfT will directly commission (the top of the pyramid). However, we are also keen to work closely with other research funders and providers to inform them of government’s evidence needs. Working closely with the research community allows DfT to utilise the existing transport evidence base and to influence future research programmes to help ensure such programmes of work can have maximum impact.

1.9 DfT uses a broad range of different types of evidence, including:
- reviewing and synthesising existing evidence, research and expert knowledge
- conducting secondary analysis of existing data sources
- commissioning new evidence generation, both qualitative and quantitative (through a variety of procurement options and competition exercises)
- developing analytical tools for modelling and forecasting
- evaluating policies and investment programmes
- monitoring and surveillance
- data analytics and data visualisation
- undertaking trials, pilots and demonstrators
- influencing and providing a steer to the research programmes of others to help align them with the Department’s needs.

1.10 We also work with a wide range of stakeholders including:
- Academic institutions
- Research Councils
- Research organisations
- Innovate UK
- Consultants
- Industry experts
- In-house analysts
- Professional Institutions (IET, ICE, IMechE, RAEng etc)
- Other Government Departments and / or Arms Length Bodies.

1.11 We welcome contact from researchers and academics who wish to discuss their research to maximise its impact and value to DfT. We host a 'meet the funders day' where Universities meet with key transport research and innovation funders. We also engage with the Universities' Transport Study Group (UTSG) and other research related events. In addition, to aid two-way communication between academics and DfT, we have established a mailbox called ‘Bridge to Research’ to provide a simple route into DfT, and for DfT to find academics working in specific areas. Please use this email address if you have any queries or would like to contact DfT officials working in a specific area.
2. Cross-Cutting Research Themes

2.1 There are cross-cutting research themes that span different areas of the Department and cut across modal areas. These have relevance to most research priorities areas outlined later in this document.

Transport Data

2.2 Data and digital technologies have been identified as a key enabler for innovation and a foundation for enabling the future of mobility. The increased digitisation of transport could have huge benefits, including cutting delays, traffic congestion and disruption to journeys. Improved transport data will allow the creation of innovative business models which have the potential to change the way people and goods are moved. The availability of data on customers’ journeys and the potential benefit of data sharing is increasing important as a route to improve the user experience.

2.3 DfT is looking at its current capabilities, the future impact of data, and the way it stored, analysed and accessed. DfT’s research interests in data are focussed on the need to overcome the barriers to data sharing that could hinder further innovation. The Department has made good progress releasing its data, with many datasets published on data.gov.uk. It is working with the wider transport sector to identify ways to overcome issues around interoperability and shared data standards. Further links have been provided in this document to datasets relating to specific research priorities.

Monitoring and Evaluation

2.4 Monitoring and evaluation are important tools with which DfT can assess our delivery against our objectives, learn from past and current activities and reduce delivery risk. It develops evidence that can be used to inform the design and delivery of future initiatives. DfT has a Monitoring and Evaluation Strategy and publishes regular updates of its Monitoring and Evaluation Programme of priority projects.

2.5 Most policy areas undertake monitoring and evaluation activity at a project or programme level. The research and data required for monitoring and evaluation, if it is to be newly acquired or generated, will feature in the evidence needs outlined in this document.

The Future of Mobility Grand Challenge

2.6 The Industrial Strategy identified four Grand Challenges - major global trends the UK has the potential to be at the forefront of improving people’s lives and the country’s productivity. The Future of Mobility Grand Challenge aims for the UK to be
a world leader in the profound changes happening in the transport sector through advances in technology, engineering and business models.

2.7 DfT are working across Government and beyond to understand and articulate the ways in which mobility is changing as a result of: new technologies; changing demographics and expectations; and new actors in the transport sector. We are exploring how the Government might achieve its desired outcomes and what an effective policy and regulatory response would be to encourage innovation whilst managing potential risks and negative consequences. The DfT has many roles in the Industrial Strategy, as a convening power to articulate our future challenges and vision for the transport system, as a customer of its outputs, and as a testbed/showcase of the UK's wares. In doing so, we aim to position the UK as a world leader in fostering innovation in transport provision.

2.8 Understanding the developments that are the focus of the Future of Mobility programme requires cross-cutting, multidisciplinary research and analysis. We must recognise both the potential impacts of technological change and the potential economic and behavioural responses to those changes, in the context of an evolving socio-economic landscape. The research and analysis we undertake as part of the Future of Mobility programme will help ensure we have a strong evidence base to support the development of policy and legislation. The strategic research needs set out below incorporate our latest thinking on the evidence priorities that will help support our future of mobility ambitions.

Transport Futures

2.9 DfT has initiated futures work to understand future uncertainty about how people and goods move around, in order to achieve positive outcomes and avoid potential risks. The work aims to help us ‘futureproof’ decision making; build resilience into research plans; and to support the Future of Mobility Grand Challenge. We will build resilience and coordination across modes by developing our understanding of how to anticipate and respond to future uncertainty in a structured way, and building the evidence, skills and tools to achieve this.

2.10 Our transport futures work provides the evidence and tools required to encourage resilient decision making across DfT, and enable everyone to think effectively about what the future means for their work. It is supported by a cross-Departmental futures community and aims to apply futures techniques to identify and build the skills and capabilities DfT will need in the future as well as resolve specific issues to support decision making.

Transport Users Attitudes and Behaviours

2.11 Social and behavioural research helps us achieve our ambition of ‘putting people at the heart of the transport system’. Understanding the attitudes, preferences and behavioural responses of people and businesses helps us design and deliver better policy and infrastructure. It is essential we investigate how our current policies impact on the travelling public. Understanding how society and travel behaviours are changing helps us to better plan for the future. Our social research needs cover cross-cutting topics, such as the role of transport in promoting equality and wellbeing, as well as research designed to inform particular policy areas.

2.12 There are specific social research evidence needs around the Future of Mobility Grand Challenge, including looking at the attitudes and potential responses of
people and businesses towards new and emerging transport technologies and services, as well as wider trends such as the changing transport and travel needs of the ageing population and to ensure what we deliver is from a user pull rather than from a technology push.

**Skills and Capability**

2.13 Innovation in technology and business models presents new requirements in the transport sector for scientific, analytical, data and human science skills that are in short supply. The skills requirement needs to be well understood to address the current needs as well as emerging challenges for the future.

2.14 As part of the Future of Mobility Grand Challenge work, DfT are keen to explore the skills and capability required to develop and work in the transport system of the future: both inside DfT and in the broader supply chain.

**EU Exit Research**

2.15 DfT and the wider Government are undertaking extensive preparations in advance of the next phase of negotiations with the EU. Concurrently, the Government will continue to do the responsible thing and prepare for all eventualities.

