National Infrastructure Commission

FUTURE OF FREIGHT
MANAGING CONGESTION
Evidence Report
This report by WSP was commissioned as part of the evidence base for the National Infrastructure Commission’s study on the future of freight.

As with all supporting evidence commissioned by the National Infrastructure Commission, the views expressed and recommendations set out in this report are the authors’ own and do not necessarily reflect the position of the Commission.

NATIONAL INFRASTRUCTURE COMMISSION

April 2019
MANAGING CONGESTION
Evidence Report

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. 70048031-001
OUR REF. NO. WSP

DATE: DECEMBER 2018
MANAGING CONGESTION

Evidence Report

WSP
WSP House
70 Chancery Lane
London
WC2A 1AF
Phone: +44 20 7314 5000
Fax: +44 20 7314 5111
WSP.com
## QUALITY CONTROL

<table>
<thead>
<tr>
<th>Issue/revision</th>
<th>First issue</th>
<th>Revision 1</th>
<th>Revision 2</th>
<th>Revision 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remarks</td>
<td>Internal QC</td>
<td>Internal QC</td>
<td>Internal QC</td>
<td>Final version to client</td>
</tr>
<tr>
<td>Date</td>
<td>10/10/2018</td>
<td>23/10/2018</td>
<td>30/10</td>
<td>10/12/2018</td>
</tr>
<tr>
<td>Prepared by</td>
<td>Morag White</td>
<td>Morag White</td>
<td>Morag White</td>
<td>Morag White</td>
</tr>
<tr>
<td>Signature</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Checked by</td>
<td>Ian Baker</td>
<td>Ian Baker</td>
<td>Ian Baker</td>
<td></td>
</tr>
<tr>
<td>Signature</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# CONTENTS

1. INTRODUCTION .................................................. 1

2. POLICY REVIEW .................................................. 2

   2.2. NATIONAL POLICY ............................................. 2
   2.3. HIGHWAYS ENGLAND ......................................... 4
   2.4. TRANSPORT SCOTLAND ....................................... 6
   2.5. WELSH GOVERNMENT ....................................... 7
   2.6. SUB-NATIONAL POLICY ...................................... 8
   2.7. CITY REGIONS (AND PASSENGER TRANSPORT EXECUTIVES) .................................................. 11
   2.8. LOCAL POLICY ................................................. 17
   2.9. RAIL FREIGHT POLICY AND STRATEGY .................... 19
   2.10. PORT POLICY ................................................ 26
   2.11. CONCLUSIONS ON CONGESTION POLICY ................. ERROR! BOOKMARK NOT DEFINED.

3. POTENTIAL FOR MODAL SHIFT TO REDUCE CONGESTION ............... 28

   3.2. MODAL SPLIT ................................................ 28
   3.3. WATERWAYS .................................................. 29
   3.4. RAIL FREIGHT ................................................. 30
   3.5. RAIL FREIGHT AND ROAD CONGESTION .................... 30
   3.6. MAXIMUM MODAL SHIFT ..................................... ERROR! BOOKMARK NOT DEFINED.
   3.7. CONCLUSIONS ON MODAL SHIFT ............................. ERROR! BOOKMARK NOT DEFINED.

4. SIZE OF THE OPPORTUNITY TO REDUCE ROAD VEHICLE UNDERUTILISATION ............... 40

5. URBAN CONSOLIDATION CENTRES .................................. 43

   5.1. BACKGROUND AND DEFINITION ............................. 43
   5.2. URBAN CONSOLIDATION CENTRES ............................ 43
APPENDIX A BIBLIOGRAPHY
1. INTRODUCTION

1.1.1. In order to keep the main ‘Managing Congestion’ report more succinct, this document provides more detailed evidence on several aspects of managing freight congestion. It tackles a number questions which supports the main report which includes:

- Policy review
- Modal Shift
- Analysis of consolidation centres
- Analysis of longer/heavier trailers
- Role of technology
- The overarching role of data
- Digital railway

1.1.2. It should be read in association with the report Managing Freight Congestion and associated appendices, which includes a glossary of terms. A summary of the output of this research can be found in the main report.
2. POLICY REVIEW

2.1.1. This Chapter describes policies and strategies for managing congestion at national, regional, and local levels, with a particular emphasis on freight related policies, and researches evidence of their impact on road congestion and rail and port capacity. The study has reviewed two example local authorities, one rural and one urban, to illustrate the types of policies and strategies employed to address congestion in different circumstances. The interventions identified within policy have been used to create a master list of measures (the toolkit) and these are assessed, together with technology and operational practices, for effectiveness as part of this study and are included in the main report 'Managing Congestion' that should be read together with this evidence report.

2.2. NATIONAL POLICY

DEPARTMENT FOR TRANSPORT (DfT)

2.2.1. The DfT is the Government body responsible for planning and investing in the UK’s transport infrastructure, and has the overall mission to “create a safe, secure, efficient and reliable transport system that works for the people who depend on it”. (DfT, 2018) The DfT’s main responsibilities are:

- **Roads** - Investing in, maintaining and operating around 4,300 miles of the motorway and trunk road network in England through Highways England. They provide policy, guidance, and funding to English local authorities to help them run and maintain their road networks and develop new major transport schemes.
- **Rail** – Develop strategy for the rail industry, funding investment in infrastructure through Network Rail, awarding and managing rail franchises, and regulating rail fares.
- **Buses** - Setting the policy framework to determine how bus services are managed.
- **Shipping** - Overall national maritime strategy and guidance; and keeping shipping safe through the Maritime and Coastguard Agency.
- **Aviation** - setting national aviation policy, working with airlines, airports, the Civil Aviation Authority and NATS (the UK’s air traffic service).” (National Audit Office, 2015)

2.2.2. The UK transport system consists of local and regional networks, connected by national corridors, linked to international gateways and these diverse parts of the network are managed in different ways. In the UK, transport functions and responsibilities are substantially devolved, to make sure “decisions are made at the right level” to provide ‘better journeys for the travelling public and meeting users’ needs’ (DfT, 2017). Transport powers and funding devolution settlements vary nationally by Government (Wales, Scotland and Northern Ireland), regionally through the recent creation of Sub-National Transport Bodies (STBs) and at a local level through local/Unitary authorities and Local Enterprise Partnerships (LEPs).

DFT NATIONAL STRATEGY: GENERAL ROAD CONGESTION

2.2.3. In 2013, the Government announced a series of “Road Reform” measures, which were designed to improve the management and operations of the SRN (DfT, 2013). The Road Investment Strategy (RIS) was established as one of the main aspects of the “Roads Reform” and committed the Government to £11.4 billion of funding to road enhancement works. One of the long-term aspirations was to encourage economic growth through working to minimise delays on the network, stating that “to ensure the SRN positively impacts growth, we must tackle congestion and delay on the network, particularly on the main freight arteries that connect cities and international gateways” (DfT, 2018). The types of road enhancement projects included:
- Smart motorways – using technology to convert the hard shoulder and manage change in hazards to increase capacity if required such as variable messaging to regulate speed and close lanes and regularly spaced emergency refuges.
- Expressways – Technology to manage traffic and relay information to drivers and provide grade-separated junctions
- Junction improvements – Mainly aimed at reducing congestion
- Technology upgrades – such as signals on slip roads, Motorway Incident Detection and Automatic Signalling (MIDAS), Variable Message Signs, CCTV cameras and gantries

2.2.4. In 2013 the DfT also introduced the first “Monitoring and Evaluation” programme to monitor the effectiveness of activities and to provide a stronger evidence base for future decisions (DfT, 2013). In terms of congestion interventions, average delay (time lost per vehicle per mile) is the Key Performance Indicator (KPI) selected to provide an indication of the negative effects on the economy, however no reduction target was set due to the multi-faceted nature of delay influences (DfT, 2014).

2.2.5. The DfT’s road congestion statistics in turn monitor the effects of congestion using two sets of statistics. These statistics are discussed in Chapter 2 of the Managing Congestion report.

2.2.6. The DfT outlined its ongoing commitment to creating “a more reliable, less congested and better-connected transport network that works for the users who rely on it” in the objectives of the 2017 Transport Investment Strategy and reports that Roads Reform projects are making good progress “in tackling some of the most notorious bottlenecks on the network, like the A14 and A303 and adding 1,300 miles of new lane capacity to cut congestion and smooth journeys on the most heavily trafficked sections” (DfT, 2017).

2.2.7. Looking forward, the “Road Investment Strategy Post 2020: Planning Ahead” describes the aims and processes for the second Road Investment Strategy (DfT, 2016). In October 2018, DfT announced the draft RIS2, setting a 2050 vision for the SRN, outlining £25bn to deliver these ambitions. To be finalised in late 2019 it outlines an investment programme that aims to continue to deliver national priorities and address long standing issues on the SRN, in addition to using road investment to rebalance the economy.

DFT NATIONAL STRATEGY: FREIGHT RELATED CONGESTION

2.2.8. Increasing road congestion is estimated to cost the freight industry £3.7billion annually and without sustained investment and proactive policy, the problem is expected to become more serious for many of the UK’s important routes (DfT, 2015). Although congestion in general is a recurring theme in national Government policies due to its increasing prevalence, interventions targeting congestion caused by freight specifically are less commonplace. Three specific in

2.2.9. Interventions DfT is investigating are:
- HGV platooning
- Longer semi-trailers (LST); and
- HGV single-carriageway roads speed limit increase.

2.2.10. These strategies are discussed in detail in Chapter 8 within the ‘Managing Congestion’ report and in Chapter 5 of this report.
2.3. **HIGHWAYS ENGLAND**

2.3.1. Highways England is responsible for motorways and major (trunk) roads in England – the Strategic Road Network (SRN) (Highways England, 2018). The SRN totals around 4,300 miles; while this represents only two per cent of all roads in England by length, these roads carry a third of all traffic by mileage and two thirds of all freight traffic.

Highways England’s stated priorities (Highways England, 2015) are to maintain an SRN which:

- is free flowing – where routine delays are infrequent, and journeys are reliable
- is safe and serviceable – where no-one should be harmed when travelling or working
- is accessible and integrated – so people are free to choose their mode of transport and can move safely across and alongside our roads
- supports economic growth with a modern and reliable road network that reduces delays, creates jobs, helps business and opens up new areas for development
- ensures Highways England activities result in a long term and sustainable benefit to the environment

2.3.2. Highways England emphasises the importance of freight traffic to the British economy, and the SRN to freight traffic; however, it currently specifies few tangible responsibilities towards the freight industry. Freight does not appear in the Operational Metrics Manual (Highways England, 2018), whilst the list of Key Performance Indicators in the Highways England Delivery Plan (Highways England, 2015) only states that: “a suite of Performance Indicators (is required) to help demonstrate and evaluate what activities have been taken to support the economy. These should, at a minimum include metrics on: supporting the business, and freight and logistics sectors”.

2.3.3. In Spring 2018 Highways England commissioned multi-year support to improve their understanding of freight businesses and the required data capture that is able to better inform freight related issues. This will allow Highways England “to collate benchmark data and develop initiatives for further improvements, lessening the impact of freight related incidents” (Highways England, 2018). It is further understood that an element of this support will focus on freight incident prevention and tailoring incident response where freight vehicles are involved.

**HIGHWAYS ENGLAND NATIONAL STRATEGY FREIGHT TRAFFIC**

2.3.4. Highways England Strategic Business Plan emphasises the importance of collaboration and consultation without committing to specific actions.

- “Work with the freight and logistics sectors and other frequent and extensive users of the network to better understand their needs and help them achieve their business objectives.
- Consult with representatives of the freight and road haulage sectors to assist future network planning”.

2.3.5. Highways England Strategic Economic Growth Plan discusses in more detail specific potential problem areas and solutions for the freight industry (Highways England, 2017):

Supporting business productivity and competitiveness, and enabling the performance of SRN reliant sectors:

- “We are also investing in innovation research and development to make journeys more reliable and efficient, and to improve communications with our customers to enable them to plan their journeys more effectively. These include working with the DfT and the freight industry on trials for freight platooning (lorry convoys) that should reduce journey times and could bring other savings for the logistics sector” – enabled/enhanced by Highways England investment in connected vehicle technology.
2.3.6. A particular example of where Highways England has identified freight congestion issues is in the provision of efficient routes to global markets through international gateways: e.g. improving access to Liverpool port (Highways England, 2017):

- Investment in the Port of Liverpool will increase the port’s attractiveness as an international gateway, especially for freight movements, as it will allow it to accommodate 95% of the world’s fleet of global container vessel types. This will lead to increased use of the port and thereby increase demand on the road network to access the port. It may also lead to the release of capacity elsewhere on the SRN as traffic joins or leaves the network closer to its origin or destination.
- The A5036 is the main road linking the port to the motorway network. Through RIS1 a scheme is being implemented to improve road safety and add capacity for additional freight movements to facilitate growth at the port (DIT, 2015). This road-based solution is part of a much wider set of proposals to deliver transport measures that will improve port access and support the port (and local economy) to grow.

HIGHWAYS ENGLAND: GENERAL ROAD CONGESTION

2.3.7. By 2040, Highways England forecasts that congestion will cost £10 billion a year in lost time unless action is taken (Highways England, 2015) and therefore the Highways England Delivery Plan develops the anti-congestion objectives and delivery methods laid out in the Strategic Business Plan. These are summarised below:

- “Supporting Economic Growth”: To relieve congestion and minimise delay, Highways England intends to deliver 112 individual schemes generating £4 in long term economic benefit for every £1 invested. Between 2015/16 and 2019/20 (Road Period or RP1), Highways England intends to start work on 15 smart motorways projects (the primary intervention for addressing capacity constraints on the SRN) as identified in Spending Round 2013 (SR13), with eight of these to be completed by the end of RP1. Highways England also intends to complete all junction improvement, road-widening and bypass projects identified in Spending Review 2010 (SR10), and complete four of the ten projects identified in SR13, while beginning work on the remainder. Additionally, Highways England intends to use public funding resources such as the Innovation Fund and the Growth and Housing Fund to boost economic growth. (Highways England, 2015)
- “A More Free-Flowing Network”: Highways England is focused on meeting a lane availability target which does not fall below 97% in any one rolling year, and clear at least 85% of all motorway incidents within one hour, in line with Government requirements. To this end their Operational Strategy sets out how they will manage demand and increase availability of the network. Over RP1, they will invest over £11bn which will contribute to a more free-flowing network (Highways England, 2015).

2.3.8. Congestion relief is central to Highways England investment plans with the implementation of motorways using the expressway standard (e.g. upgraded dual carriageway routes) and smart motorways. With freight traffic reliance on the SRN, this will have a positive impact on the impact of congestion of the freight industry.

HIGHWAYS ENGLAND: FREIGHT RELATED CONGESTION

2.3.9. The Government has already announced, and is delivering, a substantial level of investment in the SRN through Highways England. Schemes will improve capacity on critical freight routes (reducing congestion), such as the £1.5 billion A14 scheme (serving Felixstowe in particular) and improvements to the M6 in Cheshire.
2.3.10. Key economic gateways are a particular focus for Highways England: ‘Ports are highly reliant on effective road connections. They support manufacturing sectors and are key cross-modal points for the logistics and distribution sectors. Ports handle 95% of UK trade by volume and 75% by value, although the concentrations of value and volume vary; proportionally the value to volume of cargo is greater in southern ports such as Dover, Felixstowe and Southampton. Delays increase freight costs, which have an impact on the competitive advantage of parts of the UK. The pressures that port traffic puts on the SRN vary greatly between the different locations. Ports that are in the heart of a city such as Liverpool, Hull and Southampton encounter local congestion, while traffic from ports that are not close to large centres of population such as Immingham and Felixstowe can sometimes suffer delays further afield’ (Highways England, 2017).

2.3.11. The impact of port congestion can have a knock-on effect to the SRN. Operation Stack is the procedure used to park lorries on the M20 in Kent when cross-Channel services via Dover are disrupted. Implemented 74 times in past 20 years, due to increasing traffic (car and freight), this has the potential to cause increasingly severe disruption to Kent’s traffic network. A solution is being implemented to provide lorry holding areas and lorry parking areas and minimise the need to implement Operation Stack to a) better cope with cross-Channel disruption, b) lessen incentives for lorries to park illegally/inappropriately.

HIGHWAYS ENGLAND REGIONAL STRATEGIES

2.3.12. Freight traffic and certainly freight congestion are largely unmentioned by Highways England’s regional route strategies beyond generalities: “by 2040, we want to have transformed the busiest sections of the SRN to deliver the safer, more stress-free journeys that our customers desire, and the enhanced reliability and predictability that is so important to business users and freight. We see the SRN working more harmoniously with its surroundings, impacting less on local communities and the environment” (Highways England, 2015). Sub Regional Transport bodies (eg Midlands Connect) arguably provide a better source for freight strategy at a regional level.

2.4. TRANSPORT SCOTLAND

2.4.1. Scotland has the greatest range of devolved transport powers in the UK, some of which have been long separated from England and Wales and others occurring more recently. Significant transport powers for example, were devolved in 1997 by the Labour Government, which stated that the Scottish Parliament and Executive would be responsible for a “range of road, rail, air, sea transport and inland waterways matters” (Gay, 1997). The primary role for the public sector in Scotland is outlined in the National Transport Strategy as “to influence and encourage the industry to develop services that support [Scotland’s] ambitions, share good practice and facilitate legitimate collaboration” (Transport Scotland, 2016). Transport Scotland in turn was established as an executive agency in 2005.

2.4.2. With regards to devolved road powers, matters relating to road traffic and road transport are reserved to Westminster only where there is a need to ensure consistency across the UK. For freight vehicles this includes:

- How operators are licenced
- Regulation of working hours
- Conditions under which international road transport services for goods may be undertaken (Butcher, 2017).

2.4.3. The first of the Scottish National Transport Strategy key strategic outcomes is to achieve “improved journeys times and connections, to tackle congestion and lack of integration and connections in transport”. In 2016 it was reported that congestion had been stagnating, with only 11.7% of journeys made being delayed by traffic.
(Scottish Government, 2017). In contrast to other regional bodies, competition rather than congestion is outlined as the encouragement for mode shift from road to rail and water methods to move goods (Transport Scotland, 2016).

2.4.4. The first Scottish freight action plan was published in 2006 to complement the Transport Strategy at the time. The 2016 Scottish Transport Strategy outlines a refreshed freight policy that is in line with the goals of increasing competitiveness and tackling inequality that are outlined in Scotland’s Economic Strategy (Scottish Government, 2015). The Scottish Government aims to make the movement of freight around Scotland efficient and sustainable and states that “by adopting a mode neutral approach” the freight sector can continue to operate in a competitive commercial market (Transport Scotland, 2016). The strategy does not explicitly state interventions to reduce freight congestion, however some measures to achieve the key strategic outcomes are relevant to road freight congestion. Measures put in place to increase the resilience of road freight to extreme winter weather, for example can help reduce freight congestion induced by network conditions. The development of Road Haulier Winter Advice guidance, documenting vulnerable locations on the network for gritting and winter maintenance and setting up the Traffic Scotland Freight Hotline for reporting traction problems all aid information flows in real-time to hauliers and drivers to enable them to prepare and avoid hazardous areas in extreme weather.

2.4.5. The Scottish Transport Strategy also outlines that the Scottish Government is responsible for the promotion of freight modal shift in Scotland through grants encouraging businesses to take the lead in developing flexible and innovative freight operations:

- Freight Facilities Grant (FFG): £73m in Freight Facilities Grants have been made in Scotland and have removed over 172 million lorry miles from Scotland’s roads to date (Transport Scotland, 2016):
  - Assistance for coastal and short sea shipping projects: Mode Shift Revenue Support (MSRS)
  - Assistance for rail and inland waterway projects: Waterborne Freight Grant (WFG) e.g. the DfT and the Scottish Government in 2014 combined to provide a WFG to support the movement of sawn timber from Corpach (Scotland) to Tilbury (England). In the first three years of operation the project removed over 6,300 lorry journeys from the A82 south of Fort William and the M74 (Transport Scotland, 2016).

2.4.6. In addition to the measures outlined in the Scottish Transport Strategy, the 2005 ‘Improving the Efficiency of the Road Freight Sector’ report recommends more specific measures to improve the efficiency of the freight sector in Scotland. The recommendations were formulated after an in-depth analysis of the Scottish trunk road network, stakeholder consultation and literature review (IBI Group, 2005). Some of these suggestions include the use of Freight Quality Partnerships (FQP), Freight information service, agreed route network (ARN) loading and unload zones.

2.4.7. The Scottish Government has also highlighted the importance of planning deliveries to improve vehicle utilisation, reduce lost time and better manage drivers’ hours, all of which can help to reduce freight congestion. The publication of the guide to ‘Planning and Managing Effective Customer Deliveries’ provides information on how deliveries can be planned and executed more efficiently (Scottish Government, 2010).

2.4.8. With regards to rail devolution, provision and regulation of railway services is reserved to Westminster, except those services that both begin and end in Scotland, which are devolved.

2.5. **WELSH GOVERNMENT**

2.5.1. Wales also has a range of devolved transport powers in the UK, with the most recent round of devolution occurring through the 2017 Wales Act. Unlike Scotland however, it is the UK Government who is responsible
for developing and applying transport policies. Transports for Wales, which was established in 2015, instead acts in a professional advisory and consultancy capacity with no ability to initiate or engage with policy work.

2.5.2. ‘Outcome 9’ of the 17 long term objectives outlined in the 2008 Wales Transport Strategy aims to improve “the efficient, reliable and sustainable movement of freight” in Wales and highlights the importance of reliable journey times to Welsh businesses. The strategy states that the outcome will be measured using two indicators: the number of goods vehicles kilometres saved through the transfer of operations from road to rail in Wales and the travel time variance on key sections of the road network serving freight. At the point of writing, HGVs were not cited to be a major contributor to congestion due to a decline in heavy industry since 1990. However, like elsewhere in the UK, a sharp increase in light van trips was documented.

2.5.3. The last Wales Freight Strategy was published in 2008 as a companion to the Wales Transport (Wales Assembly Government, 2008). The strategy highlights that a key weakness of road freight in Wales is the significant traffic congestion in key locations on the strategic and local road networks. A number of the ‘steps towards delivery’ relate to improving the efficiency of freight on the network in an attempt to reduce congestion and include ITS, Variable Messaging Signalling, Strategic Lorry Routes and freight consolidation.

2.5.4. The aims and outcomes of the Wales Transport Strategy are being delivered by the National Transport Plan 2010 (which was updated in 2015) and monitored using the statistical indicators (Welsh Assembly Government, 2010). For ‘Outcome 9’ however, the last two available monitoring reports from 2011 and 2012 have stated that there is no “data available to monitor this indicator” (Statistics for Wales, 2012). Therefore, it is unknown if any of the implemented measures have been effective in reducing freight congestion.