2.16 Engagement between the DfT and academia on the EU Exit related research themes and questions detailed in this document will help to inform the evidence base underpinning Government and Department decisions on these preparations and negotiations. This will support the UK in both building on the opportunities arising from EU Exit and managing our new relationship with the EU.
3. Drivers of Change

3.1 The development of DfT’s strategic research needs is driven by a number of external influencers and drivers for change. These are social, economic, science and technological, and include:

<table>
<thead>
<tr>
<th>Commercial opportunities</th>
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<tr>
<td>There are opportunities for businesses to innovate and acquire commercial advantage. Innovation based companies could be attracted to UK cities and regions to boost their technology and skilled workforce.</td>
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<tr>
<th>Clean, sustainable travel</th>
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<tr>
<td>Improvements in battery technologies, electrification and the availability of alternative fuels should lead to improved air quality and reduced carbon emissions, thus having a positive impact to air quality, people’s health and wellbeing and global carbon reduction.</td>
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<tr>
<th>Technological innovation</th>
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<tbody>
<tr>
<td>New modes of transport and new business models introduce new ways of moving people and goods. They offer new ways to plan and manage journeys including on demand, joined up journeys and a potential shift towards using a sharing model.</td>
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<tr>
<td>Technological improvements to the existing network to increase capacity, increased internet connectivity to facilitate flexible working patterns and improving the provision of public transport could help ease and reduce congestion.</td>
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<tr>
<th>Changing demand and customer needs</th>
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<tbody>
<tr>
<td>People are living and working longer and the population is ageing. Travel behaviour is changing, with young people travelling less, fewer commuting journeys and changes in people’s shopping and leisure habits.</td>
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<tr>
<td>Consumer attitudes and behaviour will shape the way and the extent to which new technologies and business models develop, as well as the pace of change.</td>
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<tr>
<td>Increased urbanisation</td>
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<td>------------------------</td>
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<tr>
<td>Increasing <strong>urbanisation</strong> will put more pressure on transport and new solutions will be needed. Benefits to travellers can be achieved by optimising and enhancing existing <strong>infrastructure</strong>. There is a need to balance the attractiveness of new ways of travelling with the need to mitigate any increased in congestion - the benefits to the individual versus the potential dis-benefits to wider society.</td>
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<th>Data-driven transport</th>
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<tr>
<td>The ubiquity of data has the power to improve and join-up the transport system, underpinned by digital connectivity. This has the potential to create new business models; integrate different modes of travel; and facilitate the sharing of data between vehicles and between vehicles and infrastructure; and improve infrastructure through the use of sensing technologies. Coupled with increasing levels of <strong>automation</strong> in transport and increased potential of <strong>big data, advanced data analytics, machine learning</strong> and <strong>artificial intelligence</strong>, there is potential for profound data-driven change.</td>
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<tr>
<th>Health, Wellbeing and Inclusivity</th>
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<tr>
<td>Transport plays a key role in the way people live their lives and is important for supporting our <strong>health and wellbeing</strong>. It helps with connecting people for social or employment activities and reduces <strong>loneliness</strong>. This requires a transport system that is <strong>inclusive, safe and accessible</strong> to all. There is a need for solutions to encourage <strong>active travel</strong> to keep people moving. We also need to ensure that new technologies do not act as a disincentive.</td>
</tr>
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4. Strategic Research Needs

4.1 DfT has immediate evidence needs, set out from Section 5 onwards, to inform our immediate decision making. However, we must also respond to the strategic drivers and influences set out in Section 3 to identify medium and longer-term areas of research interest.

4.2 We are keen to work with the research community outside DfT on these strategic research needs, both to improve DfT’s ability to make informed decisions, and to grow the UK’s capability in these areas to help us better meet the challenges set out in the Industrial Strategy. By working in partnership with others, DfT can help make the UK world leaders in transport and transport research and innovation, and move towards the Government’s target of spending 2.4% of GDP in research and development by 2027.

4.3 We will achieve this through working with individual research centres as well as with UK Research and Innovation (UKRI), for example through the Strategic Priorities Fund, the Industrial Strategy Challenge Fund and other research funding initiatives.

4.4 There are a number of initiatives in the Department that support the development of our medium to longer-term strategic research needs. These are described below.

Transport Research and Innovation Board (TRIB)

4.5 DfT have recently helped form a new national board: The Transport Research and Innovation Board (TRIB). TRIB’s aim is to join-up and coordinate disparate transport research and innovation activities across the UK to achieve a more strategic, coordinated and impactful programme of work. Board members include senior leaders and decision makers of the major transport funding and research bodies in the UK as well as the Chief Executives of major transport arms length bodies and other key stakeholders.

4.6 TRIB have identified four priority themes, from a longer list developed in discussion with DfT policy leads and others, where they are focusing their immediate attention:

- **Transport infrastructure** - including smart and digital infrastructure; robotic and offsite construction and maintenance
- **Transport Integration** - especially around hubs and nodes between transport modes
- **Health, wellbeing and inclusivity** - to include air quality, noise, active health, accessibility, equity and ageing
- **Data sharing** - including interoperability and cyber security.
Science Advisory Council (SAC)

4.7 DfT's Science Advisory Council (SAC) brings together academic and industry experts to advise and challenge DfT. The SAC works with the Chief Scientific Adviser and DfT policy leads, and brings in additional independent experts where required. It typically examines and scrutinises transport innovations or conducts a deep dive on a specific scientific issue in transport in order to provide recommendations and advice to DfT.

4.8 Review and analysis by the SAC of likely future technological and social changes has contributed to the development of the DfT's strategic priorities.

Joint Analysis Development Panel

4.9 The Joint Analysis Development Panel (JADP) is made up of academic and professional experts who provide advice and challenge to DfT on its modelling and appraisal methods and strategies. This ensures our evidence base remains best practice.

4.10 The panel's impact and influence has helped to shape our priorities for future research, expose challenges and uncertainties with developing and presenting our work and ultimately helped us to build more confidence in our modelling and appraisal methods.

Longer-term Research Needs

4.11 The Department's longer-term research needs have been set out below as statements of issues that the Department is addressing where longer-term strategic investigation could greatly help our thinking.

Commercial Opportunities

For the UK to be at the forefront in the transport sector, our evidence priorities are:

- Identifying and developing the skills required to develop, work in and operate the transport system of the future
- Futureproofing our decision making, to build resilience into decisions we make now for the future and ensure we use the best science and technology available
- Understanding the impacts of new transport technologies and services on the labour market, and understanding the way jobs in the transport sector may change
- Exploring potential equity or exclusion risks of different mobility models
- The effects of transport technologies and services on productivity and growth
- Ensuring Government can develop agile regulations that helps to encourage innovation
- Exploring ways to overcome barriers to innovation in procurement processes and overcome barriers to innovation being delivered
- Understanding the effect procurement processes and other logistic management activities have on the supply-chain
- Making appraisal and modelling techniques more user friendly and easier to use.
Clean, sustainable travel
To improve air quality and reduce carbon emissions we must improve technology and services to achieve clean, efficient and sustainable travel. Our research needs include:

- Supporting the development and implementation of new, clean transport modes in regional air transport including hybrid/electric flights, short take-off and landing, and personal air travel
- Understanding the transition to a decarbonised transport system and how to achieve this
- Investigating the role for hydrogen and other alternative fuels in the transport sector Identifying what infrastructure is required to support the generation and storage of alternative fuels
- Understanding particulate matter and how this can be reduced to improve air quality
- Supporting electrification across all modes of transport and sectors where appropriate.

Technological innovation
New business models and modes could have profound impacts on people's travel habits, the level of sharing and many other factors. Our research needs include:

- Understanding the market structures that may emerge from new mobility services
- Ensuring our regulatory frameworks are agile to account for emerging technologies to quickly realise their benefits
- Identifying the benefits of ride sharing and identifying the barriers to its adoption
- Understanding opportunities for new ways of moving such as Mobility as a Service and on demand travel
- Exploring the opportunities to improve the way people and goods move in the UK including longer distance travel and last mile deliveries
- Ensuring new technologies does not discourage active travel or create a safety risk
- Ensuring security by design throughout the transport system, and how this may change in light of increasing automation, electrification, new modes and new business models.

Increased urbanisation
With the population growing, we need to find ways to ensure the transport system develops to cope with increased demand and is integrated into the wider urban system. Our research needs include:

- How to encourage the uptake of smart construction and support the use of robotic, off-site, and modular construction
• Supporting the adoption of collaborative and smart infrastructure and its implementation to effectively monitor the performance of infrastructure
• Ensuring infrastructure design covers the manufacturing, assembly and maintenance of infrastructure throughout its life
• Improving connectivity between towns and cities, as well as rural and rural/urban transition zone
• Understanding the relationship between housing, transport, employment and wellbeing
• Enhancing the modelling of changes in economic geography associated with investment in transformational transport schemes
• Better understanding the value of active travel and the quality of place amongst local communities.

Data
Making good use of data and recognising the ways it can revolutionise transport could lead to profound change in the way people and goods move. Our research needs include:

• Exploring how emergent technologies - such as AI, machine learning, distributed ledger technology, the Internet of Things, advanced data technologies - deliver tangible transport benefits
• Understanding how the creation of new modes, businesses models and technologies will impact data ownership and data sharing
• Investigating the impact of increased digitalisation and data usage on cyber security and finding ways to embed this into the supply chain
• Encouraging data sharing between difference stakeholders to remove the barriers to adoption for opportunities like Mobility as a Service
• Using analysis and modelling techniques to understand the effects automated vehicles may have on transport services, operations and congestion
• Understanding how big data can be used to better understand existing travel behaviour and used to help forecast changes in demand over time.

Changing demand and traveller expectations
Research will enable us to better understand how the transport system could develop in the future to meet the changing transport and travel needs of people, communities and businesses. Our research needs include:

• Understanding how consumer attitudes and behaviour influence the appetite for automated vehicles and ride sharing
• Identifying the Government's role in addressing public perception and acceptance of new technologies
• Exploring the effects new mobility services may have on vehicle ownership
• Understanding the factors that influence the uptake of ride sharing
• Identifying the effects of wider socio-economic trends on the ways people will use new transport technologies and services

• Understanding the sources of uncertainty in travel behaviour and developing techniques for reflecting this in our analysis of policy and investment decisions

• Developing new modelling approaches which help us to understand the longer term consequences of changes in travel behaviour and the impact of new policies, services and infrastructure.

**Health, Wellbeing and Inclusivity**

The relationship between transport and people’s health and wellbeing is essential if we are to develop a transport system that works for all. Our research needs include:

• Understanding the relationship between transport and health, wellbeing and inclusivity

• How to make active travel the default method of travel which complements any increase in new technologies and new ways of moving.

• Ensuring transport is inclusive, accessible, age friendly to all and addresses social inclusion and social mobility

• Identifying the potential equity/exclusion impacts of different mobility business models and new mobility technologies

• Understanding the public’s likely level of acceptance of data sharing and using this to create new transport modes and business models

• Developing and maintaining our evidence base on the valuation of improvements to users of the transport network and those affected by its construction and operation.

**Appraisal and Modelling**

To ensure our Transport Analysis Guidance (TAG) continues to provide a comprehensive, consistent and robust approach for assessing the impacts of transport investment we need to maintain and develop the evidence base underpinning it. Our research needs include:

• Capturing location attractiveness impacts with a focus on valuing the urban realm. These impacts represent changes in the quality of places in which people live, work and enjoy their leisure time

• Facilitating more refined appraisal of schemes that have an impact on public health and wellbeing, including active mode improvements

• Developing our modelling and appraisal of freight, including travel time reliability and resilience to extreme disruption

• Exploring the impact of new technologies, including Connected and Autonomous Vehicles (CAVs) and Mobility as a Service (MaaS) on the value of travel time savings

• Refining and developing our understanding of the impacts of transformational investments, including household and business location decisions and assessing cross-sector packages
• Continuing to develop our understanding and presentation of uncertainty in appraisal, including research into the drivers of uncertainty and the use of simpler modelling approaches to test uncertainty at earlier stages of project development

• Investigating and developing techniques to capture transport benefits when there is land use change.

Dissemination

4.12 To get the most value from the evidence and research we invest in, it is important that we communicate it effectively. In line with the Government's commitment to Open Government, we will ensure that research results and other evidence collected and used in the course of DfT's business are made available on gov.uk. There are a range of professional codes of practice to support this.

4.13 Our research findings are typically disseminated by and used in ministerial speeches, presentations, seminars, videos, good practice guidance, technical notes and a range of other literature. Where appropriate we also support dissemination by the researchers themselves, for example, through publication in peer reviewed journals and other specialist media.

4.14 As well as collaborating with universities and Research Councils, we will continue to have close collaboration with other Government Departments and Local Authorities to improve efficiency and share lessons. We also support collaboration with industry and the private sector, and support networks of technology and innovation centres such as the Connected Places Catapult, to help businesses transform ideas into viable products and services that can drive economic growth.

4.15 We welcome discussions on the research needs set out in this document. Please contact us through the Bridge to Research if you would like to discuss or find out more information.
5. Specific Research Needs for 2019

The specific research needs for DfT’s policy areas have been listed below and are organised in order of how central they are to the Department’s work.

Energy, Technology and Innovation

About the research programme

5.1 The Energy, Technology and Innovation (ETI) research programme supports DfT’s objective of reducing greenhouse gas emissions from UK transport. The work is closely aligned with the (carbon) emissions reduction plan and the National Air Quality Plan. ETI work supports the UK ambition that the majority of new cars and vans to have significant zero emission capability. By 2050, we want almost every car and van to be zero emission.

5.2 Research supports the development of policies that ensure the approval requirements for vehicles deliver safety for all road users and good environmental performance. This is achieved through effective engagement at international level. We also work closely with the Environmental Analysis team, whose research is supporting our key commitments in the Clean Growth Strategy; and the Road to Zero Strategy.

5.3 ETI research is carried out in partnership with industry, academia and cross-Government cooperation. This level of collaboration across the transport sector helps ensure that the research programme provides both value for money and maximises the benefits to the UK’s economy and environment. This is demonstrated through many of the programmes that we support which have leveraged significant investment from the private sector and industry. This has been apparent though the rapid technological advancement of low emission and autonomous vehicles which offer a significant opportunity to the UK passenger and heavy goods vehicle fleets.

Research requirements

5.4 Office for Low Emission Vehicles (OLEV)

- Vehicle to grid – Through our current £30m competition (£10m DfT, £20m BEIS) understand the integration of vehicles and supporting infrastructure with the energy base, including questions of technology, functionality, access, interoperability, smart grid aspects, vehicle usage patterns, consumer responses, enabling processes for local authorities, optimal scale and type, impact of future developments and commercial scale up.

- Freight – continue to assess potential emission savings from different freight technologies using and on and off-road testing (via the Low Emission Freight and Logistics Trial).
• Battery developments – understand battery performance and degradation, working closely with the Faraday Battery Challenge.

• Uptake – forecasting of future uptake of Ultra Low Emission Vehicles (ULEVs); understanding needs and attitudes of consumers, including perceptions of and accessibility to charging infrastructure; effects of incentives on market growth; and understanding the needs and characteristics of the fleets.

• ULEVs – assess the price and range competitiveness of ULEVs now and in the future and implications for uptake of different vehicles.

• Modelling and appraisal tools – forecast and assess the economic and social impacts of ULEV uptake under a range of different scenarios and policies.