2.5.5. The Wales Freight “Task and Finish” group was convened in 2013 to advise the Minster for Economy, Science and Transport on key freight issues and to identify appropriate interventions needed to support the development of business centres in Wales. The report was published in 2014 (Wales Freight Task and Finish Group, 2014) acknowledges that much has changed since the Wales Freight and Transport strategies were published in 2008 and although does not mention congestion specifically, contains recommendations which could potentially reduce the impact of freight on congestion:

- Integrate inter-modal interchanges in the planning system
- Review evidence for more designated truck stops
- Explore further to role of public grants in supporting modal shift: the administration for Welsh Freight Facilities Grants is done by the Department for Transport

2.6. SUB-NATIONAL POLICY

2.6.1. Central Government decision making has more recently been opened to Sub-National Transport Bodies (SNTB) to ensure that “infrastructure investment takes account of regional transport strategies and contributes towards rebalancing the country’s economy” (DfT, 2017). Transport for the North (TfN) only became a statutory body in early 2018 and three new sub-national transport bodies, Midlands Connect, England’s Economic Heartland and Transport for the South East are being developed at present, with support from the DfT (French, 2018). The rationale behind the establishment of these new transport bodies is to bridge the gap between national and local projects and therefore SNTBs tend to have more specific congestion intervention policies.

2.6.2. England’s Economic Heartland and Transport for the South East are relatively newly formed and are currently developing policies to address freight congestion in their regions, they have therefore been omitted from this review.
2.6.3. TfN, which brings together 19 local transport authorities to develop and deliver strategic transport infrastructure across the North of England. In March 2015, The Northern Powerhouse: A Report on the Northern Transport Strategy outlined the region’s ambitions to rebalance the UK’s economy, identifying logistics as one of the three enabling capabilities that has a key role in supporting the North’s economic vision (Transport for the North, 2015). The Northern Freight and Logistics Report in turn suggests that maximising the efficiency of goods movements can help deliver this step change (Transport for the North, 2016). Congestion however, has been highlighted as a significant barrier to capacity and the efficiency of freight movements and the report features some congestion specific recommendations including "complementary land-side access improvements to ports to reduce local road congestion, most importantly along the route of the M62/M60 north of Manchester and into Hull and Liverpool".

2.6.4. The report also outlines the opportunities for:

- **Capacity development**
  - Maximise use of the existing rail network, and future plans for a modern / high-speed network
  - Improvements to passenger rail that release capacity for freight services e.g. HS2/Northern Powerhouse Rail (NPR) (originally termed HS3 by some)
  - Port development potential (particularly the development of deep-sea container services into Northern Ports e.g. Liverpool2 and Teesport’s Northern Gateway Terminal) will relieve pressure on links to the South
  - Re-opening of key rail connections
  - Relatively untapped potential of inland waterways
  - Additional airport freight capacity

- **Enhanced efficiency**
  - Use of innovation and technology offers the opportunity for the North of England to remain competitive in the freight and logistics markets
  - Working with the freight industry to raise standards and improve economic efficiency
  - Freight trains are being lengthened to reduce unit costs
  - Improved rail signalling technologies
  - Combining rail freight with local electric vehicle distribution in the major urban areas
  - Longer road trailers and intermodal units are being introduced on an experimental basis which can cut distribution costs
  - Releasing existing urban warehousing space for residential development through the development of more competitive rail and water sites on the edge of conurbations
  - Rail can reduce greenhouse emissions as well as providing a faster, more cost-effective freight service.

2.6.5. Congestion is also highlighted in the 2018 Enhanced Freight and Logistics Analysis Report as a challenge facing the road freight sector in the north of England due to forecasted significant increases in freight movements (Transport for the North, 2018). The report highlights that new infrastructure provision is inevitable however that ‘it may be possible to temper this against increased initiatives though the implementation of new policies designed to produce modal shift or cause reduction in the number of vehicles on the region’s congested road network or the development and use of new technology’ (Transport for the North, 2018). Interventions identified to help TfN maximise their existing transport assets include:
Smart motorways: technology used to monitor real time congestion levels/incidents, display journey information, change speed limits to smooth traffic flow and enable the use hard shoulders to reduce. The first UK smart motorway on the M42 was introduced in 2006 and reported that journey reliability improved by 22% (Highways England, 2018).

Autonomous trucks: automated truck technologies aiming to reduce accidents, increase efficiency and potentially reduce congestion are under development. Research primarily focused at present on motorway driving and report highlights the role TfN could play in facilitating testing.

Truck platooning: vehicle-to-vehicle communication technologies can enable trucks to travel close together, allowing for better aerodynamics and increasing operational efficiencies. The report acknowledges that the technology is not as advanced in the UK compared to other places however highlights the potential of the technology in the TfN region in the future.

Vehicle efficiencies: size, configuration and weight trailer configuration considerations can increase trailer capacities. Boots, for example, introduced double decked wedge trailers in 2016 which resulted in them reducing their trunking fleet from 340 to 280 trailers, in turn cutting 216,000 operational road miles annually (Motor Transport, 2016).

2.6.6. New policy ideas designed to produce modal shift include:

- “Establishing a franchised rail freight operator for routes that are considered not commercially viable at the present time and to encourage movement of freight by rail;
- Funding of more rail freight services through the use of grants such as MSRS and Waterborne Freight Grant (WFG) schemes;
- A drive to improve the perception of alternative modes of transport for freight led by TfN and the encouragement of collaboration between transport operators and shippers;
- Increased use of alternative modes of transport for freight in public sector procurement; and
- More road network capacity made available for freight through initiatives to reduce the number of private cars on the region’s congested road network.” (Transport for the North, 2018)

MIDLANDS CONNECT

2.6.7. Established in 2015, Midlands Connect is a partnership consisting of 22 local authorities, nine Local Enterprise Partnerships, East Midlands and Birmingham Airports, and chambers of commerce from the Welsh Border to Lincolnshire (Midlands Connect, 2018).

2.6.8. The 2018 ‘Our Routes to Growth’ report outlines recommendations for building a congestion resilient Midlands Motorway Hub (Midlands Connect, 2018). Although not specifically targeting freight congestion several of the recommendations could address the growing impact of freight traffic on travel costs and delays by 2020 such as:

- Digital information and signage: Improving digital information and signage to encourage use of M6 Toll
- Widening: particularly the M42 from Junction 3A to Junction 7.
- Alternative route creation: creating an A46 Expressway as an alternative to journeys along the M5 and M42.
- Platooning: trialing HGV platooning on the Midlands motorway network.
- Ramp metering: installing traffic lights on M5 at Junction 1 and Junction 2.
- Smart Motorway Upgrade: upgrade M6 to smart motorway between the M1 and Junction 2.

2.6.9. Freight congestion on the road network is considered in more detail in the 2017 Midlands Connect ‘Freight Strategy’ which outlines the organisations aim to ‘provide congestion-free motorways/expressways radiating in
all directions [which is] likely to require more capacity or smart use of it’ (Midlands Connect, 2017). Previous strategies that have failed to solve the problem of congestion are briefly mentioned, such as the M6 smart motorway treatment which was unsuccessful in relieving congestion at the M6/M5 junction, however no in-depth analysis is undertaken.

2.6.10. Beyond the committed interventions outlined in RIS1, Midlands Connect also identify a range of gaps in the performance of the network for freight in the report which fall into the following categories:

- Targeted smart motorway schemes
- Pinch point schemes: typically grade-separation at roundabouts
- M5/M6 junction area: consider restricting junctions to reduce local traffic using motorway, alongside consideration of a large-scale widening scheme
- M42 east side of Birmingham Box: consider widening and junction upgrades to allow UK Central office developments, which are likely to generate severe evening peak congestion
- Capacity schemes: longer term schemes on principal national corridors

2.7. CITY REGIONS (AND PASSENGER TRANSPORT EXECUTIVES)

2.7.1. The Greater London Authority is the regional government of Greater London. TfL in turn is the local government body responsible for the transport network in Greater London and proposed interventions for addressing freight congestion in the capital are split by mode.

2.7.2. Policies and strategies produced by the Greater London Authority (GLA) and TfL tend to focus on the management of freight traffic demand rather than wide scale infrastructure improvement when it comes to managing freight congestion. This is particularly the case with regards to the potential for new freight demand from forthcoming developments. The 2016 London Plan recognises that the majority of freight movements will be by road however encourages “distribution and servicing in ways that minimise congestion” (Greater London Authority, 2016).

2.7.3. The 2007 London Freight Plan outlines initiatives to identify and address the challenge of reducing freight congestion and encouraging modal shift: (Transport for London, 2007):

- Fleet Operator Recognition Scheme (FORS): voluntary scheme encouraging sustainable best practice for fleet operators
- Delivery and Servicing Plans: help to proactively manage deliveries to reduce the number of delivery and servicing trips, particularly in the AM peak.
- Construction Logistics Plans: applied to the design and construction phases to improve construction freight efficiency and minimise congestion caused directly and indirectly by construction-related trips.
- Retiming: changing the times businesses make or receive deliveries, collections or servicing.

2.7.4. TfL’s Retiming Deliveries guidance highlights that more efficient and safe deliveries can be achieved through retiming and reports that over 500 sites across London have retimed their deliveries since the programme started in 2015. This in turn has “helped to reduce congestion pressures in the city by removing 166,000 deliveries annually from roads during peak times” (Transport for London, 2018).

2.7.5. The Rethinking Deliveries Report from TfL, aimed to advise on delivery consolidation and promoted the full utilisation of freight vehicles. The following consolidation solutions were identified (Transport for London, 2016):
2.7.6. The Greater London Authority (GLA) carries out an annual monitoring report on the key performance indicators relating to the London Plan, however the only indicator relating to freight is KPI 16 that aims to achieve a 50% increase in passengers and freight transported on the “Blue Ribbon Network” from 2011-202, which is London’s strategic network of water spaces (Greater London Authority, 2017). The most recent report published in 2017 reports that there has been an increase of water freight trade by 7% in 2016, however it is not specified whether this is a result of modal shift or from new flows. KPI 14 in turn targets “zero car traffic growth for London” however there is no policy specifically targeting freight traffic.

2.7.7. More recently in 2018, the Mayor’s Transport Strategy outlined freight and servicing activity as a significant contributor to congestion and stated the aim “to reduce freight traffic in the central London morning peak by 10 percent on current levels by 2026” in Proposal 15. To be consistent with the wider Mayor’s Transport Strategy, it is stressed that measures are shaped to contribute to the overall Healthy Streets Approach, which in terms of freight involves a focus on using road space more efficiently. Policy 5 ‘Efficient Streets’ outlines the timescale along which the objectives to “encourage more freight consolidation” and “reduce, re-time and re-mode deliveries” are proposed and some of the more detailed intervention proposals include:

- Construction Logistics Plans & Delivery and Servicing Plans: through the London Plan all new developments will have to demonstrate that reasonable endeavours have been taken to use non-road vehicles.
- Safeguarding wharves and railheads
- Cargo-handling facilities provision: support the Port of London Authority in ensuring that facilities are provided to accommodate intermodal freight operations e.g. roll-on roll-off deliveries, micro-containerisation and cargo cycles.
- Consider establishing regional consolidation and distribution centres: work with boroughs to identify and protect new potential sites.
- Freight Forum: continue coordination efforts to facilitate efficient freight and servicing activity.
- Efficient procurement support: support Business Improvement Districts (BIDs) work to jointly procure goods and form ‘buying clubs’.
- Micro-distribution services: establish a network served by zero emission vehicles and walking/cycling deliveries.
- Re-timing: work with BIDs to review timing of deliveries received by public and private sector organisations and discourage trips occurring at time where they have the greatest adverse effect on the network.
- Kerbside design and management: review loading provision to support efficient freight practices
- Online tool to facilitate reducing the impact of delivery and servicing: develop tool and incorporate the ‘London Lorry Standard’ to simplify the regulatory environment for HGVs.
2.7.8. There are seven regions outside London that have long had different arrangements from elsewhere in the UK in terms of organisation and funding of transport. The city regions of Greater Manchester, Merseyside, South Yorkshire, Tyne and Wear, West Midlands, West Yorkshire and Strathclyde all have Passenger Transport Executives (PTEs) (National Rail, 2018). These transport authorities are responsible for the integration of transport networks across council boundaries and therefore have greater powers than councils elsewhere (Joseph, 2014).

2.7.9. The transport authorities for each of the seven city regions are as follows:

- Greater Manchester – Transport for Greater Manchester
- Merseyside – Merseytravel
- South Yorkshire – South Yorkshire Passenger Transport Executive
- Tyne & Wear – Nexus
- West Midlands – Transport for West Midlands
- West Yorkshire – Metro: Transport for West Yorkshire
- Strathclyde - Strathclyde Partnership for Transport

2.7.10. Although not all the city regions have specific ‘Freight Strategy’ policy documents and instead encompass freight policies within their wider transport strategies, they all aim to manage their networks to provide safe and efficient freight flows and promote congestion reducing interventions. The freight congestion interventions outlined by Transport for West Midlands (which contains Birmingham, the UK’s second largest city by population), Strathclyde Partnership for Transport (the only Passenger Transport Executive in Scotland) and Merseytravel (a port city region) have been summarised below.

**TRANSPORT FOR GREATER MANCHESTER**

2.7.11. Transport for Greater Manchester (TfGM) is a local government body responsible for delivering Greater Manchester’s transport strategy. Policy 29 in the Transport for Greater Manchester Transport Strategy 2040 outlines the commitment to improving “journey times and reliability for deliveries, and to reduce the environmental impact of logistics, including the promotion of mode shift” (Transport for Greater Manchester, 2017).

2.7.12. The Greater Manchester Freight and Logistics Transport Strategy acknowledges that the congestion on the road network in the Greater Manchester region is some of the worst in the UK, with all ‘key radial routes into Manchester subject to a difference of at least 90 seconds per km in journey time between overnight and peak periods’ (Transport for Greater Manchester, 2016). It also recognises the restricting features of the rail network at present such as the wide variety of passenger and freight rail services that share a twin-track railway network and the pinch-points such as Manchester Piccadilly Station.

2.7.13. TfGM has in turn considered a wide range of measures to implement to improve journey times and reliability to create a more efficient environment for freight operating companies to operate in including:

- Fleet Operator Recognition Scheme (FORS): promoting membership to FORS or equivalent
- Delivery & Service Plans (DSP): a DSP Toolkit has been produced to help businesses identify opportunities to better manage their deliveries. It is proposed that this guidance be rolled out to specifically targeted areas.
- Retimed deliveries: ascertain support and produce guidance
- Construction Logistics Plans (CLPs): produce guidance and roll out to developers/construction companies
- Freight routes: implement where appropriate
- Freight website: information to industry to influence practices
2.7.14. The Port Salford development is an example of a logistics space under development which will “have a connection via an upgraded A57 to the M60, a rail link with an on-site rail terminal and a location adjacent to the Manchester Ship Canal. The site will therefore provide occupiers with access to low-cost rail and waterborne freight services, as well as access to the GM motorway network.” The report outlines that the number of freight trains per day is anticipated to increase by 50% by 2030.

2.7.15. Although the TfGM's ‘Freight and Logistics Transport Strategy’ has objectives that relate to reducing congestion that can be assessed numerically (such as average journey speed), these are not associated with specific policy interventions but instead a whole host of measures. The effectiveness of each of the interventions individually will therefore be difficult to distinguish.

TRANSPORT FOR WEST MIDLANDS

2.7.16. Transport for West Midlands (TfWM) is an executive body of the West Midlands Combined Authority which is responsible for co-ordinating transport services and has bus franchising and highway management powers.

2.7.17. The West Midlands is situated in the centre of the UK, meaning a large portion of the freight passing through the area is either destined for or originated from different areas of the UK or different countries. As a result of these large volumes of traffic on the network in the region, the DfT has highlighted capacity constraints on both the rail and roads networks. Ten sections of motorway in the seven local authorities for example, have been identified to be in the lowest 10% of motorways for journey reliability. Consequently, West Midlands Combined Authority published ‘The West Midlands Freight Strategy’ in 2016 to outline proposed policies and interventions to reduce the impact of freight congestion in the area (Transport for West Midlands, 2016).

2.7.18. The strategy identifies a variety of freight transport measures that have been implemented across the country to reduce freight congestion including:

- Use of consolidation centres
- Retiming to out-of-hours deliveries
- Establishing urban delivery platforms
- Controlling freight vehicle access
- Alternative/innovative mode use for urban freight shipments (e.g. freight tram or barge)
- Low emission zones and vehicles
- Freight routeing and signposting.

2.7.19. The strategy however states that these interventions are commonly implemented without an understanding of the exact nature of local freight movements and without clear action. The West Midlands Freight Strategy in turn has been informed by data collection to highlight actual freight issues, aims to deliver measurable benefit within three years and has split interventions by their applicability to different geographical extents.

2.7.20. The overarching freight strategies encompass all modes, aiming to reduce freight congestion through encouraging innovation and collaboration, to identify and implement better ways of managing the movement of goods:

- Data collection: to help improve understanding of freight movements
- Encouraging innovation in logistics management: e.g. Communications and internet of things, autonomous vehicles, connected vehicles and platooning of lorries on motorways
2.7.21. National, regional, metropolitan and local interventions have also been identified in order to help develop a more efficient, high quality road infrastructure network, which in turn have the potential to facilitate freight congestion reduction. These include:

- Additional managed motorway schemes: the first trial of Managed Motorways was in 2006 on the M42 between J3a and J6 and found that driver’s ability to predict their weekday journey times improved by up to 27% and there was decrease in collisions from 5.1 per month to 1.8. The strategy suggests further Managed Motorway Schemes on M5 between M6 interchange and J3; and M42 Junction 9 and 11, arguing the use of technology to create dynamic highway networks helps reduce congestion.
- Encouraging greater freight use of the M6 Toll: if more long-distance freight traffic could use the M6 Toll, capacity would be released on the M6 for local traffic and potentially reduce congestion.
- Motorway junction access & connectivity enhancements: specifically, M5 J1, J2 and J3, M6 J8, J9 and J10 as well as the M54/M6/M6 Toll link road.
- Strategic HGV parking sites: suitable parking facilities support road freight by providing flexibility for driver’s time regulations and delivery planning which allows for efficient utilisation of drivers and vehicles.
- Local urban HGV parking facilities: facilities that help drivers comply with driver time regulations without the need to park in unsuitable locations such as on the highway.
- Freight operator recognition: produce a recommendation report on the implementation of a fleet recognition scheme in the West Midlands.
- DSP and CLP: promote effective use using case studies to demonstrate approaches and benefits.
- Out-of-hours deliveries: trial and encourage quiet deliveries at night time and during the shoulders of the day, away from peak periods. This offers benefits to retailers and transport operators, in addition to a possible reduction of congestion.
- Urban delivery platforms and specialised consolidation centres: establish alternative urban delivery methods such as close proximity delivery platforms to help to coordinate and reduce the number of HGV trips occurring within town and city centres.
- Freight vehicle access and routing: improve coordination of HGV movements within and through the West Midlands, giving preferential access to cleaner, higher rated fleets. This should improve the level of HGV congestion in the area.
- Alternative/innovative mode use for urban freight shipments: explore and encourage freight tram, cargo cycle services, use of canals etc. as they can have positive and sustainable benefits and have the potential to reduce overall HGV mileage due to modal shift from HGVs.

**STRATHCLYDE PARTNERSHIP FOR TRANSPORT**

2.7.22. The Strathclyde Partnership for Transport (SPT) is a passenger transport executive responsible for planning and coordinating regional transport in the Strathclyde area of Western Scotland. The recent 2018 ‘Freight Strategy’ outlines that ensuring an efficient distribution of goods across the region is a key vision of the organisation (SPT, 2018).

2.7.23. Most freight in Scotland is carried by road and as Strathclyde is a key gateway, ‘congestion from freight movements is a major issue’ (SPT, 2018). Although the strategy does outline that most of the significant problems relating to congestion are localised and associated with other issues, the addition of freight traffic (mainly on trunk roads) does play a role; particularly when using unsuitable diversionary routes. A package of solutions has thus been developed to help mitigate and reduce congestion issues including:

- DSP: develop a DSP toolkit to enable DSPs to be adopted across the region, guiding and enabling the process at all levels.
- Accommodating cycle logistics: design cycling infrastructure to accommodate logistics bikes and adjust guidance to reflect the potential mix of cyclist behaviour to enable cycle logistics to operate effectively within region.
- Innovation: assess innovative freight management solutions such as intelligent loading bays, delivery lockers and use of bus lanes for deliveries during peak periods.
- Fleet accreditation: encourage use of schemes such as the Fleet Operator Recognition Scheme over the short and medium term, followed by specification in public sector procurement.
- Direction signage: improve signage to key freight nodes and generators (both on the primary network and diversionary routes) and engage with the freight sector to inform them of the most appropriate routes.
- Consolidation and groupage: develop economies of scale to generate more efficient delivery patterns by producing a best practice guide in the short term and piloting consolidation through use of existing council location.
- Land use planning: develop strategic freight locations by designing for sustainable delivery methods from the beginning.
- Web portal: develop a web portal to enable a clear channel of communication between the public and private sector regarding freight movements. Currently there is no one place for information on moving freight.

**MERSEYTRAVEL**

2.7.24. Merseytravel is the passenger transport executive responsible for the coordination of public transport in the Liverpool City Region in the North West of England. Liverpool is one of the UK’s major ports and consequently Merseyside has a very strong logistics sector. The importance of the port is also set to grow in the future with the completion of the Liverpool 2 deep-water berth (one of the myriad of schemes listed under the SuperPort development project), which will double the ports’ capacity (Liverpool City Region LEP, 2016). Efficient movement of people and goods in and out of the area is therefore critical and is outlined as Goal 5 in the 2011 Local Transport Plan (LTP) (Merseytravel, 2011).

2.7.25. The 2011 Freight Strategy (an appendix of the 2011 Local Transport Plan (LTP) for Merseyside) documents that progress has been made over the previous LTP period in reducing congestion attributed to freight movements in Merseyside, through Intelligent Transport Systems (ITS) and minor highway modifications, however that are several key congestion and bottleneck points still in need of improvement (Merseytravel, 2011). A number of interventions are outlined in the report that aim to reduce freight congestion. The intervention includes:

- Enhanced VMS integration: national and Liverpool City Region highway VMS network integrates and greater flexibility in their permitted message content.
- Increased use of Highway Authority Traffic Officers: use on trunk road as well as motorways
- Retiming deliveries: relax planning conditions which restrict deliveries to the day-time so to reduce freight movements in peak periods. Enable quiet night-time deliveries could be key,
- DSP requirements: place greater emphasis on requiring DSPs through the planning process.
- Consolidation centres: support consolidation centre development through the planning system by allocating land, or by requiring deliveries to be managed sustainably.
- Unused space in vehicles: work with private sector operators through the FQP to facilitate the sharing of unused space in vehicles.
- Monitor HGV and LGV traffic: facilitate a better understanding of freight related traffic locally to aid with future policy decisions through monitoring.
Intermodal freight terminals: create intermodal freight terminals and continue to protect existing terminals.