• Charging infrastructure – understand the requirements for Electric Vehicle charging, and how effective the policies are to support this, including the Electric Vehicle Homecharge Scheme, the Workplace Charge Scheme, and the On-street Residential Scheme.

• Through our £40m On Street and Wireless charging competition we will support collaborative, business led research into charge point design and technologies.

• Research into electric vehicle technology development will be supported by our latest Integrated Delivery Programme (IDP15 - £22m) which is focused on powertrains and electronic motors.

• Understand charging and driving behaviour – users of battery electric and plug-in hybrid vehicles, including the extent to which they are driven in zero emission mode, and EV charging infrastructure gaps in cities.

• Market impacts – understand the needs and attitudes of EV business and personal buyers, barriers that impact on EV purchase decisions, and the imminent second-hand ULEV market.

• Infrastructure and supply chain development – research in this area and scale up the technology to commercial level.

• Life cycle analysis – considered for current and future production vehicles to understand the environmental impacts of vehicle manufacture, use and disposal; vehicle manufacturer considerations in EV development.

Policy and regulation – evaluate the effectiveness of policies supporting ULEV technologies; to conduct regulatory test cycles with a strong focus on heavy duty vehicles.

5.5 Low Carbon Fuels (LCF)

• Transport fuels decarbonisation strategy – understand and support the strategy, with work ranging from availability of waste feedstock to efficiency of technologies to make sustainable, low carbon fuels for transport to meet emissions reduction targets.

• Industrial strategy and biofuel wider economic impact – analyse and identify the factors that characterise the supply chain, and the wider biofuel contributions to the economy.

Trade and investment – research the potential of the biofuel supply chain to export products and systems.
5.6 Centre for Connected and Autonomous Vehicles (CCAV)

- CCAV regulatory programme – understand the potential impacts of regulatory changes on businesses and consumers.

Wider social and economic impacts of CAVs – develop evidence around the potential impacts of CAVs on; productive use of in-vehicle time, journey time reliability, traffic flow, network management, safety, efficiency, demand and mode choice.

5.7 International Vehicle Standards

- Vehicle safety – road accident investigations data to inform opportunities to improve safety.
- Heavy Goods Vehicles (HGV) platooning – investigate the practical implementation of HGV platooning on the UK Strategic Road Network through real-world trials.
- Environmental performance – understand the real-world emissions of road vehicles.
- New technologies – understand the safety benefits, risks, costs and wider implications of new technology, e.g. advanced driver assistance systems, automated driving functions, pre- and post-sale verification of system safety (including software appraisal).
- Tyre safety – in the context of the use of older tyres, to understand better the effect of age on material properties and structural integrity.
- Consumer information programmes – testing to inform provision of information on the safety of motorcycle helmets and new cars enabling consumers to choose safer products.
- Annual roadworthiness (MOT) testing – investigate options to improve annual roadworthiness testing to detect polluting vehicles.
- Vehicle noise – identify options to detect vehicles with high noise emissions.

5.8 Environment Strategy

- Vehicle emissions and retrofit technology – build the evidence base and extend the emissions analysis in the Transport Energy Model (TEM). The Road to Zero Strategy sets out the results of this assessment and Government’s view on the relative environmental performance of different fuels and technologies, in terms of both greenhouse gas and air pollutant emissions over the period to 2050.
- Energy Strategy – the role of zero emission and transition fuels across transport (including development of the Transport Energy Model), new/innovative transport taxation approaches to deliver environmental goals.
- HGV technologies – understand how different HGV technologies can reduce emissions according to factors including their emission levels, cost and potential economic benefits, technical feasibility, practicality on the UK road network, and GDP impacts or value-added.
• Modelling – develop an extension of our modelling suite used to analyse the impact of policies on vehicle sales, and further work to understand the second-hand market. To improve car, van, HGV fleet models, analysing stock and fleet composition, driving behaviour, emissions, etc.

• Efficient driving – identify key technologies that support safe and fuel-efficient driving behaviours helping to deliver emission reductions, and a road map for their delivery into the UK.

• Development fuels – assessing the potential of fuels such as hydrogen, as well as their role in the energy mix alongside other technology such as battery electric vehicles.

• Consumer impacts - In support of work on going within the Road Transport Emissions Advice Group (RTEAG) whose focus is to ensure there is clear and consistent messaging on specific changes that impact motorists, we will be looking to gather some consumer insight data to support decisions on understanding, perception and choice.

• Climate Change Strategy – Developing natural capital approaches for transport infrastructure development and maintenance, Carbon Budget gaps/opportunities (~CCC 1.5 degree report), Mode-shift (private, commercial, freight), Climate adaptation and transport.

• Regulation and exiting EU – New approaches to regulation of new car CO₂ post EU-exit

Transport Security, Resilience and Response

About the research programme

5.9 All Transport Security, Resilience and Response (TSRR) research is targeted to enable the Department to reduce the risk to transport infrastructure, networks and the travelling public. Transport security policy, regulation, compliance and operational response draws heavily on science and technology to inform decision making. It enables the Department to have confidence that measures applied will be effective at mitigating risk, and that we are making the most of resources available.

5.10 The research programmes cover Counter-Terrorism, Cyber Security, Resilience and Natural Hazards/Civil Contingencies, and aim to:

• Understand the transport threats, risks and vulnerabilities. Generate evidence on the effectiveness of measures to manage and mitigate these risks.
  Develop and deliver science and technology mitigations to proportionally address vulnerabilities.

Research requirements

5.11 Counter-Terrorism

• The Research Analysis and Development (RAD) Team aims to:
  – Understand current and emerging threats to transport systems and their associated impacts.
— Develop and evaluate science and technology approaches to mitigate transport security risks, including consideration of, processes, systems and people.
— Develop science and technology mitigations which, in the event of an incident, will reduce the impact.

- The Future Aviation Security Solutions (FASS) programme aims to:
  — Address security risks faced by aviation and have a positive impact on the industry and the passenger experience through investment in innovative technology concepts/approaches; supporting operational trials; and facilitating quicker market exploitation.

5.12 Cyber Security

- Cyber threat and vulnerabilities – understand threats and vulnerabilities across the transport sector, including those associated with new technologies.
- Risks mitigation – mitigate cyber risks and take appropriate action to protect key assets.
- Incident response – support industry to respond to cyber incidents effectively, ensuring that lessons are identified and learn.
- Cultural change – promote cultural change and build cyber capability.

5.13 Resilience and Natural Hazards/Civil Contingencies

- Risk analysis – understand available science and technology information related to risk, impact and response options and how DfT can fill knowledge gaps.

Analysis and Science

About the research programme

5.14 Analysis and Science (ASD) occupies a unique, central position in the Department providing scientific and analytical support to teams across the Department, ensuring that the evidence on which the Department takes decisions is robust.

5.15 Its research programme delivers a wide range of tools, resources and cross-cutting evidence upon which the rest of the Department relies to inform policy decisions and externally used in the delivery of infrastructure projects and transport services. By continuously improving our appraisal and modelling methods, broadening and deepening our knowledge of transport users, understanding the impact and efficacy of our investments, supporting innovation and science in the transport sector.

5.16 ASD leverages its expertise in evaluation, economics, social research, science, engineering, operational research and data and its links to academic expertise in these areas to deliver bespoke, policy-specific research projects for teams where it is more efficiently done at the centre.
Research requirements

5.17 Transport Appraisal and Strategic Modelling

- Wider economic impacts – update the key values used to calculate wider economic impacts and finish developing a software tool to assess these impacts. To strengthen the evidence base used in business case development, enhance modelling capabilities and assessing the value of transformational schemes.