Unused rail capacity to the port: utilise unused capacity to expand rail freight at the port.

Waterborne freight: Support the use of waterborne freight to encourage modal shift away from roads through schemes such as The Peel Manchester Ship Canal Scheme which already runs along the canal.

2.7.26. The 2011 ‘Access to the Port of Liverpool Studies: Stage 2 Report’ (Sefton Council, 2011) also recommends several road based interventions:

- Make junction improvements and carriageway widening
- Make use of enhanced signage on key approach routes: better inform drivers of the routes they should be utilising to access the port. Potentially linked to the provision of a HGV parking/holding areas and vehicle booking system
- Consider the conversion of (disused) rail lines to HGV only: could be an alternative to constructing a new road as do not require third party land, however is not expected to offer value for money
- Development of HGV route restrictions: introduce bans or restrictions for HGVs on some routes
- Identification of HGV parking/holding area: could be linked to a vehicle booking system and could manage the flow of the traffic accessing the port

2.8. LOCAL POLICY

2.8.1. Local authorities have taken a wide range of approaches to managing freight congestion which would be expected given their diverse geographical, demographic, economic and social differences. However, most authorities still do not have specific freight management policies beyond objectives to manage the negative impacts of freight. This section reviews an urban and rural example of freight congestion management at a local level. The City of London was chosen as the urban example as it has the highest workday population density in England and Wales and therefore faces significant challenges with regards to managing deliveries and servicing (Department of the Built Environment, 2013). Wiltshire is used as the rural example, as their freight strategy provides good examples of measures to deal with freight through trips.

2.8.2. Local Authorities are best placed to deliver key elements of transport decision making as they are closest to the people and businesses affected. They therefore have responsibility for transport and highways in their areas, either as County Councils or Unitary Authorities, as outlined in the Traffic Management Act. The DfT Transport Investment Strategy states that a significant share of English Local Authorities’ funding is allocated by Government by formula to deliver transport decision making which endeavours to reduce congestion and strengthen connectivity to create places in which people want to reside and work (DfT, 2017).

2.8.3. County Councils and Local Authorities highlight congestion caused by freight vehicles as a concern and outline interventions to address the problem in their policies. Local policy plays a crucial role in reducing localised freight congestion and collaborative efforts are enabling local policy to increasingly feed into Highways England strategies for reducing congestion on the SRN.

2.8.4. The characteristics of Local Authorities vary significantly across the United Kingdom and so do the circumstances and extent to which they are affected by freight congestion. The types of freight congestion interventions outlined in local policy however, typically echo those stated in national policy.

EXAMPLE: CITY OF LONDON

2.8.5. As would be expected, authorities responsible for urban areas such as The City of London tend to advocate a larger number of policies that reduce and manage road freight vehicle demand. The City of London has a disproportionately sized working population for its geographical extent; as such, there is significant demand for...
physical goods and services in the city and a need to manage space on the transport network as demand continues to grow. The Freight and Servicing Supplementary Planning Document (SPD) outlines measures and policies in the management of freight and servicing (City of London, 2018). Although it acknowledges that the increased use of smart technologies and the emergence of autonomous vehicles and drones could impact urban freight management in the future, the SPD states that in the short- and medium-term freight within cities will continue relying on traditional methods and in turn advocates:

2.8.6. Measures to minimise freight and servicing trips:

- DSP: include measures that use appropriate smart or joint procurement to reduce deliveries and servicing trips in an attempt to consolidate deliveries and waste collection.
  - The City of London have produced their own guidance which states “that the ‘single most effective way of proactively managing delivery and servicing arrangements is through a Delivery and Servicing Plan” (City of London, 2017).

- Consolidation centres: suppliers to use consolidation centres within Greater London to minimise the number of trips required. DSPs for larger developments should use freight consolidation to minimise trips.
- Consolidation system: to ensure that consolidation works effectively to reduce the vehicle movements and that results in a reduction in road miles.
- Personal delivery prohibition agreements: encourage the prevention of personal deliveries to workplaces. Providing staff with a click and collect parcel drop off service is a good alternative.
- River transport use: encourage low emission river transport mode for goods and waste. e.g. Walbrook Wharf provides a means of removing domestic and commercial waste from the City with minimal use of roads.
- On-site storage: encourage provision of adequate on-site storage for goods as can reduce frequent deliveries of non-perishable items.

2.8.7. Measures to match demand to network capacity:

- Retiming deliveries: evening, night time, or weekend delivery and servicing should be the default outside residential areas and where daytime deliveries or servicing is not essential. Time restricted deliveries and servicing should in turn occur off-peak.
- Booking systems: to ensure deliveries and servicing are restricted off-peak periods.

2.8.8. Measures to mitigate the impact of freight trips include:

- Consideration to the type of transport: encourage use of river, public transport, cargo bikes or zero or low emission vehicles. Promotion that delivery vehicles meet Ultra Low Emission Zone standards.
- Appropriate provision of off-street loading bays: where on-street loading is permitted, measures put in place to ensure that the movement and safety of other road users is not affected.

EXAMPLE: WILTSHIRE

2.8.9. Local Authorities which are responsible for rural parts of the country advocate policies about information sharing compared to their urban counterparts (in addition to those that promote the management of existing demand). Wiltshire, for example, a rural county that generates relatively little freight compared to that which passes through it, states in its 2011-2026 ‘Wiltshire Local Transport Plan: Freight Strategy’ that traffic congestion is the main difficulty associated with freight distribution in the county (Wiltshire Council, 2011). The freight strategy acknowledges that improving capacity along key roads and at bottlenecks would be desirable to reduce the congestion, however recognises that continuous capacity generation is not sustainable or
financially viable and that managing the existing network and demand is a more feasible option. The following interventions are proposed to achieve a more efficient distribution of freight, however little to no evidence is available to demonstrate their effectiveness:

- Advisory/Strategic/Local Freight Routes: online platform enabling journey planning for freight, illustrating the three tiers of advisory freight routes.
- Lorry Parking: “Searching for parking facilities can cause congestion” and thus proposed improvements to existing lorry parking areas, active promotion of commercial lorry parks and a commitment to ensuring that any new industrial development provide adequate HGV parking facilities.
- Information: signage (advisory Lorry Route Signing), mapping (advisory routeing made freely available digitally and physically), information boards (freight specific boards at major parking sites in county) and advertising (raising awareness of sustainable distribution are all proposed.
- Technology: freight specific web portal offer routeing solutions prior to the start of their journey displaying information such as lorry parks, petrol stations, roads unsuitable for freight, toilets, width restrictions etc.
- Freight Consolidation Centres: Acknowledgment that there are no freight consolidation centres in Wiltshire and investigating whether ad hoc freight consolidation and shared deliveries is feasible.

2.8.10. In addition to the interventions outlines above, the Wiltshire Transport Plan also acknowledges the benefits that rail freight flows can bring over road base transport however highlights that the council, like many other rural authorities, has had difficulties in actively promoting the transfer to rail. In the case of Wiltshire specifically, the council attempted to determine the potential for transfer from rail to road in a survey, however had a disappointing response rate. This was considered to potentially reflect the level of interest and type/size of business that a road to rail freight transfer could be applicable to.

2.9. **RAIL FREIGHT POLICY AND STRATEGY**

2.9.1. This section looks at the polices and strategies employed by DfT, Transport Scotland, and Network Rail use to ensure that rail freight capacity is used efficiently and meets changing needs.

2.9.2. The DfT specifies the outputs it wants Network Rail to deliver in England and Wales over a five-year period and sets out the public funds available to deliver them. Transport Scotland has the equivalent role for Scotland. The DfT also sets overall rail policy and strategic objectives. It lets and manages the 15 passenger rail franchises in England and Wales, pays subsidies to loss-making rail franchises and receives premium payments from profit-making franchises. The Department is also the ‘operator of last resort’ should an operator fail.

2.9.3. Network Rail owns and operates the vast majority of Britain’s rail infrastructure. It is responsible for delivering the renewal and enhancement projects approved by the Department. It is also responsible for the day-to-day maintenance of the network infrastructure.

2.9.4. The Office of Rail and Road (ORR) is responsible for regulating Network Rail’s plans. It determines what it considers the efficient price for which Network Rail should deliver the outputs specified by government during each control period. It also monitors Network Rail’s progress against this and, as the regulator, holds Network Rail to account.

2.9.5. In considering rail policy, this section is focussed on Government and infrastructure policies and levers which are currently being implemented or are about to be implemented and which have the objective of, or a significant impact upon, capacity on the rail network to carry rail freight reliably. This Chapter does not cover
initiatives intended to improve rail freight competitiveness, which would lead to more rail freight volume and hence reduced road congestion.

2.9.6. Given Network Rail’s key role in planning for and providing capacity, its strategy towards providing capacity, alleviating congestion, and improving reliability is considered in more detail.

DFT

2.9.7. From the description of the rail industry structure, it is clear that a very large element of the DIT’s workload is to manage the passenger franchising process and to ensure that Network Rail delivers the outputs that the Government requires. However, the DIT does employ a rail freight team, and in 2016 the DIT published its Rail Freight Strategy (RFS) (DIT, September 2016).

2.9.8. The RFS emphasises the importance of moving goods by rail to help to deliver the Fifth Carbon Budget. The strategy recognises the importance of a stable policy framework to enable rail freight to grow and achieve its potential and seeks to provide a clear vision for rail freight, in order to provide a sense of direction from Government to help the industry plan ahead and provide greater certainty to customers and investors.

2.9.9. To understand the likely growth potential of the rail freight industry in the light of new market developments and network constraints, DIT commissioned Arup to assess rail freight growth potential by commodity and review the key capacity constraints that will limit this growth.

2.9.10. Providing more capacity is one of four action areas identified in the strategy where further action by Government and others could empower rail freight to achieve its potential.

2.9.11. On capacity, the strategy states that investment in infrastructure through the Strategic Freight Network Fund has already funded new enhancements on the rail network to support the growth of rail freight, with £235 million allocated to the fund during Control Period 5 (i.e. the funding period covering 2014-2019).

2.9.12. The need for future investment in the network after 2019 to support freight growth is being considered by DIT as part of the long-term planning process for the rail network, and will be informed by Network Rail’s Freight Network Study (FNS) and the initial industry advice submitted to the Department around the end of 2016.

2.9.13. However, the Rail Freight Strategy does not set out proposals for new enhancements to the network or specify in detail the freight paths that will be needed in future.

2.9.14. The strategy emphasises that alongside new infrastructure Government and industry will also need to make the most of capacity on the existing network. This will mean working closely with Network Rail and the rail freight industry to ensure that the allocation of capacity on the network balances the needs of all users, including freight.

---

1 Fifth Carbon Budget - A carbon budget places a restriction on the total amount of greenhouse gases the UK can emit over a 5-year period. The Government has agreed with the Committee on Climate Change and set the fifth budgetary period covering 2028 to 2032 at 1,725 MtCO2e.
2.9.15. As part of work to develop the Rail Freight Strategy, a Strategic Capacity Working Group (including Network Rail, DfT and freight industry representatives) has been exploring options for strengthening processes to identify and protect capacity, and will be taking forward work to assess whether current mechanisms in the Network Code should be modified to reflect this work. In addition, the Department is investigating the impact of freight dwell times – time spent in loops or sidings to allow passenger services to pass – which could provide a basis for assessing potential trade-offs between passenger and freight train pathing decisions.

2.9.16. Where investments on the network have been made specifically to enable freight growth, the DfT is considering whether there is a need for this capacity to be protected for rail freight growth over a reasonable time frame to ensure value for money is realised from the investment.

**BALANCING RAIL FREIGHT AND PASSENGER NEEDS**

2.9.17. In addition to Network Rail’s role in the efficient allocation of capacity, the Government has an influence over how the network is used in the way it specifies passenger franchises. Freight operators are already consulted as part of the development of passenger franchise proposals, but the development of a Government strategy for rail freight now provides an opportunity to review the current process to identify where there is scope for the current and future requirements of rail freight to be more systematically considered. In the light of the initial industry advice from the Rail Delivery Group (RDG), the DfT is working with the industry to establish how to ensure that the franchising process is informed by a realistic view of likely future demand for rail freight.

2.9.18. This issue was considered in a report for the ORR (SKM Colin Buchanan, 2012) which concluded: “The other change we tested was reallocating paths from passenger to freight in the off-peak. In the examples we tested there was a clear economic benefit from this re-allocation of capacity although we did not test whether other passenger services would be impacted by the additional freight paths outside the corridor we studied.”

2.9.19. One example considered by this study was to remove one passenger service between Felixstowe and Ipswich at about mid-day. The Felixstowe line offers a broadly hourly off-peak passenger service but is also in high demand for container train services.

> “Using MOIRA, we estimate that the revenue impact of removing this one service would be a loss of £54k per year. The economic dis-benefits associated with increasing passenger journey times (forcing some passengers to wait longer for a train) would be -£130k per year. As off-peak services are provided using spare rolling stock and train crew, we have not assumed there would be a cost saving from withdrawing this service. As shown above, a container freight path on this route could deliver economic benefits of £1.5m per year if it can operate at 90% utilisation. Even if the path was 50% utilised, the economic benefits would be worth around £0.8m per year. This is significantly more than the revenue and generalised journey time (GJT) disbenefits associated with the removal of the off-peak passenger service, although we have not assessed any disbenefits associated with passenger services outside of our case study area. This suggests that, for this case study, it is more efficient for society to operate freight services than off-peak passenger services if demand for freight reached a level where there were no more freight paths available.” (SKM Colin Buchanan, 2012)

**NETWORK RAIL’S LONG-TERM PLANNING PROCESS**

2.9.20. Network Rail’s Long-Term Planning Process (LTPP) strategy looks forward over a 30-year period, and fulfils their licence obligations to plan the future capability of the network. The LTPP has been designed to consider the role of the railway in supporting the UK economy over the next 30 years. The LTPP comprises a set of activities and documents that:
- Address the demands that are likely to be placed on Britain’s rail network over the next 30 years
- Capture stakeholder aspirations to develop new train services in the light of continuing rail investments
- Present funders with choices and options to accommodate demand and future aspirations.

2.9.21. Plans are developed on a business by business basis, including the FMS of 2013, and the FMS of 2017. The ORR approved the LTPP to inform planning for Control Period 6 (2019-2024) (CP6) and for the longer term.

**FREIGHT AND NATIONAL OPERATORS ROUTE**

2.9.22. Subject to funding, plans are delivered by Network Rail’s routes. Most of these are based on corridors, but the Freight and National Passenger Operators (FNPO) business is a nationwide virtual route focused on meeting the needs of freight operators and non-franchised passenger operators.

2.9.23. Where investment is considered to be necessary in long term plans, this is framed as “Options for Funders”, and it is for the DfT (or Scottish Government) to decide how any investment should be prioritised. In past years, DfT plans for investment were made clear for each Control Period in a Statement of Funds Available (SOFA). For the current control period, the SOFA only included funding for routine renewals, with investment in upgrades to be decided through a new, case by case, process. This has undoubtedly caused some uncertainty for freight investment: “In line with the HLOS, the level of expenditure is focused on and provides for the operations, maintenance and renewal of the existing railway over CP6. The level of expenditure makes some provision for the funding of enhancements. However, the Secretary of State expects decisions regarding specific enhancements to be dealt with separately, building on the principles set out in the “Memorandum of Understanding between DfT and Network Rail on rail enhancements,” and this statement makes no commitments to specific enhancements.” DfT Statement of Funds Available, October 2017.

2.9.24. FNPO produced a Route Strategic Plan (Network Rail, 2018) in February 2018 covering CP6 (April 2019 to March 2024). The FNPO Route Strategic Plan (RSP) includes objectives to achieve rail freight growth (quoting a potential cost of £2 billion over 15 years to provide capacity for growth) and to maintain and improve capacity and capability.

2.9.25. On achieving rail freight growth, the RSP says: “We will work with the UK and Scottish Governments and with prospective third-party investors to develop and establish funding mechanisms for this investment, which will be an urgent priority ahead of and going into CP6. Investing in the network to support modal shift and the growth of rail freight has considerable socio-economic and environmental benefits. The Benefit Cost Ratios for freight enhancement schemes are very strong typically in the range of 4:1 to 8:1. We will work with Scotland Route, Transport Scotland and the wider sector in Scotland to deliver Transport Scotland’s HLOS rail freight growth target.”

2.9.26. On maintaining and improving capacity the FNPO RSP notes: “Given the freight growth forecast in CP6 we will work with the System Operator to plan how capacity can be made available to accommodate this. A proportion will be through the continued drive to optimise use of the existing network. However, on certain routes in order to deliver a step-change in growth, enhancements to network infrastructure will be required. We will work with both the UK and Scottish Governments to make the case for continued funding to develop the Strategic Freight Network to build on the successes (and tangible benefits) of the CP4 and CP5 Strategic Freight Network funds. In the longer term, the freight capacity and capability requirements necessary to achieve continued freight growth will form a key element of the 15-year Freight Plan with the anticipated focus being on five key strategic corridors:

- Felixstowe to the Midlands/North/Scotland
- Solent to the Midlands/North/Scotland
- Cross London
- Northern Ports and Trans Pennine capacity
- Development of additional Nodal Yards (to support train regulation and capacity management)”
2.9.27. While the Freight Route Strategic Plan is required to produce proposals and plans for CP6, it takes a longer-term view of infrastructure investments and demand over 30 years, up to 2034. Core to the RSP’s strategy is the development of a Strategic Freight Network, focusing on key corridors with a consistent set of benchmarks, namely:

- W10/W12 loading gauge (relates to the size of wagons and containers)
- 775m train length (650m minimum & 1500m aspiration)
- RA10 without infrastructure driven speed restriction (RA mainly relates to train weights)
- Electrified (25kV AC, though noting the DfT’s current position set out in 2016 by the Secretary of State)
- 24/7 availability (through core & diversionary routes)

The following map illustrates National Rail’s envisaged strategic freight network (Network Rail, 2018):

Figure 1 Envisaged strategic freight network

 NETWORK RAIL SYSTEM OPERATOR

2.9.28. FNPO is unique within Network Rail in that it doesn’t actually manage any rail route infrastructure – it depends on the geographically based routes and, particularly, the Network Rail System Operator (SO) business to deliver the capacity required.

2.9.29. With FNPO being the principal point of contact with national operators, accountable for the delivery of their performance and other outputs and working closely with the geographic routes, the SO function helps to
deliver freight safely and efficiently. The SO has established teams to align to each Route, including FNPO. These teams encompass network strategy & planning and capacity planning.

2.9.30. The SO brings the needs of different parties together to ensure that the enhancements to the network are planned and capacity is allocated effectively. This is divested through different parts of SO and these are:

- Network Strategy and Planning: The LTPP is led by teams under the Strategy & Planning Directors in SO. This part of SO seeks the views of stakeholders and the roles within these teams align with devolved funders and other customers. There is a direct alignment with FNPO, as a Principal Strategic Planner (PSP) has been appointed to link directly with FNPO.
- Capacity Planning: The SO organisation is structured to provide a strategic focus for planning activities, capability and capacity analysis, the working timetable (WTT) development process, including the delivery of industry steering groups to support timetable change, management of the timetable planning rules and delivery of permanent alteration for operator requirements. Capacity Planning also leads on the weekly adjustment of the timetable for engineering works, short term operator requirements and the network wide leadership for Access Planning. Capacity Planning will support the delivery of the Access Planning process and provide a national framework in which to plan and prioritise engineering work.
- Programmes and Policy: This team provides a central resource to undertake a range of central (non-geographic) cross-functional activities and also provides support to the geographically based teams in specific disciplines. The SO team has portfolio and programme management, client portfolio services, analysis and forecasting as some of the key roles and responsibilities within this part of SO.

2.9.31. The Network Rail Long Term Planning Process, and the associated strategic plans and route plans, provide a comprehensive approach to forecasting potential demand and identifying approaches to providing the required capacity and to improve service quality. The approach strongly features joint working with the freight industry, and can be seen as representing the views and objectives of the rail freight sector as a whole.

2.9.32. The fact that investment decisions then need to be made by Government or private sector decision makers is understandable, but potentially creates uncertainty when freight businesses work to long planning horizons. The relatively new Network Rail organisation structure, particularly the relationship between FNPO and the SO business, is still developing and needs time to demonstrate that it can plan and deliver freight capacity to meet freight customer demand.

INVESTMENT IN RAIL FREIGHT CAPACITY

2.9.33. As with highways, predict and provide is the traditional approach to increasing capacity. However, the various National Rail strategies include a wide range of other levers, described below, which also address capacity issues and which are, generally, the first choice over infrastructure investment.

2.9.34. It is also important to note that the general process of investing in rail infrastructure and line improvements, while often driven by growing passenger demand, also provide capacity for freight growth. The role of the long-term Planning Process is to ensure that freight needs are taken into account when looking at routes as a whole, and to identify any additional infrastructure investments that may be required specifically to provide freight capacity.

2.9.35. A good example is HS2. HS2 is driven by the need to provide additional passenger capacity on fast growing routes. Ultimately this will lead to lower demand for long distance inter city services on the West Coast Main Line (WCML) (in particular). This will release capacity for more passenger and freight services on the existing main line. For freight, the WCML forecast to be a major constraint on freight growth by 2030. Network Rail’s strategies assume that additional paths will be made available on the WCML south of Crewe by 2026. This is
acknowledged in the business case for HS2, although freight benefits are not quantified. It is important to note that there are competing demands for additional capacity on the WCML and provision for freight, while widely supported, is not guaranteed.

2.9.36. The FNS put forward an array of suggested infrastructure enhancement options, from grade separation at key junctions to additional regulation loops or additional running lines based on identification of key capacity gaps on 11 routes. The investment options identified in the RFS suggest that realisation of such a programme requires a commensurate long-range funding envelope, cumulatively in the order of £2bn.

2.9.37. Recognising that the earlier model of ring-fenced central Government funding for SFN enhancements may not apply in future control periods and that the case for any such central Government funding is strengthened not only by compelling BCR’s but also the attraction of other contributory funding sources, FNPO’s strategy is to seek to leverage contributory funding opportunities from a range of parties and sources such as:

- Regional development bodies or Local Enterprise Partnerships
- Principal beneficiaries (e.g. ports, quarries, manufacturers)
- Ring-fencing (or otherwise recognising) the value generated by the Network Rail freight estate, if appropriate.

TIMETABLE REVIEW PROCESS

2.9.38. Network Rail’s freight business is undertaking and will continue a review of freight timetables to ensure that paths are used efficiently. This covers a number of areas:

- Reviewing path usage to remove unused paths and agree strategic capacity. This was particularly important following the dramatic decline in the movement of coal, which left a lot of booked paths which were no longer needs. The rail freight industry has been criticised in the past for retaining paths in the timetable which were rarely or never used. To date Network Rail have removed over 5,000 unused freight paths.
- Work with the Route, System Operator and FOC’s/TOCs where in upcoming major timetable re-casts the available capacity may be less than contracted rights
- Review with System Operator and customers suitability of current systems to capture network constraints and traction capability (Loads Book, Timing Loads, Lengths). This could be important as the operating details of freight trains (particularly braking curves) used for timetabling are not up to date, potentially losing capacity.

STRATEGIC CAPACITY - FREIGHT NODES

2.9.39. Network Rail’s FNS (Network Rail, 2017) introduced the concept of nodal yards to improve freight capacity and service quality. The study described nodal yards as follows:

2.9.40. “High quality freight train paths are required to support the development of freight growth. Historically, freight services have often suffered from paths which required them to wait in loops whilst faster trains passed them, increasing the overall journey time, impairing the operational efficiency for operators and delaying end customers. The creation of nodal yards can create the capability for freight to operate in paths that are more appropriate and deliver benefits such as improved timetable capacity and network performance”.

2.9.41. Developed at strategic geographic locations, nodal yards act as freight traffic staging and regulation points at the confluence of adjacent route sections, enabling effective management of freight traffic flows and better exploitation of end-to-end freight path components. Occupancy of the yard is subject to a Yard Plan, in essence, a timetable for the yard to ensure optimum freight operations.
2.9.42. Where possible, nodal yards will be designed so as to potentially incorporate key ancillary services including wagon maintenance, locomotive fuelling and crew relief facilities. Additionally, new nodal yards would also cater for W12 and 775m services as standard, with increments to these standards being dependent on location and expected commodities. These facilities will also provide an opportunity for trains to combine and split in order to serve locations which do not demand a full length train, whilst taking advantage of the efficiencies of a long train on the core leg of the journey.

2.9.43. The overriding objective of the nodal yard concept is to achieve shorter overall journey times for customers by reducing or eliminating multiple stops on-route. Therefore, any nodal yard scheme must be evaluated on its ability to deliver this output.

2.9.44. Development of nodal yards is backed in the FNPO Route Strategic Plan (Network Rail, 2018), which proposes incremental development of at least six such yards.

2.10. PORT POLICY

2.10.1. As with roads and rail, ports play a role in delivering an effective UK transport network. The policy approach to ports is considered here as it relates to congestion and an integrated multimodal approach. The policy areas related to waterborne freight are principally as follows:

- Port centred projects
- Support to operating costs for intermodal water freight handling
- Support to capital costs for intermodal water freight handling facilities

PORT CENTRED PROJECTS

2.10.2. The policy for ports in England and Wales is set out in the National Policy Statement for Ports (DfT, 2017). The policy is to provide a framework for decisions on proposals for new port developments, with each port or promoter to take its own commercial view and its own risks. For projects that are deemed to be strategically significant and with some benefits beyond just the promoter there is a framework to consider co-funding, however this framework more obviously relates to road and rail infrastructure rather than port centred projects.

2.10.3. The EU has various funding initiatives in place relevant to the ports sector to deliver environmental and congestion objectives for ports. The Connecting Europe Facility (CEF) is aimed at financing projects that fill in the missing links in transport, energy and digital networks with up to 40% funding available. The Motorways of the Seas (MoS) funding continues within the CEF. The EU research and development programme Horizon 2020 is a source of funding for innovative projects. EU funded projects whether funded directly by the EU or via national Government typically require multiple partners and located in more than one country. This means that shortsea intra EU shipping projects may be more amenable to EU funding support than deep sea international shipping projects (EC Europa, 2018).

SUPPORT TO OPERATING COSTS FOR INTERMODAL WATER FREIGHT HANDLING

2.10.4. The support available to help with operating costs is provided through two support schemes:

- Mode Shift Revenue Support (MSRS)
- Waterborne Freight Grant (WFG)

2.10.5. The MSRS scheme operates in two parts:

- MSRS (Intermodal), intermodal container movements by rail;
- MSRS (Bulk and Waterways), other freight traffic movements by rail and all movements by inland waterway (coastal and shortsea water freight excluded).

2.10.6. The MSRS provides support to operating costs over three years with possible further extension. The intention of the MSRS is that it facilitates and supports modal shift. The WFG provides support to operating costs for coastal and shortsea intermodal water freight. The WFG provides time limited support over three years with the contribution declining over this period. The intention of the WFG is that it facilitates and supports the inception of new services.

2.10.7. In the period December 2014 to June 2018, there were 297 MSRS awards totalling £91.5 million, with £4.2 million (4.6% of total) being Bulk and Waterways awards (50 no.). The available data does not further sub-divide the Bulk and Waterways awards into rail related and waterways related awards, however from inspection of the grantee’s business and the origin and destination for each award it appears that less than 5 awards are for waterways related freight handling and total less than £0.5 million.

2.10.8. In the period December 2014 to June 2018, there was only one WFG award in England and Wales, with this award being the final year of support for 2014. It is not known if the service supported by this WFG award is still operational. In Scotland there have been three WFG awards in the period 2005 to 2017 totalling £3 million. None of the projects are in operation in 2018 (DIT, 2018).

SUPPORT TO CAPITAL COSTS FOR INTERMODAL WATER FREIGHT HANDLING FACILITIES

2.10.9. The support available to help offset the capital cost of providing intermodal freight handling facilities varies across the UK. In England and Northern Ireland there is no support, and the Freight Facilities Grant (FFG) scheme ceased in England in 2011. In Wales the FFG continues to be available for rail and inland waterway freight handling facilities but not for coastal and shortsea shipping facilities. In Scotland the FFG continues to be available for rail and inland waterway freight handling facilities, and there is the Ports Mode Shift Grant (PMSG) for coastal and shortsea shipping facilities.

2.10.10. In the period August 1997 to April 2018 the cost of FFG and PMSG support grants to rail and water intermodal projects paid by the Scottish Government totalled circa £64 million for 40 projects, with £23 million (36% of total) being for water mode projects (11 no.). The estimated number of total lorry miles to be removed in Scotland by the 40 projects each year is 34.4 million, with water mode removal estimated as 7.9 million (23% of total). The cost of removing one truck mile by rail and by water respectively is: £1.55 and £2.90. Over this 22 year period from the data available it is not possible to determine whether the funded projects became self-supporting and whether the estimated number of lorry miles to be removed was realised, i.e. whether the policy of funding capital costs was successful over the long term.
3. POTENTIAL FOR MODAL SHIFT TO REDUCE CONGESTION

3.1.1. Modal shift is recognised as an objective at Government level and in most regional and Local Transport Plans. Moving more freight by rail or waterway is recognised as having a number of benefits:

- Reduced emissions. (Each tonne of freight transported by rail currently reduces carbon emissions by 76 per cent compared to road. (DfT, September 2016))
- Productivity and other economic benefits (A report for the RDG (Rail Delivery Group, 2018) estimated the productivity benefits of rail freight to be £1.17bn per year, plus an additional £556m for reducing externalities such as environmental benefits)
- By offering a lower priced solution, non-road modes allow businesses to reach new markets, including international markets, more cost effectively
- Railways and shipping are much safer than moving goods by road (The Rail Freight Group estimates that moving goods by rail reduces casualties by 600 per year (RFG, 2018)
- Removing goods from the roads has the potential to reduce congestion

3.1.2. This Chapter considers the following questions:

- What is the impact of moving goods by non-road modes on road congestion?
- What would the effect on road congestion be if freight is moved by non-road modes?
- Could the benefits of non-road modes on congestion be significantly increased?

3.2. MODAL SPLIT

3.2.1. In terms of tonnage of goods lifted, road freight is dominant, carrying 89% of goods. However, the distance moved per tonne for water and rail freight is significantly longer, so in terms of tonne kilometres (goods moved), the road share is 76%.

3.2.2. Over time, the mode share for road has increased and the share for waterways has decreased. The mode share for rail has recently tended to increase, although the loss of coal traffic in the last two or three years has seen a decline in rail mode share. This is illustrated in the following graph (DfT, 2018).
3.3. WATERWAYS

3.3.1. Movement of goods by inland waterways can be seen as consisting of the following groups:

- Coastwise shipping of containers and other commodities between maritime ports
- Transport inland to or from ports using rivers or canals
- Transport between locations on rivers or canals

3.3.2. Coastwise transport of bulk commodities does not have a significant impact on road transport. The movements are parts of integrated industrial processes, possibly competing with pipelines, with road rarely being a viable alternative. DfT statistics show that in 2015, of 42 million tonnes of goods moved by coastwise shipping, 30.8 million tonnes were dry or liquid bulk.

3.3.3. Coastwise shipping of containers generally refers to feeder movements between major ports within the UK, for example from Felixstowe to Scotland. In 2015 this amounted to 11.4 million tonnes of goods and 3.1 billion tonne kilometres (DfT, 2016).

3.3.4. MDS (MDS Transmodal, 2018) suggests that coastwise shipment of containers is a not generally contestable by road or rail freight. The MDS report states: “Coastal Shipping (shipping between British ports): There is also some coastal container traffic by sea between British deep-sea ports and regional ports (e.g. Felixstowe to Tees and Felixstowe to Grangemouth). However coastal shipping and rail are often generally considered separate markets - with rail offering a regular quick service, and coastal shipping offering an infrequent but cheaper service for transferring deep-sea containers between ports. We do not foresee significant changes in modal shares between rail and coastal shipping and therefore coastal shipping has not been directly included in these calculations or modelling. We do not foresee port capacity constraints as being a limiting factor restricting the growth in coastal or feeder shipping within the time period covered by these forecasts.”

3.3.5. The biggest opportunity to reduce road freight volume through modal shift to waterways is likely to be through changes to the market for UK ports, with potentially more calls at ports other than Felixstowe, Southampton, or...
Transport inland from ports using rivers or canals is a small but important market. There are two main groups of traffic:

- Inland movement from the Thames Estuary to Thames Wharves above Tower Bridge. A recent review identified that wharves West of Tower Bridge have an annual capacity of 1 million tonnes, with little potential for growth (GLA, 2018). DfT water freight statistics show that 2.2 million tonnes of freight were moved in land on the Thames in 2015 (DIT, 2016).
- Freight operations on the Manchester Ship Canal, River Severn, River Trent, River Humber, and Medway. In combination 1.4 million tonnes of freight were lifted on these waterways in 2015, with half being on the River Humber or Manchester Ship Canal. While these flows are locally significant, they cannot be said to have a significant impact on congestion nationally.

Conclusion

Whilst movement between points in the UK by waterways remains a feature of freight movements, it seems unlikely to see a major growth as a significant means to tackle congestion. More potential is offered by changing the port of entry for various types of goods.

3.4. RAIL FREIGHT

3.4.1. Rail freight’s share of inland transport measured in tonne kilometres grew by 72% between 1996 and 2014, but since then has declined largely due to the dramatic loss of coal traffic. While rail freight carried 14.8% of non-waterborne inland freight (tkm) in 2014, this reduced to 10.4% by 2016.

3.4.2. As discussed in Chapter 2 of the Managing Congestion report, Network Rail and the DfT forecast continued strong growth in rail freight for the next 25 to 30 years. The 2013 FMS saw rail freight growing from 11% of tkm in 2011 to 19% by 2023.

3.5. RAIL FREIGHT AND ROAD CONGESTION

3.5.1. Various industry reports and strategies emphasise the importance of rail freight in reducing road traffic and hence reducing congestion. The RDG pamphlet ‘Rail freight – working for Britain’ (Rail Delivery Group, 2018) provides a high level estimate that the 1.66 billion vehicle kilometres of lorry traffic avoided by rail freight is worth £1.7 billion. This is includes approximately £1.2 billion of cost savings for rail freight users and approximately £500m of external benefits including decongestion.

3.5.2. Measuring the impact of rail freight on congestion is not straightforward. Several questions need to be addressed:
3.5.3. The impact on congestion depends on the time of day goods are moved and the conditions on the roads used.

3.5.4. Published estimates of the benefit of modal shift to rail freight are derived at a very high level based on an average benefit per lorry kilometre saved. In practice, the benefit will vary greatly between, say, a busy urban motorway or a quieter rural dual carriageway.

3.5.5. The Evidence Report illustrates three possible ways of measuring the impact of rail freight on road congestion:

- Reports by Metropolitan Transport Research Unit (MTRU) for the rail freight industry
- Using the DfT’s Mode Shift Benefit (MSB) measure
- A new approach for this study focusing on the busiest rail freight corridors and road congestion hot spots.

MTRU CONGESTION STUDY

3.5.6. In March 2017 Freight on Rail published a report by MTRU titled ‘Impact on congestion of transfer of freight from road to rail on key strategic corridors’ (MTRU, 2018). The objective of the MTRU study was to establish the feasibility of a realistic modal shift from HGVs to rail which could reduce road congestion in key strategic corridors.

3.5.7. The overall approach to this research was to identify four busy sections of trunk road and estimate the proportion of HGV trips along those sections that could realistically be transferred to rail freight services. The four road sections were: Felixstowe A14, Southampton M3/A34, M6 Junctions 12 to 13, M62 Junctions 21 to 22. Two of these represent ports and the other two are busy sections of motorway.

3.5.8. The study then looked at all HGV trips across the UK and identified the types of vehicle and commodities which tended to travel over longer distances.

3.5.9. The report asserted that 2,000 vehicles per day would be sufficient to significantly reduce congestion at any particular location on the road network. The main focus of the report was to determine whether transfer of 2,000 vehicles per day from selected locations on the road network could be an achievable objective. For example, looking at Southampton the report identified 4,000 articulated HGVs AADF (Average Annual Day Flow) moving by road just north of the container terminal. The current mode share for rail from the port was given as 35%. Increasing rail share to 50%, which is in line with port targets, plus background growth of 2% per annum would suggest an additional 2,200 HGVs per day by 2030, meeting the threshold. A similar calculation was performed for Felixstowe.

3.5.10. For the two inland locations the report cited difficulties in estimating the potential volume that could be transferred to rail, and opted for an estimate of 20% of articulated HGV traffic. This was despite the significantly shorter average trip passing through the M62 site.

3.5.11. For all 4 sites the study checked with Network Rail freight and route studies and strategies to ascertain the availability of rail capacity to carry the traffic transferred from road.

3.5.12. The main conclusion of this study was that there is potential, and rail capacity exists, to transfer significant volumes of freight from road to rail.

3.5.13. The scope of this study was such that it did not produce any estimate of the congestion benefits of such a transfer.
MODE SHIFT BENEFIT (MSB) APPROACH

3.5.14. Mode Shift Benefit (MSB) values are estimates of the benefit of removing a lorry mile from the road network in Great Britain, by transferring the goods to rail or water freight instead. MSB values form the basis for modal-shift grants awarded by the DfT. MSB was previously referred to as the Sensitive Lorry Mile value (SLM). (DfT, n.d.)

3.5.15. MSB values vary by road type and between busy and less busy sections of motorway. MSB assigns a simple value per lorry mile saved, which includes values for a variety of external costs as illustrated in the table below (DfT, 2014).

<table>
<thead>
<tr>
<th>Road</th>
<th>Motorway High</th>
<th>Motorway Low</th>
<th>A</th>
<th>Other</th>
<th>Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestion</td>
<td>99</td>
<td>24</td>
<td>72</td>
<td>78</td>
<td>57</td>
</tr>
<tr>
<td>Accidents</td>
<td>0.5</td>
<td>0.5</td>
<td>5.6</td>
<td>5.5</td>
<td>2.7</td>
</tr>
<tr>
<td>Noise</td>
<td>9</td>
<td>7</td>
<td>8</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>Pollution</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Greenhouse Gases</td>
<td>6</td>
<td>6</td>
<td>7</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>7</td>
<td>7</td>
<td>24</td>
<td>171</td>
<td>18</td>
</tr>
<tr>
<td>Other (roads)</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Taxation</td>
<td>-31</td>
<td>-31</td>
<td>-32</td>
<td>-40</td>
<td>-32</td>
</tr>
<tr>
<td>Rail</td>
<td>-8</td>
<td>-8</td>
<td>-8</td>
<td>-8</td>
<td>-8</td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
<td>12</td>
<td>82</td>
<td>235</td>
<td>58</td>
</tr>
</tbody>
</table>

The DfT has periodically reviewed and adjusted these figures, and published background information on how they were calculated. The values in Table 1 were updated from the values adopted in 2010 from a calculation described in the Mode Shift Values Technical Report of 2009 (DfT, 2009).

3.5.16. The approach to calculating the benefit of removing HGVs from roads is based on the observation that when HGV traffic is added to a road it will often reduce the average speeds of other traffic travelling on it. There is evidence that, as well as reducing average journey speeds, increased traffic also increases the variability of journey speeds, often reducing the reliability of journey times. Each of these phenomena has an impact on vehicle operating costs. Costs resulting from changes in journey time or operating costs are referred to as Marginal External Cost – Congestion (MEC-C).

3.5.17. The DfT’s National Transport Model (NTM) provided outputs used to calculate the congestion element of the MSB. The description of the method is reproduced below:
The first step in estimating MEC-C using the NTM is to run the model to produce traffic forecasts for the year in which MEC-C estimates are required.

The NTM calculates the MEC-C by adding an incremental amount of traffic, in this case HGV traffic, to each of the links in the model and using speed flow curves to calculate the changes in average speeds experienced by other vehicles using the link. The model uses these changes in speed to calculate the impact on vehicle journey times. It then uses the guidance on valuing time savings in TAG Unit 3.5.6: Values of Time and Operating Costs to value the delays caused to other vehicles, and the guidance on estimating vehicle operating costs, also in TAG Unit 3.5.6: Values of Time and Operating Costs, to estimate the impact of the reduction in speed on other vehicles' fuel and non-fuel operating costs.

The changes in operating costs and the value of delays are summed across all other vehicles to provide an estimate of the journey time and vehicle operating cost elements of the MEC-C.

The estimated MEC-C varies significantly according to where additional HGV traffic is added to the road network. We have used the output of the NTM to estimate 215 separate MEC-C values to reflect this. The values vary by type of road, area and level of congestion. The 215 values represent different combinations of the 10 area types, 7 road types and 5 congestion bands used in the NTM.

The NTM currently does not model changes in journey time reliability. Instead, we have uprated the journey time component of the external cost estimates by 50% on rural motorways and rural trunk roads and 20% on other roads to reflect the impact of additional HGV traffic on journey time reliability. These uprates were also used to derive the existing SLM values. They were derived from applications of the Incident based Cost-benefit Analysis (INCA) software. They refer to the value of journey time reliability benefits as a proportion of the value of journey time savings benefits across a sample of road schemes. The uprates cover changes in reliability arising from two sources: incident-related journey time variability; and day-to-day variability.

3.5.18. The approach used existing congestion impact costs for every link of the road network in the model across time slices covering the whole day. However, this disaggregated data was deemed to be too complex to calculate MSB values, and so the simplified approach focussed on a single figure for each of only four road types has been used.

3.5.19. At a national level, however, the weighted average MSB values are based on all articulated road traffic, not simply on routes where rail freight takes traffic off the road network. This potentially exaggerates the decongestion benefit, as the road journeys avoided could tend to be over long distances on relatively uncongested roads.

3.5.20. In order to obtain an estimate of the congestion value of lorry journeys saved by the use of rail freight in 2016, the calculation below applies MSB values to the total volume of lorry miles saved. Two values are used: the average MSB value for all goods transported by road in GB, and a lower value which would be used if all lorry miles saved were on uncongested motorways. The actual value would be somewhere between the two.

\[
\begin{align*}
\text{Lorry km saved 2015/6} & = 1.78 \text{ billion} \quad \text{(ORR, 2017)} \\
\text{Lorry miles saved} & = 1.11 \text{ billion} \\
\text{Mode Shift Benefit Value at Great Britain average} & = 1.11 \text{ billion} \times £0.57 = £630,443,212 \\
\text{Mode Shift Benefit Value for Motorway, Low} & = 1.11 \text{ billion} \times £0.24 = £265,449,773 
\end{align*}
\]

3.5.21. These estimates are for one year – 2015/6 and suggest that use of rail freight in that year produced savings of between £265 million and £630 million in congestion.
COMMODITY AND CORRIDOR APPROACH
PORTS / DEEP SEA INTERMODAL

3.5.22. Looking at the first of these two dominant rail freight commodities, deep sea intermodal rail freight (or ports rail freight) is strongly focused on movements to and from the key container ports of Southampton and Felixstowe, with additional, and growing, traffic to and from Liverpool, London Gateway, Tilbury, and Teesport.

3.5.23. Rail services carry a significant percentage of inland container movements for these ports: 29% for Felixstowe and 35% for Southampton, and this is despite the fact that neither port operates rail services to London (due to the short distance).

3.5.24. The use of rail to and from these ports provides an alternative to road transport via the A14 (Felixstowe), and the M3/A34 (Southampton). As the main destinations for trains are the West Midlands and the North West, rail also removes significant volumes of rail freight from the M42 and the M6 around Birmingham, and the M6 from the Midlands towards Manchester.

3.5.25. In order to estimate the potential impact of diverting container traffic from rail to road on these corridors, a timetable analysis of trains to the two ports suggested that the split of volume to each region would be as follows:

Table 2 Timetable analysis

<table>
<thead>
<tr>
<th></th>
<th>Felixstowe</th>
<th>Southampton</th>
</tr>
</thead>
<tbody>
<tr>
<td>WM</td>
<td>27%</td>
<td>26%</td>
</tr>
<tr>
<td>NW</td>
<td>36%</td>
<td>35%</td>
</tr>
<tr>
<td>NE</td>
<td>30%</td>
<td>29%</td>
</tr>
<tr>
<td>SC</td>
<td>3%</td>
<td>0%</td>
</tr>
<tr>
<td>SW</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>EM</td>
<td>0%</td>
<td>6%</td>
</tr>
</tbody>
</table>

3.5.26. Applying these regional splits to the 2016/7 estimated rail freight volume for each port, Table 3 shows an estimate of the number of road vehicles removed from various corridors given current volumes of rail freight (both directions combined). While the analysis focuses on flows to and from deep sea ports, there is a very successful operation transporting supermarket goods between DIRFT (near Rugby) and Scotland, operating up to six trains per day. This operation removes a further 504 lorries per day from a long corridor which includes the section of the M6 used in the analysis below. Therefore, for this section a further 504 lorries per day has been added.