- Future travel demand forecasts – continue developing the evidence base on how the underlying relationships between key drivers of travel demand – such as growth in income and population; trip rates and fuel costs; and observed travel patterns – are evolving and reflected in the assumptions made in our modelling tools. Considering the impacts of anticipated future changes in the way we travel (e.g. the introduction of CAV and Mobility as a Service).

- Uncertainty in analysis – understand the scale of uncertainty around key variables in our models, as well as wider methods for analysing and presenting uncertainty; feeding into the Future of Mobility Grand Challenge on the treatment of uncertainty in decision-making; and underpin any future updates to guidance.

- Complete the development of a new National Transport Model (NTMv5) – which accounts for the latest evidence on travel behaviour to be used in forecasting and policy testing.

- Guidance on matrix building – develop new guidance and provide leadership to the industry on how the rich wealth of data sources now available to modellers can be best used set standards, solidify best practice and provide consistency in a highly technical area.

- Values of Travel Time Savings (VTTS) – use existing evidence about how congestion impacts passenger experience to firm up our understanding of how congested VTTS can inform modelling for appraisal; to refine our approach to equity and end-user segmentation in appraisal.

- Environmental and health impacts – improve approach for quantifying air pollution impacts (NOx and PM10) impacts in urban areas; to understand the behavioural drivers of walking and cycling demand; and to improve how we capture the benefits of removing barriers to walking and cycling in appraisal. To re-estimate the value of a life year underpinning the appraisal of health and safety impacts across our framework.

- Improving cost estimation in appraisal – complete work to update our headline rates of Optimism Bias (OB) to reflect the latest evidence; to refine the OB methodology to provide a more granular and robust segmentation of OB rates and consider OB on benefits and project schedules.

- **Value for Money indicator** – continue to publish an annual update of the value for money of DfT’s investment portfolio; to strengthen our approach to collecting and analysing value for money data; to better understand potential value of our investments, and the expected impacts of schemes.

- Review **DfT’s Analytical Assurance Framework** – ensure it is fit for purpose and identify opportunities for improvements.

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1 Further detail on our research priorities can be found https://www.gov.uk/government/consultations/transport-appraisal-and-modelling-strategy-informing-future-investment-decisions
5.18 **Department for Transport’s Office for Science**

- **Innovation research** – funding early-stage research projects into innovative ideas and concepts to enhance the UK transport system and creating opportunities; exploit emerging technologies; to support DfT’s delivery and policy priorities, including the Future of Mobility Grand Challenge.

- **Future of Mobility** – understand and anticipate the consequences of disruptive technologies. To better understand science and technology to help to deliver the Industrial Strategy Grand Challenge on the future of urban mobility; horizon scanning; identify opportunities to improve value for money, efficiency and improved environmental standards.

- **Live and big data** – explore the benefits of this data and develop transport-specific use cases including to understand the frameworks and standards “info-structure” required; public attitudes towards big data; and the use of digital technologies.

5.19 **Social and Behavioural Research**

- **User perspectives and priorities** – strengthen the evidence base on the user perspective regarding: journey reliability; connectivity; affordability; and the drivers of customer satisfaction.

- **Transport implications of a changing society** – evidence on the potential implications of social, economic, behavioural and demographic changes, and their strategic implications for managing risks and planning of the transport network.

- **New technologies** – investigate and understand current and future transport needs, preferences, and the public acceptability of new and emerging technologies and services. Ensuring technologies and technology-based services are both developed around users and also realise their wider social and economic benefits. Including autonomous vehicles; Mobility as a Service; new shared services; new business models for car ownership; and the use of data in transport.

- **Health, wellbeing and equality** - increasing our understanding of how transport promotes health, wellbeing and equality.

- **Exploiting existing data sets** – undertake additional analysis of our longitudinal data sets to explore issues such as the interaction between transport and life opportunities, and changing car ownership. Explore the benefits of linking our data to other sources, such as DVLA and social media data.

5.20 **Evaluation Centre of Excellence**

- **Evaluate investments and policy decisions** – continue to develop a strong evidence base to guide our activities, and reduce the risk of poor decision making and inefficient delivery.

- **Monitoring and Evaluation Programme** – develop evaluation designs to deliver robust evidence; to support scheme development by understanding causal mechanisms that contribute to its success; and to develop the Department’s capability in evaluation. To develop new methodological approaches that ensure that evaluation designs build more strongly on appraisal.

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2 Innovation grants are awarded through Transport Technology Research Innovation Grant (T-TRIG) competitions
Rail

About the research programme

5.21 The rail research programme is focused on delivering the evidence to support the Secretary of State’s vision for the railways, including plans to end the operational divide between track and train and an evolution of the franchising system.

5.22 The proposals set out in the government’s Strategic vision for rail include commitments to expand the railway network, to boost housing and economic growth, and to deliver major passenger benefits. It pledges to introduce digital rail – new technologies that have the potential to reduce crowding and improve train punctuality for passengers – across more of the country.

5.23 Future research will be carried out to support the delivery of improved passenger experience across the network, whilst encouraging the use of new technology and innovation to improve services, including major changes that will extend passenger rights.

Research requirements

5.24 Rail Analysis

• Economics and modelling research – continuing to develop the evidence base for rail forecasting, modelling and appraisal; passenger demand forecasting; economic appraisals; and develop existing models. To strengthen the evidence base on elasticities and other model inputs to develop in-house models on rail demand.

• National Rail Travel Survey (NRTS) – updating the NRTS data collected between 2000 and 2004/5. This is vital as it used by nearly all Departmental rail analysis functions including franchise specification; the bidding process; route and market strategies; model updates; scheme assessments; station catchment analysis; and source of ultimate rail origin and destination data.

• Train crowding and capacity – undertaking an innovative project to explore the technical and physical dimensions of train crowding, alongside passenger experience; re-evaluate the metrics used to define rail capacity (crowding); informing the crowding and capacity standards set in rail franchises; and provide useful insights for rolling stock design and innovation.

• Scheme evaluations – evaluation to inform future investment decisions and scheme planning to demonstrate effectiveness and value for money.

5.25 Major Projects

• Programme evaluation – conducting monitoring and evaluation on Crossrail baseline evaluation programme, to understand the impacts of the programme investment post-opening.

5.26 Passenger Services

• Policy on ticketing – carrying out research to support fares reform and new smart ticketing concepts and to investigate the impact of recent policy change on small businesses.

• Improve accessibility – explore ways to improve accessibility of the railways for disabled passengers’ including; the Accessibility Action Plan to define the benefits
of investment in accessible rail vehicles and to consider a future revision of existing standards; and to explore dynamic wayfinding applications for those with disabilities and as safety applications in emergencies.

5.27 Rail Strategy, Security and One Railway

- New technologies – accelerating innovation and exploiting new technologies that reduce costs, increase capacity, reduce emissions and improve the customer experience; to deliver the Capability Delivery Plan (delivered primarily through grants to the RSSB and Innovate UK).

- Understanding the demand goods and services – understanding how overseas governments, procurers, and supply chain companies see UK rail in comparison to our competitor countries. To improve exporting activity, strengthen supply chain performance and deliver better long-term outcomes for the railway and UK economy.