3.5.27. These numbers are significant on all of the routes, as shown in the table below which includes analysis of current traffic flows based on an analysis undertaken for this report which considered two years of traffic count data for each section of trunk road or motorway.
### Table 3 Estimate of the number of road vehicles removed

<table>
<thead>
<tr>
<th>Location</th>
<th>HGVs per day (both directions combined)</th>
<th>Percentage increase on current HGV count</th>
</tr>
</thead>
<tbody>
<tr>
<td>A14 to Cambridge</td>
<td>1,154</td>
<td>+14%</td>
</tr>
<tr>
<td>A14 Cambridge to M6</td>
<td>793</td>
<td>+7%</td>
</tr>
<tr>
<td>M3/A34 to Oxford</td>
<td>706</td>
<td>+11%</td>
</tr>
<tr>
<td>M40 Oxford to M42/M6 J</td>
<td>433</td>
<td>+5%</td>
</tr>
<tr>
<td>Felixstowe + So'ton + DIRFT M6N</td>
<td>1,512</td>
<td>+8%</td>
</tr>
</tbody>
</table>

3.5.28. What does this mean for congestion? Average speed profiles for each location for every 15 minutes across the day were compiled, and an assessment was also made of the percentage of capacity used each 15 minutes. Typically, the sections on the A34, M3, and A14 showed profiles like the one below:

**Figure 2: Speed and Available Capacity Profile: A14 / M1 Junction (WSP, 2018).**

3.5.29. This profile shows that through most of the daytime around 50% of capacity is still available, and therefore there is no drop in average speeds across the day. This would suggest that adding additional traffic to the volumes of traffic seen in 2017/8 would not cause significant congestion, but any increase in traffic volume tends to slow average traffic speeds.
3.5.30. However, the profile for locations along the M6 corridor is significantly different, as shown below.

![Image of M6 profile](image)

**Figure 3: Speed and Available Capacity Profile: M6 J10 -J11 (WSP, 2018).** On the M6 corridor around Birmingham, through much of the day existing traffic volumes leave little spare capacity, resulting in a decrease in average speed. Adding a significant number of additional lorries at any time in daylight hours would be likely to worsen congestion further and / or cause traffic to divert onto alternative routes.

**CONSTRUCTION MATERIALS TO LONDON**

3.5.31. It would not be correct to assume that every tonne of construction materials transported to London by rail would otherwise have been transported by road. Construction materials have a low intrinsic value, and are very sensitive to the cost of transport. Moving materials to London is a close fought competition between rail and water, with, generally, wharves on the Thames serving Central and East London, and rail terminals serving West, North, and South London.

3.5.32. If the rail terminals were to close, most movements would transfer to water for the main haul from distant quarries or sea dredged aggregate wharves. This would lead to longer road final delivery journeys in London from Thames wharves to West London and other areas previously served by rail. Currently the average journey from a rail head or wharf to a construction site is very short – possibly 5km-10km. Removing the option for rail would see the average journey for the transferred traffic increase to perhaps 15km-20km.

3.5.33. Using this data, it can be calculated that without rail over 3,200 lorry journeys in London would be extended by around 10km each day, leading to 8.2 million additional lorry kilometres across London each year. As construction traffic is increasing, this could grow to 14.6 million additional HGV km in London by 2033 (based on 3% volume compound annual growth rate).

3.5.34. This additional HGV traffic would be concentrated around the Thames wharves, which are often in the most congested areas of the city.
3.6. POTENTIAL BENEFIT OF INCREASED MODAL SHIFT TO RAIL

3.6.1. Neither the Network Rail Freight Network Study, nor the DfT Rail Freight Strategy quantify the impact of not providing the capacity required at major pinch points. The MDS revised 2023/24 rail freight forecasts (MDS Transmodal, 2018) estimate that capacity constraints at key locations could constrain growth in their highest growth scenario to 120 million tonnes from 128 million tonnes, a reduction of 6%. In tonne kilometre terms the reduction would be 9%. This would suggest that potential to expand beyond 120 million tonnes is likely to be limited to traffic which does not pass through key pinch points.

3.6.2. This section considers the potential future impact of modal shift to rail from road under two scenarios. The first scenario is to consider the potential for rail freight volume to grow over the next 26 years, unconstrained by infrastructure; the second scenario is to look at the potential impact of a theoretical new freight rail route, to provide an indication of a possible “maximum rail freight” scenario.

UNCONSTRAINED GROWTH

3.6.3. In considering how much rail freight could grow over the coming years, there are two industry forecasts that could be considered:

- The FMS forecast of 2013 (Network Rail, October 2013) which resulted in a forecast compound annual growth rate (CAGR) of 3% in tkm terms between 2011 and 2033
- The MDS/National Rail 2018 (MDS Transmodal, 2018) rebased forecast, which has a CAGR of 3.1% for tkm between 2016/7 and 2023/4. This is more up to date but only covers 7 years.

3.6.4. Assuming that average payloads on lorries remain the same, using the Mode Shift Benefit approach to estimate the congestion value of saved lorry miles would produce the following annual benefit (2020 values in 2015 prices) based on an unconstrained network:

Table 4 – Forecast congestion value of rail freight based on 3.1% CAGR

<table>
<thead>
<tr>
<th>MSB Value</th>
<th>2016/7</th>
<th>2023/4</th>
<th>2033/4</th>
<th>2043/5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unconstrained Rail Freight Growth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>£630,443,212</td>
<td>£757,177,961</td>
<td>£1,027,506,593</td>
<td>£1,394,348,296</td>
</tr>
<tr>
<td>Low Motorway</td>
<td>£265,449,773</td>
<td>£318,811,773</td>
<td>£432,634,355</td>
<td>£587,094,019</td>
</tr>
<tr>
<td>Estimated Constrained Rail Freight Growth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>£630,443,212</td>
<td>£711,747,283.34</td>
<td>~£800,000</td>
<td>~£800,000</td>
</tr>
<tr>
<td>Low Motorway</td>
<td>£265,449,773</td>
<td>£299,683,066</td>
<td>~£338,000</td>
<td>~£338,000</td>
</tr>
</tbody>
</table>
3.6.5. If the network were essentially constrained to current levels of capacity, the MDS research for NR would suggest that 2023/24 freight volumes would be approximately 6% lower than the unconstrained scenario. It can also be assumed that from 2023/24 onwards rail volumes would be increasingly constrained. By 2043 constraints to rail capacity could reduce congestion benefits by between £250m and £500m per annum.

3.6.6. Using the corridor approach, focused mainly on deep sea containers, the tonnage CAGR for ports’ intermodal traffic in the MDS study is 3.7% (this value has also been used for the DIRFT to Scotland flow). Using this figure suggests that much greater numbers of lorries would be removed from the selected corridors. For instance, the number of lorries transferred to rail on the A14 would increase from 1,100 per day to 3,000 per day by 2043, and for the M6 the number removed would increase from 1,500 per day to 3,900 per day.

3.6.7. Regarding overall traffic growth, rail freight would reduce traffic on these sections by 2% to 3% in vehicle numbers, equivalent to a 4% to 6% reduction in terms of PCU. Increasing traffic by the equivalent of 4% to 6% may not seem significant, but it equates to 4 or 5 years of general traffic growth, and would mean major capacity improvements might need to be brought forwards by 4 to 5 years if rail freight was not used.

**MAXIMUM MODAL SHIFT**

3.6.8. A more dramatic development would be to create a dedicated rail freight corridor from Kent (for the Channel Tunnel and Dover) to Scotland, able to carry road freight trailers. This could offer several bypass opportunities for hauliers:

- Channel ports to North of London (M25 bypass)
- London to the Midlands (M1 bypass)
- Midlands to Scotland (M6 bypass).

3.6.9. This is not a proposal or recommendation of this report – although major rail freight infrastructure schemes along this corridor have been proposed in the past – but is being used to illustrate the theoretical maximum benefit of modal shift on congestion.

3.6.10. Even operating at half of its full capacity, such an operation could virtually eliminate long and medium distance lorry journeys from the most congested sections of the motorway network. With 100mph capability and no need to stop for drivers’ breaks, access to and between markets would be greatly improved.

3.6.11. Further work would be required to calculate the impact on congestion, but at the very least such a system could postpone or avoid the need for large scale investment in road improvements.

3.7. **CONCLUSIONS ON MODAL SHIFT**

3.7.1. Movement of goods by rail or water offers significant environmental and safety benefits over movement by road. In addition, using rail and water freight services is a key element of some businesses, which, if an alternative to road freight was not available, would come under significant pressures or even cease operation.

3.7.2. In terms of impact on congestion, almost every tonne of rail or water freight lifted means less traffic on roads. Every lorry mile avoided has a value, which is crudely expressed in the congestion element of the Mode Shift Benefit, which has a strong link back to traffic modelled impacts. The value of congestion savings generated by rail freight currently lies somewhere between £265m and £637m per annum. This could increase to £587m to £1,394m per annum by 2045 if rail freight grows in line with industry forecasts.

3.7.3. Assessing the actual impact on congestion for sections of road would require more detailed modelling, and would particularly depend on assumptions on the time of day that additional HGVs would use the roads.
However, any increase in HGV numbers will slow road, and on some sections this will lead to capacity being exceeded, bringing forward the date when road improvements might be required.

3.7.4. Measuring the impact of lorry journeys avoided on specific sections of motorway is complicated, also depending on what other measures are taken to improve road capacity to meet growing demand for car traffic. However, diverting container traffic from rail to road would have a significant impact on the M6 around Birmingham, and would also accelerate worsening congestion on the A34, M3, and A14.

3.7.5. In London, without rail freight, 40% of London’s building materials would face a changed, extended, and more costly journey, leading to more lorry traffic in central London, particularly during the morning peak.
4. SIZE OF THE OPPORTUNITY TO REDUCE ROAD VEHICLE UNDERUTILISATION

4.1.1. Key to reducing empty running is understanding which journeys that run empty or under capacity are potentially available to carry more goods, and which goods are available to be carried on those routes. Companies must strike a fine balance to ensure intermediate and final legs are better utilised while still ensuring the fleet’s primary role, i.e. delivery, is protected and optimised. For many operations this is a challenging objective. Generally, the shorter the loaded journey, the more difficult it will be to find a return load without significant empty triangulation links. For other operations there are physical constraints to returning loaded – for example the need to wash tanks when changing commodity, or to sterilise trailers to carry food.

4.1.2. For the loading factor there are more variables – including vehicles which operate with multiple deliveries or collections, and vehicles carrying light weight products which fill the lorry in cubic space terms but not by weight. Mixing loads with different commodities or for different customers is an added complexity when trying to maximise fill.

4.1.3. The DfT study into freight collaboration (TRL, 2017), discusses empty and under capacity running and references several studies which highlighted that the real opportunity to carry goods on empty lorries is far less that the 29% popularly quoted. The report cites examples such as the Fast Moving Consumer Goods (FMCG) sector where the realistic opportunity is much lower, citing incompatible loads and shorter journeys, making filling the load on route back to the depot not financially advantageous. This is explored in McKinnon and Ge’s study in 2006 and Palmer and McKinnon work in 2011. Both concentrated on the FMCG sector, such as soft drinks, toiletries, and processed foods.

4.1.4. McKinnon and Ge’s report concluded that approximately 2% of empty journeys could be backhauled resulting in a 2% reduction in kms driven (McKinnon and Ge, 2006). This is a far cry from the near 30% previously quoted in other studies. This is in part because the McKinnon report takes out the loads that are not compatible with load sharing e.g. short (less than 100km) multi-drop journeys. In contrast, the later Palmer and McKinnon research identified an opportunity to reduce kms driven by 7.9% through backhauling (Palmer and McKinnon, 2011). However, this could be achieved only if time constraints were relaxed, permitting a greater coordination of delivery and pickup windows and hence greater exploitation of back loading opportunities.

4.1.5. The main limitation is that research found to date on the levels of empty running and the realistic opportunity to gain better utilisation are limited to the FMGC sector and may not be reflective of other industries where the opportunity may be larger (or smaller). as could their potential to remove journeys. In Table 5 empty running data is broken down into business types.

<table>
<thead>
<tr>
<th>Business Type</th>
<th>Percentage empty running</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veh kms (millions)</td>
<td>Rigid</td>
</tr>
</tbody>
</table>

Table 5 CSRGT empty running by business type
<table>
<thead>
<tr>
<th>Mainly haulage</th>
<th>10,601</th>
<th>34.2</th>
<th>29.8</th>
<th>31.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainly own account</td>
<td>8,632</td>
<td>29.8</td>
<td>27.8</td>
<td>29.1</td>
</tr>
<tr>
<td>Agriculture, forestry and fishing</td>
<td>241</td>
<td>37.9</td>
<td>40.8</td>
<td>39.7</td>
</tr>
<tr>
<td>Energy and water supply</td>
<td>54</td>
<td>31.2</td>
<td>33.3</td>
<td>31.6</td>
</tr>
<tr>
<td>Manufacture, mining and quarrying</td>
<td>1,568</td>
<td>31.4</td>
<td>33.3</td>
<td>32.0</td>
</tr>
<tr>
<td>Construction</td>
<td>516</td>
<td>37.4</td>
<td>36.2</td>
<td>37.3</td>
</tr>
<tr>
<td>Wholesale, retail trade, repairs and hotels</td>
<td>3,462</td>
<td>27.3</td>
<td>24.1</td>
<td>26.0</td>
</tr>
<tr>
<td>Transport, storage and communication</td>
<td>1,000</td>
<td>22.5</td>
<td>19.8</td>
<td>21.1</td>
</tr>
<tr>
<td>Banking, finance, insurance, business services and leasing</td>
<td>677</td>
<td>31.2</td>
<td>22.8</td>
<td>31.8</td>
</tr>
<tr>
<td>Education, public admin and defence, extra-territorial organisations</td>
<td>15</td>
<td>36.9</td>
<td>-</td>
<td>36.9</td>
</tr>
<tr>
<td>Heath, social work and other community services</td>
<td>1,098</td>
<td>31.6</td>
<td>43.0</td>
<td>33.9</td>
</tr>
<tr>
<td>All business types</td>
<td>19,233</td>
<td>29.8</td>
<td>27.8</td>
<td>29.1</td>
</tr>
</tbody>
</table>

4.1.6. There is evidence that increasing transport costs and the prospect of oil prices rising steeply in the future give companies a strong incentive to improve their vehicle loading. Modelling by Rizet (Rizet, 2012) suggests that doubling the load factor on a ‘heavy duty vehicle’ from 50 per cent to 100 per cent reduces the fuel consumption per 100 tonne-kms from 2.1 to 1.2 litres. This improved loading reduces the number of vehicle movements, cutting traffic levels and easing congestion on the road network (McKinnon, 2015).

4.1.7. Whilst much of the detailed assessments of the scale of empty running is within the FMCG arena, the construction industry offers some further examples worth exploring. Construction is different from other freight movements in that as well as requiring large quantities of material inputs, it also generates significant levels of waste. Both TfL in their Construction Logistics Programme and individual case studies have noted there is potential for reducing empty running by construction vehicles through backhauling waste to points of disposal, reuse, recycling or reclamation.

4.1.8. A study by Winston, from Nelson Mandela Metropolitan University, noted that the logistics of construction materials delivery and waste removal are considered separate businesses. Consequently, the movement of construction materials from the point of production to the point of consumption is uncoordinated with that of waste removal from sites (M Winston et al, 2012). The case study in the report concluded that at least 36% of all traffic resulting from movement of construction vehicles on the roads in Cape Town in general could be removed (M Winston et al, 2012).

4.1.9. As another example, in London 35% of daytime HGV traffic is generated by the construction industry, which equates to 520,000 miles per day (TfL, 2018). TfL’s overarching aim for the Construction Logistics
Programme is to achieve a 5% reduction in Central London construction road freight miles by March 2020. It aims to achieve this in part through the use of Construction and Logistics Plans (CLPs), as is discussed later in this report. However, in London backloading of construction vehicles may be difficult to achieve due to the very short distances between railheads and wharves supplying materials and construction sites.

4.1.10. In conclusion there is much debate as to the scale of the opportunity for reducing empty running, however, it is clear is that the commonly quoted 30% empty is not a fair representation of the size of the prize and that actually a more reasonable figure would be between 2 and 7.9%. This evidence is limited however to the fast moving consumer goods and grocery sector and the opportunity in other industries is less well documented.
5. **URBAN CONSOLIDATION CENTRES**

5.1. **BACKGROUND AND DEFINITION**

5.1.1. As part of the Future of Freight: Managing Congestion study, the NIC requested a review of the evidence on the use of consolidation centres.

5.1.2. Logistics consolidation is a term that describes the use of a physical location that involves multiple inbound part vehicle loads being merged together to create fewer but fuller vehicles for the final delivery to the end destination (whether that be a supermarket, airport, large municipal building such as a town hall, hospital, university or a whole area such as a shopping centre). In recent years the term consolidation has taken on a wider context including procurement (for example shared buyer initiatives), however the purpose of this research is to concentrate on logistics consolidation and the use of a centre or facility. Consolidation can happen within organisations (such as a supermarket consolidation within their own organisational boundaries) or it can mean consolidation products by a 3rd party across numerous companies.

5.1.3. There are three types of consolidation centre:

- Regional consolidation centres (RDC) which have been established by large supermarkets for their own goods, that also house a large warehouse facility and serve a wide geographical area.
- Urban consolidation centres (UCC) which are run by third party logistics operators and are located on the outskirts of a large town or city. Such centres are often located within close proximity to the strategic road network to promote ease of access for visiting supplier or courier vehicles.
- Micro consolidation centres provide a more contemporary operating model and by their nature only require a small operating space and are often situated very close to or inside the area being served. Cargo bikes (and sometimes small electric vans) are the vehicle type of choice for micro consolidation centres, due to the lower operating range of these vehicles. The centres may be characterised with the use of a used shipping container to store a small quantity of goods and the cargo bikes on a small piece of land which is a much smaller scale operation compared to the regional or urban consolidation centres mentioned above.

5.2. **URBAN CONSOLIDATION CENTRES**

5.2.1. This Chapter considers consolidation centres in the urban environment rather than strategic consolidation, which has been proven robustly as demonstrated by the wide spread use of consolidation through regional distribution centres used by many businesses.

5.2.2. The purpose of urban consolidation centres is to reduce vehicle movements in urban areas by receiving deliveries at the consolidation centre and then making the final delivery to the city centre in a dedicated vehicle, which will often be low or zero carbon, so for example instead of six lorries delivering to six retailers, one vehicle makes the delivery to all outlets.

5.2.3. Urban consolidation centres are often cited as being a critical path to enabling more efficient deliveries to urban environments. The recent Transport Systems Catapult study suggest that UCCs can play an important role in helping local authorities to meet emission targets and reduce congestion.

5.2.4. Urban consolidation centres are generally operated by third party logistics operators and located on the outskirts of a large town or city. UCCs are ideally located close to strategic roads to promote ease of access for supplier or courier vehicles.
5.2.5. In terms of scope, UCC can serve all or part of an urban area, or possibly focus on large site or group of sites with a single landlord such as a shopping centre, airport, or hospital.

5.2.6. Studies have shown that the types of locations and prevailing conditions where a consolidation centre is most likely to be appropriate and therefore have the best chance of succeeding include:

- Specific and clearly defined geographical areas where there are delivery-related problems;
- Town centres that are undergoing a major retailing redevelopment;
- Historic town centres and districts that are suffering from delivery traffic congestion;
- New and large retail or commercial developments (both in and out of town);
- Major construction sites. (Brown et al, 2014)

5.2.7. Independently set up consolidation centres are often driven either by challenges in serving the areas (security, kerbspace, loading bay restrictions) or by a requirement of planning permission. However many of the examples are publicly funded operations where a local authority is driven by a need to reduce congestion.

5.2.8. There are a number of studies and examples of urban consolidation centres. Many UCCs operated with some public funding and their long-term success has not been clear, with a lack of consistent evaluation. Some UCCs which are now privately operated and self financing were initially set up with some kind of government funding. Examples are described in the dashboard for consolidation centres in Appendix E, and some of the more well-known ones are summarised below:

### Table 6 Consolidation centre examples

<table>
<thead>
<tr>
<th>Example</th>
<th>Set up</th>
<th>Status</th>
<th>Publicly funded (in part or totally)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bristol &amp; Bath Freight Consolidation Centre</td>
<td>2004</td>
<td>Open</td>
<td>Yes</td>
</tr>
<tr>
<td>Houses of Westminster urban consolidation centre</td>
<td>2007</td>
<td>Open</td>
<td>Yes</td>
</tr>
<tr>
<td>Freight Consolidation Service (LB's Camden &amp; Islington)</td>
<td>2014</td>
<td>Open</td>
<td>Yes</td>
</tr>
<tr>
<td>Southampton Sustainable Distribution Centre</td>
<td>2014</td>
<td>Open</td>
<td>Set up yes, now privately funded</td>
</tr>
<tr>
<td>Norwich Transhipment Centre</td>
<td>2007</td>
<td>Unconfirmed</td>
<td>European Funding</td>
</tr>
<tr>
<td>Regent Street - Regent St.</td>
<td>2008</td>
<td>Open</td>
<td>No</td>
</tr>
<tr>
<td>Heathrow consolidation centre</td>
<td>2001</td>
<td>Open</td>
<td>No</td>
</tr>
<tr>
<td>London Construction Consolidation Centre</td>
<td>2005</td>
<td>Open (concept applied to a new site)</td>
<td>Yes</td>
</tr>
<tr>
<td>Meadowhall Consolidation Centre</td>
<td>2003</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
5.3. BENEFITS OF UCCS

5.3.1. UCCs have been proven to have the following benefits:

- By improving the load factor and using multi drop journeys, business can reduce distances travelled leading to reduced congestion, and improved air quality and reduced carbon emissions
- End user benefits in terms of fewer deliveries, fewer interruptions and less storage
- Improved safety, i.e. fewer collisions, injuries (KSI), reduced conflict with other road users and intrusion
- Increased in-bound vehicle utilisation.
- An opportunity also to disconnect longer distance strategic ‘trunking’ operations from urban delivery, so allowing trunking to be conducted at night when the highway network is more reliable (TTR, JMP, 2010)
- The total kerbside time and space occupied by vehicles making on-street deliveries can be reduced (Brown et al, 2014) with the potential to reduce PCNs
- Reduced wasted mileage from delivery vehicles taking wrong routes, getting lost, trying to find parking space, or missing delivery slots, because the dedicated UCC drivers know the area and the final customers
- Allowing the end user to be more responsive to changes in demand by having stock located closer to the facility. Deliveries can be made daily or on request (depending on the agreed operating model)
- Free up time and boost the morale of staff at the receiver’s end because smaller more manageable deliveries allow them to spend more time on key tasks. Furthermore, deliveries can be arranged for a time that best suits the receiver rather than having to organise a time that suits both the supplier and the receiver. (Scott Wilson, 2010)
- UCCs also have the potential to provide added value services that can benefit the end user which may include activities such as unpacking, hanging, security tagging and re-labelling free up staff at the receiver end. Other added value may be the collection of waste and /or damaged goods that can be taken back to the UCC and recycled, thereby reducing empty running
- Opens up the opportunity to use alternatively fuelled vehicles by being closer to the final customer
- Where there are other restrictions in an area such as Clean Air Zones – where freight suppliers are restricted or penalised for accessing particular areas – can increase the attractiveness of UCCs. (Van Rooijen, T. & Quak, H, 2009)
- Ability to deliver value-add activities – such as enhanced security or off-site storage.

5.4. EVIDENCE OF SUCCESS

5.4.1. TSC identified a number of reports that concluded that there were reduced freight vehicle movements (Allen, Browne, TRL) as a result of UCC, in addition to Choongh-Campbell’s assertions of the reduction in demand for kerbside space which in itself is a cause congestion. (Transport Systems Catapult, 2018).

5.4.2. However, the success of UCCs has been mixed, with a number of studies identifying key barriers to success.

- Financial viability has been the main barrier to successful adoption, with the centres often requiring public sector subsidy to maintain operations. TSC is the first to attempt to quantify all the benefits and costs of the use of an urban consolidation centre.
- The extra ‘leg’ added to the supply chain imposed by the UCC is viewed as an additional cost. The literature suggests that UCCs require large subsidies to support their long-term operation (Browne, M., 2005)
In cases of larger operators or 3rd party logistics a degree of consolidation already happens further up the chain and therefore there is little benefit for further consolidation as loads are already full and service a number of sites.

Adequate transport infrastructure is required to access / egress the warehouse facilities and the lack of sufficient accessibility to UCCs has led to failures in the past.

Results of the use of UCCs and electric vehicles showed that the total distance travelled and the CO2eq emissions per parcel delivered fell by 20% and 54% respectively as a result of this delivery system. However, the evaluation has also indicated that the distance travelled per parcel rose substantially in the City of London delivery area as a result of the electric vehicles having far smaller load limits in both weight and volume compared with diesel vans (University of Westminster, 2011).

5.4.3. Aside from this result indicate that localised improvements in transport activity and associated environmental impacts can be considerable as a result of establishing a UCC. However, at a wider scale traffic reduction and its associated environmental impacts will be less significant. (Browne, M., 2005)

5.4.4. In conclusion, UCCs can to be considered as part of an urban freight plan, however, it is likely that its success is dependent on the specific location (and availability of appropriate land/space) and the nature of the business it aims to serve, and therefore a non-subsidised and sustainable UCC cannot be a universally used solution in all circumstances. In the TSC example the study was able to demonstrate that in this instance the benefits outweighed the costs to the user. Other than this study there is little evidence to say the costs can outweigh the overall benefits to the operator. The success is dependent on the recruitment of users, which if made mandatory, will help ensure its success.

5.4.5. Browne also notes that “focusing solely on the direct monetary costs associated with a UCC and its operation may lead to a misunderstanding about the potential longer-term benefits” and that the longer term and wider impacts need also to be taken into account in appraising individual opportunities. (Browne, M., 2005). The evidence suggests that combining and consolidating can improve the delivery efficiency resulting vehicle size may increase and/or be fuller and so fewer vehicles on the road. Some concerns were noted that it could mean more (albeit more environmental friendly) vehicles (Challenge Panel, 2018). A report in 2011 by the University f Westminster highlighted that more miles were travelled when using electric vehicles due to the lower payload that could be achieved, so whilst carbon is reduced, the impact on congestion could be greater by more miles having to be travelled. That said as can be seen below the examples found demonstrated a reduction on vehicles as a result of UCC and therefore, evidence is mixed.

<table>
<thead>
<tr>
<th>Example</th>
<th>Vehicle reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bristol &amp; Bath Freight Consolidation Centre</td>
<td>Delivery vehicle movements have been reduced by 66% for participating retailers (Bristol City Council, 2006).</td>
</tr>
<tr>
<td>Houses of Westminster urban consolidation centre</td>
<td>No information found</td>
</tr>
<tr>
<td>Freight Consolidation Service (LB’s Camden &amp; Islington)</td>
<td>45% reduction in the total distance travelled by delivery vehicles, resulting in decreased emissions (TfL, No date)</td>
</tr>
<tr>
<td>Southampton Sustainable Distribution Centre</td>
<td>21-35% reduction in delivery visits (these are estimated due to lack of take up) (Citylab, 2018)</td>
</tr>
</tbody>
</table>
Norwich Transhipment Centre | Fuel savings were achieved but nothing reported on vehicles numbers/miles reducing (Civitas, No date)

Regent Street - Regent St. | Vehicle movements to participating stores reduced by up to 85% (Clipper, Undated)

Heathrow consolidation centre | BAA set targets at full implementation of a 66% reduction in the number of vehicles delivering to the airport (DfT, 2002). No information could be found on current status.

London Construction Consolidation Centre | The London CCC reduce vehicle deliveries to site by up to 60-70% (TfL, 2008)

Meadowhall Consolidation Centre | No information found

5.4.6. Success is also dependent on all stakeholders (especially the potential customers) feeling that there is a delivery issue that needs resolved. This can then help with the recruitment of customers where a real need (commercial as well as environmental) is identified.

5.4.7. In summary, there are a number key conditions that need to be met in order to achieve success and need to be in place prior to UCC being introduced:

- Appropriate location – based on location of end delivery point. This may be impacted by the planning guidance and emphasis given to logistics and UCC in local plans
- Incentives in place – i.e. improved service because restrictions have been lifted resulting in improved service to the end customer
- Buy in of users – gaining economies of scale is imperative in order to ensure the financial benefits of an UCC achieved, especially if operated without subsidy
- Benefits of the specific UCC need to be clearly outlined to potential users
6. INCREASING THE SIZE OF VEHICLES

6.1. BACKGROUND

6.1.1. As part of the study, the NIC requested a review of the evidence on the impact increasing the size of vehicles on congestion, infrastructure and other users. As one of a number of interventions, dashboards have been created, however the following section reviews the potential impact of vehicle size.

6.1.2. In the UK, the key piece of research which has influenced the discussion around longer and heavier road vehicles was in 2008 undertaken for DfT by TRL. In Europe a study was undertaken in 2013 on “mega trucks” as defined as any large goods vehicle longer than 18.75m or heavier than 44 tonnes (i.e. over the limits set by Directive 96/53/EC).

6.1.3. Goods vehicles that are longer and or longer and heavier than those currently permitted in the UK are in use, under trial or being considered in several countries and is considered as one of the ways to improve the efficiency of the transport and logistics industry – ultimately providing an opportunity to improve payload. Feedback as part of the call for evidence undertaken by the NIC as part of the Future of Freight commission suggests that regulations limiting vehicle size are a constraint to improving payload (TfL, 2018). The IGD white paper reflects on the fact that they believe higher capacity vehicles need to be considered by Government as such vehicles used in the right circumstances, for example long haul operations, can offer less lorry miles and subsequently reduce carbon emissions (IGD, 2015). In the UK longer trailers (LST’s) have been on trial since 2012 in response to the view that “Making substantial inroads to the de-carbonisation of road freight requires innovation in both vehicle performance and logistics. The single most effective change in the short term is use of higher capacity vehicles” (Professor David Cebon, 2017). Concerns over safety, manoeuvrability, infrastructure and adverse effects on rail freight mean higher capacity vehicles remain a controversial subject.

6.1.4. Using appropriate vehicle for the task being undertaken is cited as being a key driver to reducing empty running, therefore improving congestion and efficiency. As well as considering smaller vehicles (which is reflected in the increase in van traffic) or cycles the need for larger, longer vehicles are also a potential opportunity to manage appropriate road use, especially on the SRN.

6.2. LONGER, HEAVIER AND HIGHER CUBE

6.2.1. The impact of longer, heavier and high cube vehicles could have significant other impacts, not least on other users, emissions and on the national infrastructure.

6.2.2. The DfT undertook a study into longer, heavier vehicles in 2006 which study concluded that, depending on the industry take-up, Longer Heavier Vehicle (LHV) usage could lead to a net increase CO₂ emissions by effecting a modal shift from rail, although it revealed that LHVs would result in a net reduction of fatalities due to the overall reduction in vehicles on the roads, and would substantially reduce freight transport costs (although capital investment costs had not been accounted for). The report found there could be several benefits to allowing the extension of existing articulated trailer lengths, creating LSTs (DfT, 2006). As the 2013 European Study shows, there are different conclusions on the impact of modal shift and these are central to the very divergent conclusions that studies reach about the impact of LHVs on infrastructure, road traffic flow, road safety, and greenhouse gas emissions: the benefits accruing from using less vehicles to transport the same amount of goods could be offset or even reverse depending on the magnitude of the modal shift. The study demonstrates the fundamental assumptions that lie at the heart of different analyses, which centre around the choice of ‘elasticities’ that are assumed. Elasticities represent the extent to which changing costs of road
freight affect demand for road freight, rail freight, waterborne freight and others (Directorate General For Internal Policies, European Parliament, 2013). The DfT study concluded that the impact of heavier vehicles would be significant.

6.2.3. The following highlights a number of examples of where LHV are being used.

**Sweden**, along with Finland, already permits LHVs on its roads, and has done so historically. The maximum gross combined weight (GCW) permitted is 60 tonnes, and the maximum length is 25.25m. This maximum weight has evolved over time, from 51.4 tonnes before 1990, to 56 tonnes in 1990, and then up to 60 tonnes in 1993. Swedish roads are classified according to their load bearing capacity. There are three classes (BK1, BK2 and BK3), with the permitted weight of vehicles depending on the load bearing capacity class. BK1 includes approximately 95% of the public road network, and allows for the heaviest vehicles. In built-up areas, there is a larger proportion of BK2 and BK3 roads. The experience in Sweden is that LHVs lead to reduced GHG emissions and vehicle operating costs per tonne-km, with no observed decline in road safety or infrastructure wear. In addition to this, Sweden boasts one of the largest modal shares for rail in its freight market of any EU member state (Directorate General For Internal Policies, European Parliament, 2013).

**Finland**, until the late 1960s, due to its low population density and the large distances involved in transport, did not restrict the length of HGVs. This gave rise to long and heavy vehicles transporting goods more profitably. As traffic increased, dimensions became more of a concern. In 1975 the Finnish authorities limited the maximum vehicle length to 22m, which nonetheless remained more generous than in the rest of Europe. Contrary to the length legislation, the permitted maximum gross combination weight (GCW) in Finland, as in Sweden, has increased in steps as infrastructure has improved and demand has increased. In 1993, the permitted maximum GCW was increased to 60 tonnes. Finnish experience of using LHV combinations has been generally positive. With respect to freight modal split there is no evidence to suggest negative impact as the market share of rail transport is higher than the EU 27 average (25% vs. 19%). As regards safety, the available data gives no indication that long vehicle combinations are less safe than regular vehicle combinations. With regards to infrastructure costs, the critical factor has been found to be the weight per axle. The 2002 study conducted by the Finnish Ministry of Transport and Communications showed that LHVs with the maximum load per axle permitted still have a lower impact than HGVs. Critical to these findings is the importance of even load distribution. Almost all of the advantages gained by using LHVs in terms of emissions, cost savings and road infrastructure wear are contingent on loading capacity being well utilised (Directorate General For Internal Policies, European Parliament, 2013).

**Denmark** introduced a national trial which was initially set to last for three years, running until November 2011. However, in 2010, the Ministry of Transport decided to extend the trial until 1st January 2017. The maximum dimensions set by the Danish Government for this trial are 25.25m for the truck’s length and 60 tonnes for its weight (48 t and 54 t) respectively, for six- and seven-axle combinations, with a maximum axle-load of 10 t. The impact of LHVs have been extensively assessed by the Danish Government, which has contributed €17m to infrastructure improvements to the road network, and forecasts some increased long-term investment in maintenance. However, the infrastructure costs are, in the opinion of the Road Transport Directorate, more than balanced by the benefits in the long-term. Benefits include efficiency savings for transport companies, and reduced environmental impact (Directorate General For Internal Policies, European Parliament, 2013).
6.3. LONGER (NOT HEAVIER) VEHICLES ON THE ROAD

6.3.1. The UK Longer Semi Trailer (LST) trial is considering a number of key areas, which ultimately will reflect on whether the industry use the “extra space” and if so what impact would this have on:

- Efficiency (gaining environmental and other benefits)
- Safety (compared to the trailers they replace)
- Economics (to operators, clients, local economy & national economy)
- Impact on infrastructure

6.3.2. There are number of facets to be considered as part of the change in vehicle sizes. The trial of LSTs in the UK has gained significant insights into the impact of longer vehicles on infrastructure. The following comments have been generated from working directly with the LST Trial project team (Risk Solutions and WSP) using published data. As far as operators’ infrastructure (physical and operational changes) is concerned the trial operators had to assess whether their sites (and their customer sites) were fit for LSTs with little or no modification, and as part of this some sites were deemed to be inappropriate for LSTs. Through the trial process some operators did make modifications to accommodate LSTs – common ones being:

- Assigning defined sets of bays for LSTs – usually at the end of the depot yard to avoid LSTs ‘sticking out’ in a line of otherwise 13.6m trailers
- Repainting / repositioning safety / depot features previously fixed for 13.6m (e.g. walkway lines on road, landing plates for trailer legs)
- Signage
- Warehousing spaces for loads ‘prepared’ are often laid out on warehouse floor in pallet spaces in groups of 26 (single deck trailer) – 30 pallet spaces needed.

6.3.3. In addition to physical changes, sometimes internal systems modifications were also needed, such as software planning loads adapted to allow 30 pallet loads – but only where the assigned trailer is an LST. Operators have also commented to then need to consider driver selection is also a consideration. The trial demonstrated that even on an ‘approved’ route the LST may take specific driver skills or awareness to permit safe passage.

6.3.4. As far as the national infrastructure is concerned for the purposes of the trial – and indeed for some years following any adoption of any longer/heavier designs – the new trailers must ‘fit’ into the existing infrastructure by choosing appropriate routes (for example those that avoid very sharp turns) and as such all LST trial operators are advised to pre-assess routes. Some companies have formalised this process by specifying route and training drivers noting constraints such as:

- Sharp turns at any location including entry to / exit from the end sites
- Turns at junctions with tight lane widths or roadside assets
- Limitations for turning vehicle around if required

6.3.5. This has not been taken forward beyond individual organisations taking it upon themselves to incorporating these constraints and it is noted that the next phase of the LST trial is to consider the policy action needed if LSTs were to be a permanent fixture on the UK roads. This includes what factors or thresholds need to be applied to say whether a road is suitable for LSTs (or indeed, other special trailers like Double deckers) and then what is the appropriate mechanism for embedding those factors into

- route selection (by the operator) or
6.3.6. The 2018 data gathering is looking specifically at damage events and so in 2019 the LST project will have a richer picture of whether the LSTs are involved in more damage incidents than the standard-length trailers in the fleets in which they are being operated. The LST project have been collecting damage data since 2012 and if rear-end shunts are treated as a separate group (which not related to trailer length) then the majority are of course occurring during turning, but the annual report from 2016 suggests that increased risk of property damage collisions compared with standard trailers in the same operator’s fleet, may occur in some situations and this has been a focus for data gathering in the subsequent trial years. Table 7 LST incident figures summarises the latest published data. A new annual report is due to be published, however at the time of writing this was not public.

Table 7 LST incident figures

<table>
<thead>
<tr>
<th>Injury incidents – National</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Collisions</td>
<td>Casualties</td>
</tr>
<tr>
<td>18 (3)</td>
<td>23 (3)</td>
</tr>
<tr>
<td>54</td>
<td>72</td>
</tr>
<tr>
<td>165</td>
<td>237</td>
</tr>
<tr>
<td>0.33</td>
<td>0.30</td>
</tr>
</tbody>
</table>

On a per kilometre basis, nationally, LSTs have been involved in around 70% fewer personal injury collisions and casualties than the average for Great Britain articulated HGVs. (95% statistical confidence level)

<table>
<thead>
<tr>
<th>Injury incidents – Urban (Based on ONS Urban areas - excluding motorways)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Collisions / Casualties</td>
<td>Collisions / Casualties where LST involved on public highways or public access areas (2012-2016) resulting in injury</td>
</tr>
<tr>
<td>3</td>
<td>URBAN Personal injury incidents involving an LST (All – regardless of any ‘LST Related’ judgement)</td>
</tr>
<tr>
<td>117-159</td>
<td>Safety incident rate (collisions per billion vehicle km) over whole trial for urban distance est. of 6-8%</td>
</tr>
<tr>
<td>573</td>
<td>Equivalent rate for all Great Britain articulated HGVs</td>
</tr>
<tr>
<td>0.2 - 0.28</td>
<td>Urban collision rate ratio (LST vs All Great Britain Artics)</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------------------</td>
</tr>
</tbody>
</table>

On a per kilometre basis, considering only operations in urban areas (excluding motorways), LSTs have been involved in 70-80% fewer personal injury collisions, compared with the urban average for all Great Britain articulated HGVs. (95% statistical confidence level).

Damage-only incidents 1 damage-only event reported to the trial for every:

| 1 in 2.8m km | OR | 1 in 23,000 legs |

A small study suggests that increased risk of property damage collisions compared with standard trailers in the same operator’s fleet, may occur in some situations. The sample is too small to generalise to the whole LST fleet. We recommend further work in this area, with a particular focus on issues of drivers’ awareness when operating LSTs (and other less ‘standard’ trailer types) and route familiarity / frequency.

6.3.7. It can be said based on the trial data that whilst there are some impacts of the trial LSTs in national infrastructure these would appear not to be significant or require significant change if LSTs were adopted. Discussions with Risk Solutions noted that this is on the assumption there will be approved routes, either agreed with authorities or via operations own planning departments as some roads will be unsuitable (as there are with existing HGVs). It is also worth noting that damage is a key focus for the 2018 report.

6.3.8. Other impacts

- There will have been a direct safety benefit of around 5% reduction in collisions, equivalent to around two-three collisions and, three-four casualties, saved during the period of the trial (to date) using LSTs rather than standard 13.6m trailers due to the reduction in the number of journeys (Brand, 2017).
- It is worth noting that the instance per km is lower partially because they are being careful and this is a trial and that this may be different if LSTs were made a standard option for operators.

6.3.9. While LSTs could reduce the demands placed on key parts of the SRN, rail and sea also play a significant part in the national transport strategy. Greater use of rail and waterways is recognised through Government policy as being an important driver of sustainability as well as offering greater modal choice for businesses. The research into the impact of LSTs on rail freight suggested that, higher vehicles (double deckers) represent greater competition for rail for the freight maker, and that there are other factors at play that impact the use of rail for freight that is not a factor of the adoption of LSTs (WSP, 2018).

6.3.10. The pre-trial estimate (of emissions reduction) was of a saving of 3,000 tonnes of CO₂, from the operation of LSTs during the 10-year trial. Since the trial was launched in 2012, the environmental impact discussion has moved on from a focus primarily on carbon, to the combination of carbon and air quality. While the average saving in distance and journeys of just over 5% provides a rough proxy for all emissions savings, there will be factors other than distance to consider, including the types of engines in use and road speed. With the datasets now gathered the next phase of the trial (results to be reported shortly) will consider the wider impact on emissions (Risk Solutions, 2017). The percentage saving for operators does vary with some highlighting a
potential dis-benefit. However, in the real world those operators at the lower end of savings wouldn’t run LST’s. The following case study examples how a business has been impacted by the use of LSTs.

Wincanton is running 16 longer semitrailers (LSTs) with a further 53 on order, under licence from the DfT. The fuel and emissions per unit load are expected to be up to 15% less than a standard semi-trailer. The LSTs, developed with Don-Bur, come in two lengths, a 15.65m trailer, which can take two additional rows of pallets, and a shorter 14.6m version. Wincanton has worked with the manufacturers to ensure that the trailers are safe and drivers can adapt to the new handling requirements. The rear steer back axle helps to prevent poor tracking of the tractor and corner-cutting at junctions. Wincanton is also working with the Cambridge Vehicle Dynamics Consortium on active rear steering which uses an on-board computer to provide a ‘path-following’ steer system on multiple axles. Wincanton has a diverse and complex operation which presents opportunities and challenges for the use of LSTs. LSTs have great potential to remove vehicles from the road, and will be well suited to volume-intensive loads. However, fully integrating LSTs into the fleet depends upon identifying the correct loads and on effective planning to make sure they are optimised. LSTs cost around 20% more and weigh around 250kg more than a standard trailer but are more fuel per unit carried when used optimally. Wincanton believe optimised LSTs can offer a 15% fuel and CO2 saving. To achieve more, Wincanton identified that it needs more time to integrate the LSTs into their operations and then to consider the right product portfolio to match the enhanced capabilities of the vehicle (FTA, 2013).

6.4. HIGHER CUBE – HEIGHT AND VOLUME

6.4.1. There are, on average five bridge strikes a week, however these are not limited to double decker trailers. Use on motorways and most parts of the SRN are common place. Operations do need to plan routes as some bridges will be too low for double deckers. Any increase in height beyond the current double deck height (up to 4.9 meters) would not be possible without significant changes to the road infrastructure e.g. bridge heights on motorways. In addition, there are some perceived risks with double deckers and the HSE has researched good practice in the safe use of double deck trailers and has identified measures that operators can take to reduce the risks inherent in using double deck trailers those being:

- loading risks,
- delivery planning (to avoid physical restrictions)
- manual handling and
- working at heights (HSE, 2018).