High Speed and Major Rail Projects

About the research programme

5.28 The research programme complements analytical activities in DfT and HS2 Ltd in ensuring that robust evidence and analysis informs key programme decisions. Research will focus on supporting major programme milestones and will support longer-term policy development work in preparation of the end state railway.

5.29 DfT-led research tends to address evidence gaps in areas where the Department has lead responsibility (e.g. strategic case analysis, programme evaluation) or the development of tools, models and guidance. HS2 Ltd is a key research partner and collaborations are also in place with other parts of DfT such as Rail group and the analytical professions.

5.30 Research areas fall under four overarching research themes: maintaining confidence in the HS2 evidence base; improving the way in which we capture and articulate the impacts of HS2; developing the tools and evidence to support delivery and maximise benefits; and evaluation.

Research requirements

- Assessing the implications of different delivery options – development of analysis and modelling tools to support development of the future regulatory framework and operating strategy (e.g. on financing, competition).

- Preparing for HS2 evaluation – publishing a core evaluation study alongside the final business case for Phase 1. The next steps are the development of further evaluation methodologies and case studies to understand the impacts of the programme on individuals and the economy.

- Tools and methods to support quantification of costs and benefits – continuing work to maintain and enhance evidence and data underpinning business case assumptions, analysis and demand forecasts.

- Wider economic, social and environmental context – exploring socio-economic and technological drivers, e.g. potential changes in commuting patterns as a
result of new high-speed rail connections, and the impact of technological innovation on rail journey patterns.

- HS2 as a catalyst for wider benefits – research looking at maximising the wider benefits of HS2, including regeneration and growth impacts, the impact of improved connectivity and the regional benefits of HS2.
- Modelling the macro-economic impacts of HS2 – developing models to understand impacts at national and regional level, e.g. the potential (temporary) macro-economic impacts of construction.
- Understanding and leveraging the potential contribution of HS2 on UK supply chains – exploring how its development could facilitate an increase in the capacity and breadth of the UK supply chain involved in procurement activities associated with HS2, within the context of the Industrial Strategy.

Strategic Roads, Economics and Statistics

About the research programme

5.31 Strategic Road, Economics and Statistics (SRES) research supports responsibilities in overseeing and sponsoring the governance and activities of Highways England as well as tackling congestion and helping shape future Road Investment Strategies (RIS) for the Strategic Road Network.

5.32 Key research themes include the economic impact and wider benefits of potential road schemes; analysing value for money road investment options; implications of new technologies for future policy and investment; and developing models and methodologies for improved measurement and analysis.

5.33 Additionally, the delivery of high quality Official and National Statistics provides the foundation of evidence-based policy and decision making. Outputs are used to develop, monitor and evaluate roads policy; inform and underpin delivery objectives; and respond to and meet the requirements of the European Union and other external users. The statistics produced are used by all modes, across DfT.

Research requirements

5.34 RIS Futures

- Road schemes – work with Highways England to develop road schemes identified for delivery in Road Period 2 and analyse investment options.
- Performance specification – examine the RIS2 performance specification to ensure it is setting Highways England challenging and deliverable standards for safety and reducing delays.

5.35 Roads Economics, Modelling and Evaluation

- Expert analytical advice and challenge – continue to provide expert advice and challenge for the most complex and leading-edge analysis supporting delivery of RIS1 and RIS2.
- Consider multiple schemes in appraisal guidance – build on existing methods for appraising individual schemes to develop a new methodology for assessing
multiple schemes in a single area together and the implementation of this in appraisal guidance.

- Congested values of time on appraisal – incorporate previous research on the impact that congested conditions have on the value drivers place on their time, into transport models and test the impacts on DfT projects.
- Areas of natural beauty – create a methodology for considering access to natural environments in road and rail interventions and apply it to the Trans-Pennine Tunnel project.
- Landscape impact valuation – implement previous work to develop an ‘ecosystem services’ approach for landscape impact valuation into specific models.
- Wider economic modelling – validate the Highways England Land-Use/Transport Interaction (LUTI) model for examining the impacts of road interventions on the wider economy, to identify areas of maximum uncertainty for further research.
- Wider economic impacts of road investment – evaluate historical projects to inform future RIS1 and RIS2 schemes.
- New network management tools – understand potential connectivity innovations which could significantly impact traffic management on the Strategic Road Network for RIS2 and RIS3. To model the impact of improved network management.
- Data visualisation – develop capability of displaying relevant information on RIS2, for public use and to report progress.
- Faster analytical tools – provide quality assurance of analysis, reducing impact of analysis production times on project delivery.
- Understand freight demand – initiate a long-term study of logistics movements to inform RIS2 and RIS2 development and improve modelling of freight.
- HGV levy – develop modelling tools to assess viability of options for cost neutral, fairer system which encourages efficiencies and meets environmental ambitions.
- Roads reform evaluation – generate evidence on how well the reforms are delivering to strengthen delivery and aid development of future RISs.

5.36 Statistics Road and Freight

- Data sources – explore alternative and novel ways of collecting, analysing and disseminating data on the road network.
- Travel behaviour – understand changes in travel behaviour to inform the future content and coverage of required statistics.

Road Safety Standards and Services

About the research programme

5.37 RSSS research supports the development and implementation of policy across a broad range of areas from road safety to efficiency of road freight.

5.38 The programme is designed to ensure that policies are evidence based and well targeted to issues that will have the biggest impact on road casualty reduction which
is important considering that the long-term decline in the number of British road casualties has levelled off in recent years. Research is focussed on evaluation of regulatory changes, infrastructure related initiatives as well as a focus on road user behaviours.

5.39 The Dangerous Goods research programme derives directly from experience with road tank vehicles which were not compliant with internationally agreed regulations. The research programme supports improvements in design, construction, testing and inspection of tankers. It supports the UK negotiating position at various international fora on standards.

5.40 Road safety, traffic flows and speeds, economic impact and vehicle emissions/greenhouse gases are all affected by one or more of the policy interventions covered by the Freight research programme. It provides evidence base for future policy decisions like reducing emissions HGVs in line with the Road to Zero strategy and work to assess lorry speed limits increases.

5.41 Demand for the strategic and local road network is at record levels and continues to grow. Investment in roads and infrastructure could lead to roadworks and the potential for disruption. New technologies offer the potential to address these issues. Research to understand new technologies like CAVs may affect the road network, the road user and the social and economic benefits.

Research requirements

5.42 Road User Licensing, Insurance and Safety (RULIS)

- Vulnerable road users— various projects to improve safety of cycling and walking, as set out in our response to the Cycling and Walking Investment Strategy Safety Review call for evidence and research to assess the benefits of new personal protective equipment for motorcyclists.

- Young novice drivers – continuing our work to review the effectiveness of technological, educational and behavioural interventions to enhance skills, knowledge and attitudes (Driver 2020).

- New driver/rider training and testing – research to assess the impact of legislative changes for learner drivers to have motorway lessons with an Approved Driving Instructor.

- Drink and drug driving – monitoring the effectiveness of the 2015 drug driving legislation; research to inform the development of a high risk of offender scheme for drug drivers; review of the Drink Drive Rehabilitation Scheme (DDRS); further development of a rehabilitation course applicable for both drink and drug driving; analysis to understand issues with obtaining blood samples from drug driving offenders.

- Driver distraction – research to better understand technological distractions, including in-vehicle technology distracting.

- Motor insurance – research to assist the negotiation on and implementation of the Motor Insurance Directive

- Safer roads –review of the Safer Roads Fund.