6.4.2. HGVs are inherently more vulnerable to rollover than passenger vehicles and rollover may occur for reasons unrelated to the geometry of the vehicle itself or the loading configuration, however double-deck vehicles share certain characteristics which may increase the risk of rollover:

- Higher centre of gravity
- Drivers may not be accustomed to driving double-deck vehicles and enter corners too quickly
- Vehicles typically loaded with roll cages, which are likely to roll if not loaded correctly

6.4.3. The following case study example shows how business have considered how to improve load efficiency.

Marks & Spencer became the first company in the world to use a revolutionary, new articulated trailer, whose teardrop shape reduces CO₂ emissions by 20%, when compared to a standard cab-trailer fleet operation. The lightweight trailer can carry up to 16% more load than a standard trailer. Its aerodynamic shape also delivers a 10% fuel saving. This dispels the long-held belief in the trucking industry that you
cannot improve fuel efficiency without compromising load capacity. At the time of launch M&S’ 141 Teardrop™ trailers were said to reduce its carbon footprint by 840 tonnes every year. Simon Ratcliffe, General Merchandise Logistics Director at Marks & Spencer commented: “The Teardrop™ trailers are another step in our efforts to take our UK and Irish operations carbon neutral under Plan A, M&S’ five-year eco-plan. Don-Bur’s revolutionary design has helped us not only reduce fuel usage and carbon emissions, but also allows us to carry more stock per trailer, cutting the number of journeys we need to make." (Don Bur, 2018)
7. IMPACT OF CONNECTED AND AUTONOMOUS VEHICLES (CAVS)

7.1. BACKGROUND

7.1.1. As part of the study, the NIC requested a review of the implications of CAVs for the freight industry and its operations (i.e. parking space reductions, driverless vans/HGVs). This Chapter provides a review of this area.

7.1.2. Transport is on the cusp of a revolution largely driven by digital technologies. The connectivity of vehicles to each other and to networks provides for hitherto impossible network management and customer experience improvements. That digital connectivity provides (in part) the foundations for automated and ultimately autonomous solutions. In parallel the move towards de-carbonisation of transport is resulting in innovations in alternatives to petrol and diesel, hybrid technologies, battery and hydrogen solutions. The pace of change is considerable, driven by academic research, industrial innovation with private funding and pump-primed Governmental investments.

7.1.3. However, the rate of change is hugely variable with innovations in road and rail developing at different rates as well as differentials in technology innovation between light and heavy-duty applications. Whilst, for instance, electric cars and vans are becoming increasing commonplace, technology development is for HGVs is less developed. Similarly, the focus for automated and autonomous technologies has been the car with only a few notable exceptions considering application for trunk haul freight applications.

7.1.4. Whilst it could be argued that this innovation disparity is driven by commercial drivers (such as the scale of the international car market and the need to retain market share) the ultimate benefits for domestic and industrial use could be very similar.

7.1.5. We summarise the primary principles of technology change as follows:

- Digital connectivity – provides the foundations and building blocks for improved safety features, integration with traffic control, information and other systems and provides improved communications and information for drivers. In the UK, significant investments are being made in ‘connected corridor’ pilots to develop and test functionality that provides enhanced in-car / in-cab information to drivers with a view to improving network efficiency. Ultimately digital connectivity could reduce the need for roadside / rail side infrastructure moving control and other information to the drivers’ dashboard display. Digital connectivity between vehicles is the foundation for road freight platooning applications where following vehicles are under the control of lead driver.

- Automation (and ultimately autonomous operation) – automated driver assistance has been an incremental addition in vehicles of all types over recent years. These aids make for an easier driving experience (less stress, improved safety) as well as providing improved operational efficiencies such as fuel savings. As these aids increase in complexity and number we start to approach autonomous functionality where vehicles drive themselves for part or all of the time. Autonomous cars are a reality with numerous pilots and tests being undertaken around the world and a limited number of freight trials have also been undertaken. Trials of autonomous freight trains have been undertaken and autonomous trains are operating as part of the Thameslink core in London. Airborne freight applications for light loads are in development as are autonomous shipping applications. Autonomous vehicles (of all modes – road, rail, air and sea) potentially reduce costs (by removing the driver), provide safety benefits (the aim being to significantly reduce errors) and provide wider operational benefits in terms of asset utilisation and the ability to operate 24 hours a day.
The safety benefits are particularly important for lorries. Accidents involving goods vehicles have a high rate of fatalities, and result in large delays to other vehicles.

- De-carbonisation of transport – the move away from fossil fuels to zero emission at the point of use for all modes is gathering pace. Over recent years we have seen the application of cleaner fuels such as CNG and LPG. The focus, at a governmental policy and industrial level, is towards zero emission at the point of use – capitalising on battery and hydrogen technologies. Whilst technology is developing rapidly commercial deployment to date has been focused on the lighter duty cycle car / van sector with HGV technology being somewhat behind due in part to the weight of batteries. On rail a significant volume of rail freight is already moved with electric traction (and using Network Rail’s low carbon supplies), numerous hybrid, battery and hydrogen passenger trains are in advanced development but again little on the heavy-duty, trunk haul side. Hydrogen propulsion and advanced battery technology could enable freight applications where weight impacts (and in turn payload impacts) could be minimised. Coupled with advances in vehicle technology is the parallel need to invest in energy infrastructure be that electric vehicle charging points (and associated grid infrastructure) or hydrogen fuelling stations and the associated distribution networks.

7.1.6. Significant investment is being made in these primary areas of transport technology innovation and in the UK policy supports and encourages this innovation and uptake. It is important to remember though that this innovation extends far beyond just changes to vehicles and their use, the connected, autonomous and de-carbonisation agendas have far reaching implications for domestic and logistic applications.

7.1.7. These have broken these implications down into four key areas (as detailed below) drawing out the primary implications and considerations for freight / logistics use particularly the interfaces with adjacent sectors and commercial business and operating models:

- Vehicles and their day to day operation
- Vehicle access and parking
- Freight and logistics operations
- Network Impacts

7.2. VEHICLES AND THEIR DAY TO DAY OPERATION

7.2.1. Ongoing technological innovation within freight vehicles will have implications for the day to day operation;

Connectivity

- Digital applications for freight / logistics applications are well established in terms of vehicle and load tracking, fuel and driver efficiency and just in time delivery. Connectivity between vehicles and the networks they use could potentially improve driver and operator information at times of delay or disruption.
- Network connectivity will help manage supply and demand potentially giving an enriched view of vehicle movement and network capacity helping operators plan journey times with more certainty and network operators understand movement and potential congestion.
- Digital connectivity between vehicles provides the foundations for applications such as HGV platooning which for certain flows / applications could potentially deliver fuel and other cost savings.
- The move towards digital signalling on the railways provides for advanced management of train movements potentially increasing overall capacity. However, the implications for freight trains on heavily trafficked passenger routes are less obvious where differential speeds will continue to be an issue.
Automation

▪ The continuing automation of drivers’ tasks could lead to improved driver experience and safety particularly with regards to collision avoidance – a significant benefit if it avoids incidents involving HGVs
▪ Autonomous operations, for either part of the time or full-time, changes the relationship between vehicles and networks as well as how they interact with other vehicles. The implications for HGV automation are wide ranging and potentially game-changing. Consideration will have to be given to risks on the network including the security of high value loads.
▪ Similarly, autonomous trains change the network / locomotive relationship but with the highly controlled railway environment the risks and challenges are different and arguably easier to control.
▪ Autonomous airborne solutions (drones of light and heavier payloads) potentially introduce a new mode into the freight and logistics landscape with a brand-new set of interactions, risks and considerations which will all need careful consideration in their own right.
▪ Within the shipping sector the automation of barges and ships promises operational efficiencies but also raise potential security and operational risks.

De-carbonisation

▪ The use of battery technology has implications for the duty cycles of both road and rail vehicles where the availability of charging infrastructure could be a factor with regards to established operational regimes. As battery range increases and charging times reduce supporting infrastructure will evolve to meet vehicle needs, this is a potential challenge in itself not only in terms of potential redundancy of assets but also with regards to the ability of the local grid to serve demand.
▪ Whilst hydrogen fuels may avoid some of the issues associated with battery technology a network of refuelling stations will be required at terminals / depots and potentially on the network to meet operational demand.
▪ Fleet renewal rates and the cost of technology will be key drivers in terms of vehicle change. Moves towards vehicle leasing rather than purchasing could potentially accelerate change within the fleet but only once technology is mature enough to meet commercial applications.

7.2.2. It should be noted that due to the expected gradual uptake of technology in the freight sector, driven by fleet renewals and practicality / cost of solutions, that impacts would be phased over time and would vary between freight flows (weight particularly).

7.3. VEHICLE ACCESS AND PARKING

7.3.1. Changes to vehicle technology will also have implications for the places that vehicles access as part of their duty cycles;

Connectivity

▪ Once fleets become digitally connected the potential exists to manage kerb space access and parking assets in more dynamic way matching vehicles (and loads) to the places they need to serve. If integrated systems of allocation and booking are permitted (these are already in existence) loading / unloading disruption can be managed.
▪ Within the context of an electrified fleet digital connectivity could help link vehicles with available charging infrastructure and payment solutions.
Automation

- The move to autonomous vehicles could have major implications for how vehicles access places and how the ‘last metre’ is tackled. Whilst autonomous vehicles could provide the delivery mechanism for many applications how loads are delivered to the customer (from kerb side to office for instance) will change the relationship between customer and operator. Trunk haul operations will be easier to manage with fully autonomous warehousing / logistics eco-systems but how deliveries are made in urban areas will continue to evolve.
- Autonomous vehicles could potentially park themselves at remote parking facilities allowing for a disaggregation between operations and non-productive activities.

De-carbonisation

- Electric charging infrastructure changes the shape and form of parking needs with vehicles needing access to specific types of charging infrastructure. This could place constraints on depot and service station layouts potentially increasing land take and reducing flexibility.
- Impacts of electric charging infrastructure will need careful consideration especially where the grid could be under capacity pressures if large fleets of heavy-duty vehicles need to charge at the same time (overnight for instance).
- Hydrogen fuels avoid the challenges of battery technologies but will need the provision of new fuelling and storage facilities at depots and service stations.

7.3.2. Similarly, the impacts on terminals and the use of kerb-space will change over time, giving designers and planners the opportunity to ‘bake in’ new technology functionality into new facilities as well as considering the retro-fitting implications.

7.4. FREIGHT AND LOGISTICS OPERATIONS

7.4.1. Fundamental changes to the way in which vehicles meet the needs of customers will have wide ranging implications;

Connectivity

- As stated earlier digital systems are already an intrinsic part of many freight and logistics operations. Connectivity between vehicles, networks and operations could provide for enhancing information to improve operational decision making and associated efficiencies.
- The increasing application of IT automation and Artificial Intelligence could automate many existing manual functions. Within integrated end-to-end warehousing and logistics solutions AI will inevitably impact traditional operations moving towards on-demand operational models.

Automation

- The introduction of autonomous technologies into freight and logistics operations could result in a seismic shift in existing operational models. The removal of the driver from the system could result in significant changes to drivers’ jobs, but consideration will be needed to solve ‘last metre’ (as described above).
- Platooning operations could deliver some of the benefits of autonomous operations but will still have human control. Operational challenges will emerge with regards to which flows could be viable for platooning operations
- All forms of automation will potentially impact how depots and terminals are arranged with potential improvements in asset utilisation (as a result of self-parking).
De-carbonisation

- A move to fuels beyond existing diesel applications will have inevitable implications for existing operational regimes. Duty cycles could change in terms of where vehicles need fuelling, and where supporting infrastructure is, thereby disrupting long established commercial models.
- There are also implications in terms of the costs of vehicles, comparative energy costs and the cost of new supporting infrastructure on and off the network. These will all impact ultimately impact uptake.
- With a move to non-mechanised drive trains (as provided by electric motors) maintenance needs could be significantly reduced thus delivering cost savings and potentially increasing asset utilisation.

7.4.2. Operational implications are likely to be driven by the commercial realties and potential benefits that technology brings over and above traditional solutions. The transition to change is likely to slow (rather than a big bang) but intervention by government in terms of policy or financial incentives could accelerate change.

7.5. NETWORK IMPACTS

7.5.1. With a potential seismic shift in the shape and form of the fleets, there are potential wider impacts that influence networks and other users;

Connectivity

- Digital connectivity, especially where all vehicles are connected, could provide for significant network operations improvements. The ability to be able to manage network supply with user / customer demands will enable the dynamic management of the network extending the functionality of measures such as Smart Motorways significantly.
- In a fully connected world the need for roadside / rail side infrastructure will be reduced with control and other information being provided in vehicle thus reducing network costs and maintenance liabilities.
- Connectivity will potentially result in more de-centralisation of control to vehicles, however it needs significant penetration rates for benefits to be realised. Furthermore, the implications of this are potentially less predictable and more chaotic networks where automated re-routeing results in less efficient networks instead of more efficient. This is a change from the current approach aimed at benefiting the network as a whole rather than the individual vehicles. The impact of varying AI systems with differing levels of training and maturity from different vehicle manufacturers may result in less efficient routing and network optimisation (using digital twins and modelling can support in testing the expected impacts). There is a need to improve/change certification and MOTS of vehicles before they are allowed onto the network, as a result further increasing costs and reducing individual ownership. This will also impact upon the freight industry hence we will see fewer individual freight operators and more consolidation in the market place, which potentially has benefits in terms of managing scheduling and route optimisation.

Automation

- The transition to autonomous vehicles is likely to be a major challenge. A mixed fleet of non, semi and fully autonomous vehicles could lead to new risks and potentially change established thinking with regards to network capacity. Management of autonomous vehicles (including freight vehicles) on the road network has yet to be finalised and various concepts have been suggested ranging from autonomous only lanes to dedicated corridors.
- Advocates suggest that automation will deliver safety improvements through the reduction of driver related errors and ultimately increase capacity through the closer running of vehicles.
Under digital railway systems automation could allow for more frequent freight trains but only where there are not differential speeds (with passenger trains) possibly limiting applications to specific routes, times of day or with faster freight solutions.

Advanced Driver Assistance Systems provide benefits in terms of safer networks and travel however significant penetration rates are needed for reducing congestion through closer headways. However, the impact of being able to switch these systems off (which is currently possible) removes the benefit. In terms of ADAS automated braking this occurs primarily because the drivers do not feel they work correctly in wet weather conditions. This probably needs improved certification of systems before rollout and driver training. In general, there is an increasing trend in software utilisation across the industry but poor technology use and understanding from freight operators. Freight operator training is needed to maximise understand and benefits. For example, Massively Open Online Courses (MooC) can improve understanding and knowledge in the freight industry.

**De-carbonisation**

- It is not expected that the move to electric and hydrogen will impact networks per-se but as highlighted above they will impact fuelling and charging needs.
- If vehicle performance changes (in terms of acceleration, braking etc.) this could impact network capacity but it is too early to predict these impacts.
- Wider consideration will be needed as to the potential implications upon the electricity grid and local capacity and how a hydrogen network could be established.

7.5.2. Anticipating change on the network is equally challenging. Change will occur at different rates at different places across the country. Anticipating where infrastructure change should be made will need careful consideration and avoiding potential obsolescence of technologies will be a paramount concern. However, opportunities exist to steer infrastructure development in a way that supports frictionless trade, such as the quicker and wider rollout of the infrastructure required to support vehicle connectivity. For example, Ofcom could stipulate coverage requirements in 5G licence negotiations that drive ubiquitous connectivity across transport networks with potentially reduced impact on government funds and a quicker rate of delivery.

7.5.3. In summary technology innovation in transport is well underway but application (and in turn uptake) is lagging behind that for private car / van applications. Whilst this could be considered a dis-advantage in terms of delivering change and improved outcomes it will allow for many of the fundamental building blocks to be commercially tested and proven at-scale. That said the needs of the freight / logistics sector are very different from the domestic light-duty market and therefore we would suggest the following active interventions between partners;

- Visioning – a shared vision for technology application will be needed between industry, government and network operators to help
- Sharing – the sharing of opinions, data, practical evidence and business imperatives will be vital to success adoption of new solutions
- Collaboration – will be needed between the public and private sectors along with the support of industry bodies to capitalise upon technology innovation
- Integration – the integration of energy, digital and freight operations will be imperative to achieving efficient operations with reduced network impacts
7.6. PLATOONING AND ROAD TRAINS

7.6.1. Road trains – where a single tractor unit will pull multiple connected trailers – are a concept widely used in some countries such as the USA, Canada, Australia, and in Scandinavian countries in Europe – i.e. those where vast distances need to be travelled (IGD, 2015).

7.6.2. In the UK a study into the opportunities of HGV platooning (the linking of leading and following vehicles through connected vehicle technology) is currently underway. This is considered later in this Chapter, under the role of technology. In 2017 the DfT commissioned research to identifying the issues and risks of a UK road based trial of truck platooning technology.

7.6.3. The feasibility study into undertaking a trial was undertaken in 2014 and highlighted that platooning is predicted to bring about significant benefits in terms of safety (casualty reduction), real-world fuel efficiency, emissions (lower CO2), road capacity and congestion (more efficient use of the road space leading to improved traffic flow), and driver convenience. It also identified risks to other users which included:

- Distraction of other road users
- Negative influence on driving behaviour of other road users
- Obscuration of information for other road users (signs, markings, etc.)
- Difficult to overtake
- Prevents other road users from exiting the motorway at desired junction
- Motivation of dangerous driving manoeuvres (e.g. pulling ahead of platoon/in the middle of platoon)
- Increased road congestion (TRL, 2014) which could have associated impacts on capacity and congestion

7.6.4. The feasibility study also suggested that if limited to five vehicles, there would not be an impact on infrastructure, but that if platoons were formed on motorways longer platoons could be used without impact on the infrastructure. The issue of slip roads, prevailing road conditions, impact of roadworks, toll booths, tunnels and bridges with specific weight restrictions would need to be considered as part of the future trial. This implies that there could be an impact (TRL, 2014).
8. THE ROLE OF TECHNOLOGY

8.1. BACKGROUND

8.1.1. Technology improvements in the logistics industry and supply chains have an overarching role in potentially helping to manage freight congestion or the impact of congestion on freight. Technology is sometimes the driver of change, and sometimes a key enabler for other changes such as operational changes.

8.1.2. It is important to consider that transport in all its guises is a means to an end. It connects people with places and the things they need to do, raw materials to manufacturers and goods to market. Over the last twenty years we have seen the explosion of digital technologies opening up new opportunities, new ways of doing things, creating new business opportunities, and this coupled with air quality concerns and the move to a low carbon agenda have led to some significant advances.

8.1.3. Technology has a role to play in all aspects of managing congestion on the network but in many cases this will be interdependent upon vehicle / commercial operations unlike the application of similar technologies for domestic (car-based) deployments.

8.1.4. Some parts of the transport sector have been late to the digitisation agenda but it is now clear that considerable changes are anticipated of the coming decades which will impact every aspect of how people engage with and access their mobility needs, which in turn serve society and the wider economy. The freight and logistics sector has long since adopted digital solutions as a central part of the revolution that has happened as a result of the internet, but this is only part of what will be an increasingly complex landscape.

8.1.5. Allied with this is a changing set of relationships with new entrants influencing the mobility agenda (such as communications, energy, data and vehicle companies) who all have their own commercial viewpoints and the future shape of mobility.

8.1.6. Transport itself is on the cusp of a revolution (largely facilitated by digital connectivity) which is linking customers, the vehicles and services they use, payment mechanisms and networks together potentially creating a hyper-connected mobility eco-system.

8.1.7. Some aspects of these changes are starting to be seen but there are significant and potentially rapid technology changes that could re-shape our networks and how we access and use them. Enabling digital connectivity across modes also has the potential to not only manage supply and demand within individual modes but also across integrated networks.

8.1.8. In WSPs New Mobility Now publication, technology trends have been grouped these technology trends into five principles as illustrated below;

Figure 4 New mobility principles
8.1.9. These trends can be detailed further as follows;

- **Connected - movement of data between people, other people, vehicles, assets and systems** - Digital connectivity is already underpinning many of our daily activities where access to communications networks (fixed or mobile) is possible. Equipping the transportation network (road and rail) with high quality, continuous digital connectivity will aid the delivery of capacity, safety and productivity benefits. It will also provide the foundations (in some use cases) for autonomous functionality. Digital connectivity will in future be essential in providing the digital backbone that will allow many other innovations to be fully developed.

- **Automated (including autonomous) - replacement of ‘mundane’ human tasks with technology including ‘driving’ tasks** - The automated agenda is gathering pace. Within the transport sector autonomous trains have been commercially viable for some time (Dockland Light Rail being a UK example) and advances in computing power and sensor capabilities have led to well publicised advancements in road technology. Whilst full autonomy (Level 5) may well be some way off (2030 and beyond), lower scale applications (Autonomous Emergency Braking, self-parking, lane follow/keep etc.) are available now and manufacturers are suggesting commercialisation of Level 3 vehicles (autonomy with human supervision) in the next few years. Freight vehicle platooning trails are due to commence in 2018 on the Highways England network and autonomous ‘droids’ are delivering groceries in Milton Keynes and South London. Vehicle automation on the roads (and ultimately the railways) will significantly impact how they function and perform as well as having potential impacts on place-making and utilisation of space. Automation is also impacting other sectors, the use of Artificial Intelligence for decision making in service, financial and legal sectors could potentially see the elimination of certain types of jobs which will inevitably impact mobility needs. The use of autonomous vehicles and robotics in warehousing is helping drive the home shopping revolution and robots are being developed and deployed in many hazardous environments to improve human safety.

- **Electric and alternatives - decarbonisation of energy production, storage and consumption** - Alternative propulsion systems in transport are rapidly expanding. Hybrid, self-charging and plug-in electric cars / vans are readily available, hybrid, electric and hydrogen buses are on the UK roads and hybrid and battery trains have been tested on the rail network. Fuel cell electric vehicles (FCEV) are due to be available in the next few years and advances in LGV and HGV technologies will see wider deployment of alternative fuelled freight. This seismic shift away from fossil fuels, driven in part by policies such as
taxation, low emission zones and the planned phasing out of petrol and diesel will lead to new infrastructure needs in terms of electricity generation, distribution and storage (particularly for high load vehicles such as freight) and in the case of hydrogen, new distribution and filling networks. Whilst the benefits are obvious there will be challenges for rapid and wide scale deployment.

- **Shared – the sharing of services vs. traditional ‘ownership’** – The sharing of assets between users has been a developing and disruptive trend in transportation over the last few years. Facilitated by digital connectivity solutions match demand (customers) with supply (available assets or journeys) generally via app-based solutions. Many feature on-account payment systems streamlining the customer experience and some encourage feedback or incentivise positive customer behaviours. Shared access to mobility solutions in the form of bike hire, car hire, taxi or pooled transit and bus offer people alternatives to ‘owning’ a car particularly in urban areas where services are accessible the majority of the time. Many shared mobility solutions are blurring traditional transport modes and testing existing regulatory and other frameworks.

- **Business models – new consumer models of access, consumption and payment** - with the trends above disrupting the traditional models of booking, paying for and access transport and mobility new business models are starting to emerge offering improved customer choice, flexibility and experience. Largely driven by underlying data aggregation such solutions not only simplify ticketing but also proved tailored and personalised travel information. In addition, bundled energy generation and storage solutions are being offered with new electric vehicles offering a completely different mobility model.