- Improving the evidence base around road safety – develop work streams on road collision accident investigation between 2018 and 2021; continuing work to improve the way collisions are predicted and impacts are estimated.
5.43 **Dangerous Goods**

- Petroleum road fuel tankers – continued research to support proportionate improvements to safety and efficiency of petroleum fuel tankers, including design, construction, testing and inspection.

5.44 **Freight, Operator Licensing and Roadworthiness**

- Longer semi-trailers – an ongoing operational trial of longer semi-trailers with a focus going forward on the safety, urban use and potential impacts of national rollout of longer semi-trailers; and modelling/testing work relating to an incident with a longer semi-trailer.

- Policy and Impact Assessment Validation – a three-year study to evaluate the April 2015 increase in the maximum speed limits for HGVs over 7.5 tonnes on single and dual carriageway roads in England and Wales.

- Revenue support freight grant schemes – fresh evaluation of the marginal costs of using rail or water to transport freight compared with road, and a full review of the mode shift benefits for any future Mode Shift Revenue Support, Waterborne Freight Grant or similar schemes.

5.45 **Traffic and Technology**

- Physical Infrastructure – testing the compatibility of Cooperative Intelligent Transport Systems (C-ITS) on the A2/M2 connected corridor; developing guidance to support a new statutory code for the Specification for the Reinstatement of the Highway (SROH); local authority grants for innovative to improve traffic management programmes.

- Future-proofing design guidance for local authorities – scoping exercise on Manual for Streets which will also be an opportunity to include updated guidance on designing accessible and inclusive public spaces (e.g. Shared Space); identifying the future physical infrastructure requirements of CAVs and associated regulatory considerations.

- Digital Infrastructure – discovery project to understand what data local authorities hold, what is its value, and how can it best be utilised; a study into the future ‘digital demand’ required by CAV’s and the technology and networks that will provide connectivity.

- Local authority competition to exploit road condition data – captured by connected vehicles; testing and evaluating the new UK data standard for smart parking; reviewing how data is managed on Urban Traffic Management and Control database, ensuring it meets the future mobility requirements of our cities and transport networks; and evaluating operational C-ITS projects.

- Strategy and analysis – providing inputs into the Road Investment Strategy (RIS) 2 technology vision and investment planning process.

- User Experience – scoping work to understand how technology in vehicles impacts driver’s attention; responding; undertaking research into reducing emissions through C-ITS; a review of Blue Badge eligibility criteria; and a review of the pavement parking enforcement powers available to local authorities.
Local Transport

About the research programme

5.46 Local Transport is responsible for policy around bus and taxi services, local roads, walking and cycling. It aims to support the delivery of key programmes and policies to deliver better local transport for the country. It supports the improvement of local infrastructure’s accessibility and usability for all users, the boosting of bus usage and encouraging active commuting.

5.47 Analysis and research is needed to fill important evidence gaps in the evaluation of the impact of active travelling and accessible travelling policies. The evidence is needed to implement legislation and to better understand the types of projects and programmes which are efficient and value for money.

Research requirements

5.48 Buses and Taxis

- Bus passenger experience – understand how to improve user experience, with the aim of increasing bus patronage.
- Disabled people’s needs on public transport – improve understanding in on disabled people’s experiences of taxis and private hire vehicles, specifically refusals for people with assistance dogs or using wheelchairs.
- Low-emission buses – undertake research to support the uptake, by finalising research on their real-world attributes.

5.49 Local Infrastructure

- Improving road building and maintenance operations – The United Kingdom Roads Liaison Group, part-funded and chaired by DfT, agrees on UK-based research priorities to be taken forward by the sector.
- Local infrastructure investments – we require councils to evaluate transport investment using our evaluation frameworks to make better decisions. DfT will publish an assessment of schemes in 2018.
- Evaluation – undertake work to understanding the wider economic impacts of road investments, and to thus inform future investment decisions.

5.50 Active Accessible Travel

- Active travel interventions – evaluate the implementation and success of active travel interventions funded through Cycling City Ambition Grants, and Bikeability training. To develop and provide the National Propensity to Cycle Tool, a cycle infrastructure planning tool.
- Inclusive Transport Strategy – evaluate policies and programmes implemented under the Inclusive Transport Strategy.
- Value for money of accessibility investments – investigate the economic value of accessibility improvements.
• Electric vehicles, e-bikes and e-cargo bikes – identify research gaps and priorities following a call for evidence in 2018.

Aviation

About the research programme

5.51 The Aviation research programme supports delivery of a safe, secure, sustainable aviation sector that meets the needs of the consumer.

5.52 A robust, independent evidence base is vital to ensure that action on airport capacity is pursued in a legally defensible manner. Deep understanding of local impacts – and how these can be mitigated – is also necessary to address the widely reported concerns of local residents. This evidence also underpins the UK’s position in international negotiations to reduce carbon emissions and other environmental impacts.

5.53 Research will underpin the development of Airport Capacity and the new Aviation Strategy. The main principles that will support the Government in investigating the development of a new aviation strategy are:

• **consumer focused** – putting passengers and businesses at the centre of everything we do.

• **market driven** – emphasising the role of Government as an enabler, helping to make the market work effectively.

• **evidence led** – targeting intervention on specific problems which Government can address, avoiding activity that does not respond to a clear problem.

Research requirements

5.54 **Aviation Strategy**

• The Strategy work will primarily be managed internally with external research assistance and will be focussed on the following 6 objectives:

  1. Helping the aviation industry work for its customers
     - Provision of information – explore how consumers make decisions and if they have enough information to make choices based on factors such as: price; flight time; punctuality; quality; safety; environmental.
     - Surface access – understand modes passengers use to travel to and from the airport. To investigate the consumer appetite integrated tickets and whether there are any market or institutional barriers preventing its adoption.
     - Delays and cancellations – develop ways to make consumers more aware of their rights and to develop the right framework for European Union exit.
     - Protecting consumers – understand current protection schemes and to research alternative methods.
     - Border experience – improve passenger experiences by understanding the issues; and work with the Home Office short and long term to explore options for smart solutions.
Disabilities or reduced mobility – minimise the barriers to people choosing to travel by air.

Disruptive passengers – help the aviation industry to tackle the disruptive passenger behaviour.

Service disruption – improving available evidence on the costs and impacts of disruption (e.g. reduced or cancelled plane services) to passengers, businesses and the wider economy, and the potential for alternative routes and impact mitigation.

2. Ensure a safe and secure way to travel

Safety – ensure regulatory framework keeps at pace with emerging technology and new innovative business models including pilot fatigue; space weather; improved standards for off shore helicopter ditching; and wake turbulence.

Security – increase quality and implementation of international aviation security standards.

3. Build a global and connected Britain

Global access – improve access to various destinations at more competitive prices; to consider the strategic trade-offs when negotiating future air service agreements.

UK trade and exports – continued development of the air freight sector to support UK trade and exports.

4. Encourage competitive markets

Encourage competitive markets – continue this success and ensuring our markets work effectively and our industries are competitive.

Slot regulations – understand whether different slot allocation methods would deliver (i) efficiency; and (ii) against Government objectives (e.g. domestic connectivity, competition, international connectivity, maintaining the UK’s hub status).

UK connectivity – consider whether the nations and regions of the UK have the connectivity they require. This will include considering the benefits that arise from additional connections; into Heathrow expansion, between regions and direct connectivity to key overseas markets. To understand whether market will deliver these connections without Government intervention; and to consider what (if any) policies Government should consider.

Regulations and taxation – assess the impact of charges (e.g. Air Passenger Duty) and how charges can better meet other Government policy objectives.

Smaller airfields – build and maintain strategic vision for which smaller airfields support the benefits of General Aviation to the wider economy.

5. Support growth while tackling environmental impacts

Supporting growth – address resilience in the airport system to development of the Supporting Growth objective within the Aviation Strategy by understanding and manage local environmental impacts (e.g. noise); and to develop right regulations.

Emissions reduction – develop a framework for UK aviation carbon emissions to 2050 to action climate change, including UK’s domestic and international obligations.
– International standards – research to inform the UK position on international technical standards for noise and emissions, and to contribute to setting economically and environmentally reasonable international standards.

– Non-CO\textsubscript{2} impacts – understand the uncertainty around non-CO\textsubscript{2} impacts of aviation.


– Carbon abatement – develop cost and abatement data to produce marginal abatement cost curves; and assess the assumptions and data sources that feed into the aviation demand model.

– Noise impacts – review health impacts and attitudes towards aircraft noise.

– Impacts of airline operation and new aircraft concepts – understand the noise impacts of operational choices made by airlines (such as climb and descent gradient and using reverse thrust during night landings) and different airspace design options; understand the noise characteristics during cruise of new aircraft concepts such as supersonic transports and open rotor engines.

– Noise levels – develop evidence to better understand noise levels, how noise should be measured and communicated, and the effectiveness of mitigation measures, including operating restrictions.

6. Develop innovation, technology and skills

– Innovation – ensure policy and regulatory frameworks are designed to encourage and support the emergence of new technologies and innovative business models.

– Agile regulatory framework – encourage development and uptake of new technologies.

– As part of wider work to be commissioned from the Civil Aviation Authority on noise policy – interest in the potential noise impact of future technologies. This would include a literature review of electric aircraft, drones, personal air mobility vehicles, sometimes referred to as ‘flying cars’, supersonic jets, rockets, and propose an interim approach to manage their impact at early days of implementation.


– Benefits from change innovation, technologies or solutions – understand impacts, challenges and opportunities of increased automation and electrification in aviation.

– Understanding consumers – understand behaviour and public acceptance of new technologies. Research would inform the role that Government can play (e.g. in providing information) that encourages uptake of technologies which bring wider benefits, such as societal.

– Drone safety – follow-up to current research looking at the impacts of drone incidents, e.g. on aircraft.

5.55 Airport Capacity

– Environmental factors – explore environmental aspects of land take and habitat damage, noise, carbon and air quality impacts.
• Infrastructure – investigate design, operation and commercial viability and fundability of new infrastructure, and understand surface access and connectivity provision.

• Capacity – understand measurement of airport capacity and the impact on passengers to capacity shortage and additional provision.

• Economic benefits – understand consumer impacts and establish wider economic benefits, including increased foreign investment and effects on the future UK economic geography.

• Trade impacts – understand freight operator impacts and wider trade implications.

• Aviation models – ongoing need to ensure these models are up to date and fit for purpose, and this may require additional research and external expertise.

5.56 Environmental Impacts

• International standards – research to inform the UK position on international technical standards for noise and emissions, and to contribute to setting economically and environmentally reasonable international standards.

• Non-CO₂ impacts – understand the uncertainty around non-CO₂ impacts of aviation.

• Market based measures – analysis to support international negotiations, including European Union negotiations on the future of the Aviation European Union Emissions Trading System.

• Carbon abatement – understand what action can be taken to reduce carbon emissions from aviation, and at what cost; and assess the assumptions and data sources that feed into the aviation demand model.

5.57 Cross-cutting Research

• Market intelligence – accurately timed data and market intelligence to underpin policy development, e.g. to support the Aviation Strategy, Brexit negotiations, compensation, alternative dispute resolution and Airline Travel Operators Licenses (ATOL).

• Aviation model – development of evidence base underpinning the aviation model, and updating its functionality.

Maritime

About the research programme

5.58 A variety of Government Departments and Agencies, including Defra, the Marine Management Organisation and the Maritime and Coastguard Agency undertake research that is relevant to the maritime sector, alongside research by academic institutions and industry. DfT’s maritime research activity is therefore concentrated on specific areas of research not covered elsewhere.

5.59 The maritime industry is internationally driven with most regulation deriving from the International Maritime Organization (IMO) and the International Labour Organization (ILO). This research strategy also includes research supporting the UK’s negotiating stance in these organisations.
Research requirements

- Strategic vision – develop the “Maritime 2050” programme to maintain and strengthen the UK success. To build the evidence base for the six main themes; Trade; Technology and Innovation; Environment; Infrastructure; Skills; and Security and resilience.

- Ports modelling – in-house work to develop modelling capability of UK port activity and enhance forecasting methodology; research into the demand for short sea passenger ferries on both international and domestic routes.

- Reducing emissions and improving air quality – reducing greenhouse gases and pollutant emissions from shipping; investigating solutions for ships; the barriers to their implementation; the impacts of market-based measures, alternative technologies and the role for new policies and regulations.

- Waterlogged munitions – ongoing monitoring of SS Richard Montgomery; research on the water conditions surrounding the wreck and the condition of the munitions.

- Maritime resilience – improving evidence on the costs and impacts of disruption, and the potential for alternative routes, and means of travel to mitigate these impacts at both local and global level.

- Regulation and European Union Exit – assess the impact of new policy interventions and opportunities of European Union exit; continue work on port simulation modelling to estimate effects on specific ports.

- Maritime regulation – assessing impacts of new policy interventions, including valuing the social costs of a maritime incident and an economic assessment of the Ballast Water Management Convention.

- Statistical analysis – to develop Official Statistics outputs and explore new sources (e.g. AIS, HMRC Trade Statistics) to improve validation.

Communications

Rationale for research programme

5.60 DfT Communications research programme helps to support Departmental objectives of raising awareness and understanding of policies and programmes, changing behaviour to benefit individuals or society, and informing and reassuring the public during a crisis and promotes the UK transport sector internationally.

Research requirements

- THINK! campaign tracking – undertake ongoing pre and post campaign tracking to evaluate the impact of communication to assess awareness, attitudinal shift and claimed behaviour. Used to reduce the number of people killed or seriously injured on roads.

- EU exit campaign tracking - undertake pre and post campaign tracking to measure campaign effectiveness. The research will track campaign performance against KPIs around audiences’ awareness, understanding and action in regards to what they need to do when the UK leaves the EU.
• Creative testing – understand during a campaign if the content produced will resonate with the audience and influence their behaviour.

• Qualitative testing – assess stakeholder opinions of and public reaction to messaging and narratives; to understand how messages and activities are being received, using focus groups and surveys to improve the quality of audience engagement to support prioritisation and design.

• Annual stakeholder survey – understand stakeholder’s views and inform our approach to stakeholder engagement in the future.

• Social media listening – analyse online activity to measure impact of communications; to support digital strategy development for each campaign; test the impact of our communications; and track online activity during periods of crisis in, ‘real time’, to enabling us to respond flexibly and urgently to changing priorities.

• Surveys – measure campaign effectiveness of the Year of Engineering 2018; to measure changes in awareness and attitudes towards engineering among 11-16-year olds, as well as their parents and teachers. To develop an evaluation tool to investigate the impact of delivering direct experiences to a minimum of one million young people.