## 8.2. TECHNOLOGY IN FREIGHT AND LOGISTICS

### 8.2.1. In considering the role that technology has to play within the freight and logistics sector it is important to consider how these innovations will integrate with existing business models and operations. New technologies such as the electrification of vehicles and the future role of autonomous transport are likely to have major impacts on the nature of freight and logistics operations, how customers (businesses and individuals) interact with vehicles and services and potentially the cost base in terms of human interactions.

### 8.2.2. The trajectories of change are unclear in the heavy freight sector (for both road and rail) given the heavy-duty cycles and in some cases the imperatives of just-in-time and highly sophisticated operations. However, what is clear is that investments in the digital connectivity of the freight sector, investments in automation (including platooning), the ongoing electrification of LGVs and research into HGV applications (including hydrogen) and nascent commercial operations in shared delivery solutions means that the trajectory is set.

### 8.2.3. Whilst changing technology is expected to impact the freight and logistics sector, it is expected to be lagging compared to light duty applications such as for cars and vans, this being largely a function of the heavier payloads and supporting infrastructure needed for HGV operations.

### 8.2.4. There is an inherent danger that existing and future technological solutions could easily become obsolete, with their need eliminated or functionality superseded. The transport technology space is evolving rapidly with both established and new entrants disrupting existing norms and working practices right across the transportation field.

### 8.2.5. With regards to freight and logistics, given that it is a sector driven by commercial (and customer) needs, that decision making will be agile but driven by the desire for robust business cases for investment. This provides network operators with a number of specific challenges;

- **Timeliness** – at what point should investments be made to encourage accelerated uptake of solutions which deliver (for instance) business and wider benefits
▪ **Applicability** – it may not be necessary to support technological solutions in all places, phasing may be more appropriately either on corridors, or in centres or by (in the case of HGVs specifically) flows.

▪ **Funding** – who should be paying, the public sector to encourage innovation and to achieve wider societal benefits and / or the private sector to increase commercial returns and / or deliver efficiencies

▪ **Risk** – who should bear the risk of interventions which could be unproven at scale in the UK (considering UK conditions) and what happens in the event of failure

8.2.6. In addition, we need to consider plausible technology scenarios considering the primary levers of change in various combinations. Such an approach could provide for an informed starting point in considering likely change specific to the needs of the freight and logistics sector and the future needs of our national networks. Such levers could include:

▪ Electrification – the rate of change of electrification of the HGV market

▪ Automation – the likely uptake / applicability of automated technologies to UK freight flows / use cases

▪ Legislative – the likely future framework for technology ranging from light touch to highly specified

▪ Last mile – the shift to a disaggregated freight future with local manufacturing / distribution

8.2.7. There is much investment in technology from a European perspective with the Alliance for Logistics Innovation through Collaboration in Europe, ALICE. ALICE is the European technology platform for logistics, which develops a comprehensive strategy for research, innovation and market deployment of logistics and supply chain management innovation in Europe. Following its mandate, ALICE is providing recommendations for the next Work Program 2018-2020.

8.2.8. ALICE is addressing freight transport and logistics with an integrated perspective in two ways: what to transport and how to transport. It addresses areas such as:

▪ Synchronomodal freight transport,

▪ Urban logistics,

▪ Circular economy & logistics,

▪ Integration of transport and manufacturing to build smart supply chains and

▪ Safety and security issues related to goods trade.

8.2.9. Moreover, logistics is a promising field to leverage the full potential of technologies such as Internet of Things, Big Data, Robotics and Autonomous Systems towards increased efficiency and sustainability of European Industry and also contribution to sustainability, minimising environmental impacts of freight transport and congestion (Alliance for Logistics Innovation through Collaboration in Europe, 2018).

8.2.10. ITS is often a generic term which can mean anything, but for logistics management it can be integrated into assist in many areas. The Netherlands is seen to be one of the leading lights for ITS use where they have focused efforts on the use of ITS in a number of ways:

▪ Optimising the use of road, traffic and travel data

▪ Continuity of traffic and freight management ITS systems

▪ Road safety and safety of freight transport

▪ Integration of the vehicle into the transport infrastructure

▪ Data protection and liability (Ministry of Infrastructure and the Environment, 2017)

8.2.11. In summary the application of technology in the freight sector could deliver benefits with regards to managing congestion on the road and rail networks. They could improve just in time deliveries and reduce the impacts of movements with regards to other users and neighbours. However, the application of technology should not be
considered in isolation and must be part of wider policy and strategy considerations and where appropriate be built into future programmes. Consideration on where best practice can be seen allows for the progressive use of technology based on shared learnings.
9. THE OVERARCHING ROLE OF DATA

9.1. DATA IN LOGISTICS

9.1.1. Management of data in logistics has always been as important as managing the transport of goods for logisticians. Many flow charts for supply chain management show goods flowing in one direction with data flowing between the main activities on the chart.

9.1.2. Effective information flows are not only important for the correct positioning of goods, but also for related processes such as invoicing, handovers between contractors, customs or transport documentation, or dealing with insurance and liability.

9.1.3. Modern supply chain management is extremely sophisticated and often fully integrated with all of the other activities of a business. Scanning a packet of crisps at a supermarket till initiates a chain of actions that ultimately result in a new carton of crisp packets being delivered to replenish the supermarket shelves.

9.1.4. A presentation by the University of Antwerp provides examples of the various types of data that would be used in a typical freight transport business (University of Antwerp, 2018).

- Order Management Systems:
  - Origin, destination
  - Time interval
  - Order characteristics etc.
- Asset Management Systems
  - Loading units
  - Trailer information
  - Truck information etc.
- Human resource planning
  - Availability
  - Certificates
  - Scheduled tasks
- GIS/navigation/communication tools
  - On-board units
  - Mobile devices etc.
- Other (real-time) data/info sources:
  - Road closures
  - Traffic information
  - Terminal delays etc.
- Administrative tools
  - Invoicing
  - Reporting

9.1.5. Business employ a range of tools to manage this information, including, for example, routeing and scheduling systems, delivery management systems, warehouse management systems, and fleet management systems. A major challenge and opportunity for all businesses is to integrate these systems better, and to make their data more transparent and useable across their business.
9.2. **PUBLIC SECTOR DATA**

9.2.1. For the public sector, particularly infrastructure planners and operators, freight is sometimes seen as a difficult area to obtain data. Transport planners have developed complex models of demand and supply to manage infrastructure and plan investments, but principally focus on passenger transport. Typical transport models look at the origin, destination, mode, and journey purpose of people’s journeys. From this information models can predict behaviour when various changes are made such as changed costs or changed journey times. Factors which impact on mode or route choice are also well understood including, for example, passenger attitudes to crowding, and willingness to change travel time to avoid congestion. Census data is the most widely used data source for passenger modelling, but other sources are also used including traveller surveys, spot traffic counts at junctions, passenger counts, and attitude surveys.

9.2.2. In contrast, road freight information available to transport planners is limited to little more than:

- Traffic count data, generally broken down by hour of day and vehicle type (although different types of count use different definitions for goods vehicles)
- Crude data on origin, destination, commodity, load, and vehicle type for UK registered goods vehicles (the CSRGT – based on a small sample size, so origin and destination data is published at region to region level, but can be made available county to county)
- Even higher level data for the movement of foreign registered goods vehicles.
- Occasionally, ANPR data showing the route vehicles take through an area but is limited to the area in which it recorded and there can be issues of data privacy if this information is not sufficiently anonymised.
- Data on registrations of various vehicle types

9.3. **ROAD FREIGHT MODELLING**

9.3.1. A particular effect of the low quality of freight data is that there is little understanding of the way that freight responds to changes, and little understanding of future changes in demand or the flow of goods through supply chains. In many cases, freight responses to transport investments are modelled simply as background movements that may change route, but where demand grows in line with national trends. A particular risk of this approach is that local factors are not taken into account, for example opening or closing or major manufacturing plants.

9.3.2. Corridor models do contain HGV OD information however its level of reliability varies. The more reliable models include HGV trip matrices derived from observed data, conventionally derived from road side interview surveys but more often based on sources such as ANPR, GPS and mobile phone network. The risk with all of these is the sampling rate and whether it is representative of a typical pattern of HGV movements. The surveyed samples are then factored up to observed counts of HGV traffic.

9.3.3. In cases where surveys are not in-scope or insufficient then the HGV movements are derived synthetically (gravity and land use modelling) and/or using other vehicle types/purposes (LGVs and car business purpose trips) as a proxy for HGV OD patterns.

9.3.4. Once a base year representation of HGV movements has been built and validated using information such as ANPR for routeing, HGV counts, and journey time data, they are then forecast typically using the Regional Traffic Forecasts. These are the successor to the NRTF and the DfT has recently updated them from 2015 to 2018. The forecasts are extrapolations based on various socio-economic scenarios of regional growth in vehicle kilometres by vehicle type and road type (all purpose, motorway, trunk road etc.). If details of local land use proposals are known then the forecast can be adjusted from a blanket factor approach to targeting the
growth on where a new warehouse or retail park is situated. TRICs or other trip rate data source is used to estimate the trips produced or attracted to a site.

9.3.5. In corridor models HGV forecast origins and destinations are fixed after forecasting i.e. they only respond to a change in travel costs by re-routing where possible. They do not change destination, reduce frequency, time of travel or mode.

9.3.6. At a national level, the GBFM, operated by MDS Transmodal, underpins freight forecasts. The GBFM contains geographic data on industry and population, as well as CSRGT data, traffic counts (for calibration), and a detailed database of rail freight flows. It has proven to be a reliable tool for forecasting high level demand and mode share. However, like all models of its type, to an extent calibration is based on assuming that future supply chains behave in a similar way to historic supply chains. Much of this study is showing the rate of change in the freight industry is significant which therefore may impinge the value of this model in predicting future freight needs.

9.3.7. For rail freight, Network Rail has a record of every consignment of freight moved by rail, including weight, origin, destination, and commodity. For commercial reasons this data is confidential, and Network Rail only permits its use in an aggregated and anonymised format. In contrast, every train movement is now available for interrogation through various third-party applications, but this does not provide details of payload or commodity.

9.4. PRIVATE SECTOR DATA

9.4.1. In contrast to the poor quality of public sector freight data, there is an abundance of high quality private sector freight data. But making best use of this data is made more difficult by a number of issues:

▪ Even within a company, data is often poorly integrated and not transparent
▪ Data is commercially sensitive and so never published and rarely shared
▪ Collaboration between companies is difficult unless a third or fourth party logistics operator is responsible for the goods of both companies
▪ Data is provided in a wide range of formats, and to differing quality standards.

9.4.2. Other sources of data include GPS and mobile phone tracking data. This is now commonly provided to organisations interested in managing road networks, providing real time indications of congestion. Currently this data is not provided separately for HGV, although exercises have been undertaken using anonymised data for large retailers to monitor hundreds of thousands of movements via proprietary route planning and scheduling software (IGD, 2017).

9.4.3. Real-time and Historical journey time data from aggregators such as INRIX, TomTom, TrafficMaster, Google, Here, Masternaut provide summarised journey time information in real-time/historical datasets. The Masternaut example does have specific freight data within it (from vehicles fitted with the Masternaut telematics devices). Whilst Masternaut has a large fleet, it is still not significant in terms of the overall freight fleet in the UK, however it could inform origin destination datasets for freight. This dataset does not provide information on the type or volume of goods transported.

9.5. USING FREIGHT DATA

9.5.1. The following provides a case study in the use of freight data in the form of a Delivery Management System (DMS) or Delivery Booking System.
A new generation of apps is evolving which are primarily intended to help companies to manage deliveries to busy sites. Examples include construction sites, exhibition centres, or factories. The heart of a delivery management system is a booking tool, which allows companies delivering to a premises to book a slot for delivery. The tool manages slots to ensure that goods are delivered when they are needed, and that the resources required for unloading or reloading will be available. Every delivery is recorded, and processes are put in place to deal with unscheduled deliveries. Detailed management information is provided on the performance of each supplier or each unloading location. Many delivery management systems provide a 'control tower system' that allows all inbound movements to be monitored and managed in real time, often through apps on the delivery drivers’ smart phones.

Delivery management system data is commercially sensitive and therefore treated in confidence. However, the information contained in the data could be extremely useful for transport planners and city traffic managers. For example, London requires property developers to forecast construction traffic and to employ various strategies to reduce demand. But forecasts are developed from theoretical information on materials, and London boroughs do not have the resources to monitor actual performance. Providing access to delivery management systems records would allow deliveries to be monitored and improve the accuracy of future construction traffic forecasts. Control tower DMS data could be provided to traffic managers to provide a real time insight into HGV arrivals into busy city centres.

GPS or phone tracking software could be used to improve the quality of CSRGT road freight data. This information could be used to better plan infrastructure investments, or for real time traffic management. Ultimately, more consistency and transparency of freight data is key to achieving greater collaboration between businesses. Knowing exactly which goods are needed where and when, and what vehicles are making which journeys, provides significant opportunities to use empty space on vehicles, as discussed in the section on collaboration.

### 9.6. BLOCKCHAIN

#### 9.6.1. Blockchain is a Distributed Ledger Technology (DLT), which is a special type of distributed database. Each computer ‘node’ or member in a network stores an identical ‘ledger’ or database. This database takes the form of a chronological chain of unique groups of information called ‘blocks’, hence blockchain. They are securely linked together using cryptography. (Transport Systems Catapult, 2018).

#### 9.6.2. Features of blockchains make them particularly suitable for application to logistics management. The Transport Systems Catapult report asserts that blockchains can enable:

- Traceability and auditability
- Disintermediation
- Smart contracts

#### 9.6.3. These are all fundamental issues for logistics managers. Again, the Transport Systems Catapult report states that some of the main proposed business benefits of using blockchain are:

- Increased collaboration – sharing information and processes between businesses (B2B) and customers (B2C)
- Increased sharing of trusted information – enabling consensus-based validation of information, via a distributed, replicated database, to ensure data integrity
- Increased efficiency – removing duplicated effort by maintaining a common ledger which can be used to manage smart contracts and dramatically streamline processes
- Reduced costs – removing the need for third-party intermediaries as well as the duplicated effort that is required for maintaining separate databases which contain the same information
• Reduced risk – minimising errors and the risk of malicious tampering, with traceable transactions that can show who did what and when to both tangible and intangible assets
• New business models – creating new commercial opportunities and revenue streams, as a result of decentralisation and disintermediation (cutting out the middlemen)

9.6.4. “Global supply chain networks are very complex. Multiple stakeholders (manufactures, land transportation providers, warehouses, freight forwarders, custom brokers, governments, ports, ocean carriers and final customers) need to interact in different operative transactions. Such complexity, especially with multiple data exchanges in the processes, can potentially lead to increased cyber insecurity and unclear visibility such as shadow accounts and tampered goods or data. Blockchain technology could bring collaboration, trusted information, consensus, immutability, and provenance to the movement of value, in this case a physical item, across supply chains. The technology could help reduce inefficiency in the system, through removing duplicate effort across different stakeholders in maintaining separate databases and documentation about the same consignment, automating approvals and removing some intermediaries. A single version of the truth could be established in seconds, rather than hours or days, allowing capacity utilisation to be optimised.” (Transport Systems Catapult, 2018)

9.6.5. Especially in the marine environment there are plenty of examples of where Blockchain is being trialled including:
• Container Logistics Pilot – Port of Rotterdam, Samsung SDS, and ABN Amro
• Port Connectivity Pilot – Associated British Ports, Marine Transport International
• Completion of the world’s first bunker delivery and transaction using blockchain – GoodFuels Marine
• Supplier Management System – DB Schencker, VeChain
• Efficient and secure global trade platform – IBM, Maersk
• Shipment of Almonds from Australia to Germany – Commonwealth Bank of Australia

9.6.6. However, none of these give an estimation of view on the impact of congestion outside of the port.

9.6.7. Blockchain is not the only technology which allows data to be shared across complex supply chains, but it has unique features which have the potential to reduce complexity, reduce cost, and foster new forms of collaboration. It is already being applied to maritime transport, and will also prove valuable for logistics systems where goods are transferred between modes or vehicles en route.

9.6.8. Whilst there are benefits to freight and logistics organisations of using DLT such as blockchain, making the case for sharing this anonymised information for the ‘greater good’ of the network to external organisations such as Road Operators or Transport Planners, is still up for debate. There is evidence the governments are willing to pay for software-as-a-services that include floating vehicle data to manage the road network performance (Magazine, 2018) but it is not clear on whether there is a market for this data outside of these organisations. One final point, the use of DLT to join up data within organisations could lead to increased decentralisation of control with unintended impacts for transport networks and increased difficulties for network wide real-time network management.

9.7. BIG DATA

9.7.1. This is data that has large ‘Volumes, Variety, Velocity and Veracity’. Over the last ten to fifteen years there has been a huge increase in the number of connected devices and data streams that are collected by logistics and freight organisations. This includes cars, smartphones, RFID readers, webcams, blog entries, e-commerce catalogues, sensor networks and many more anonymous data sources. This data is collected at differing data
rates, formats and with varying quality. The benefits are not in the collection and storage of this data but in statistical data mining of the data, using data science techniques, for specific use cases to deliver business value. In the freight and logistics industry areas where big data are expected to benefit include strategic planning, operational efficiency (optimise processes and resource planning and route usage), customer experience (optimise customer segmentation, interaction and service use) and new business models (expanding and creating new revenue streams from data).

9.7.2. The GPS sample includes data from freight and non-freight sources but the sample size does not currently allow statistical significance in terms of freight movements. The origin destination data and what is being carried tends to be obtained from surveys of Transport Operators that are obliged to provide statistical information to the DfT. This is then extrapolated with the GPS data to provide some freight specific statistics.

9.7.3. In this context, blockchain could help as it could provide a platform for sharing anonymised data in a secure way for the benefit of all road users. Linking telematics data with Delivery Management System data could provide a benefit to the UK road users and support short term and longer-term planning use cases and near real-time delivery planning. This could be a voluntary opt in system or, potentially, mandatory. These datasets could support delivery of freight data portals and exchange services. The difficulty would be building trust with freight operators and getting their buy-in.

9.8. CONCLUSION

9.8.1. Accessing, mining and sharing data is key to maximising the potential of many of the interventions discussed in this report, in particular empty running and route optimisation. There is a central role for Government to facilitate the development of data standards that would enable better transparency.

9.8.2. Blockchain and Big Data have the potential to become a disruptive trend in the logistics industry. However, the application of Big Data analytics is not immediately obvious in this sector and there are challenges in data privacy, data quality, technical feasibility and skillset. The particularities of the logistics business must be thoroughly examined first in order to discover valuable use cases. (DHL, Big Data in Logistics, 2013).
10. DIGITAL RAILWAY

10.1.1. Digital railway is the proposal for the UK to adopt modern digital signalling and train control within the next 25 years and create credible options to upgrade the railway to next generation technology as it becomes available. The Digital Railway programme is the industry programme which brings together diverse stakeholders to make this happen. The programme is led and managed by Network Rail.

10.1.2. Examples of these technologies include (Network Rail, April 2018):

- European Train Control System (ETCS), which allows trains to run closer together and travel at their optimal speeds and provides enhanced train protection
- Traffic Management (TM) (linking with other systems such as DARWIN and Crew & Stock), which maximises the throughput that infrastructure can support, improves service recovery and enhances performance
- Connected Driver Advisory System (C-DAS), which provides decision support to drivers in the cab to improve timetable adherence and therefore overall performance
- Supervised Automatic Train Operation (ATO), which provides the ability to control trains to a finer resolution in order to run to the maximum capability of the infrastructure in a more consistent way
- Smart infrastructure, with remote condition monitoring technologies, which will improve performance, reduce disruption and improve safety
- Rolling stock system performance, together with decision support tools, providing predictive faulting, performance and reliability improvements and smarter recovery from perturbations
- Telecommunications, providing the backbone to transfer data and information between systems, to operational staff and customers
- Data, Digital Railway is a data-configurable railway, and therefore a high level of data confidence and integrity is essential, supported with the appropriate cyber security and business continuity processes.

10.1.3. Use of new technology is expected to enable shorter freight journey times, greater capacity for freight operations, more flexibility to respond to short-term needs, and higher speeds thus reducing delivery times. The access requirements of FOC fluctuate, necessitating short term planning and re-planning. This can be difficult to arrange alongside passenger services, but it is the sort of challenge that digital technology could help to overcome. The single greatest obstacle to these goals is the "go anywhere" nature of freight operations and the consequential need to fit the majority of freight locomotives as soon as ETCS roll out on the infrastructure commences. The concept of "targeted implementation" of ETCS, could prove particularly problematic for freight operators except where clear freight corridors or captured fleets can be managed.

10.1.4. In addition to claimed capacity benefits, the Digital Railway is expected to support greater flexibility for freight operations at three levels:

- **Short term:** Day to day / hour by hour. Train operations in the UK are relatively simple – there is no wagonload network, and most trains operate as full trains returning from destination to origin. However, short term timetable changes are required, and offering a more flexible short-term planning option may be useful for some freight businesses.
- **Medium term:** Month by month / week by week. On a medium-term basis, the Digital Railway identify trends in freight movements, and support operators to take medium-term decisions to plan new routes, modify rolling stock deployment, defer routine maintenance, employ extra staff and take other measures to alleviate pinch points and help manage high-useage periods. Again, though, this may have minimal applicability to the UK.
10.1.5. All of this means that rail freight could be a beneficiary of the Digital Railway. The safe and efficient pathing of non-timetable routes using traffic management functionality would allow real time, short term interjection of routes to respond to the variability in freight demand.

System Development

10.1.6. Before freight can participate in The Digital Railway some critical problems need to be resolved. The variable length, weight, performance and 'go anywhere' nature of freight trains presents a problem to operators as the performance and safety related data which they will need in their onboard computers will vary from route to route and train to train. This contrasts with passenger trains that tend to run for their whole operational lives on a specific route at the same weight and length.

10.1.7. Train integrity - the knowledge that all carriages or wagons are attached and where they should be - is a problem not encountered by most passenger services where a 'train line' automatically checks that all the carriages are connected. For freight where the number and type of connected wagons may vary according to the dynamic freight transport requirements means that a solution to this issue needs to be found.

10.1.8. The requirement for freight routes to be agile and respond to a dynamic end user environment presents problems in a system where train paths are allocated and managed according to a planned timetable which, for operational reasons, needs to be agreed some months in advance.

10.1.9. All of these issues have potential solutions. They have not been progressed to full maturity at this stage. If the political, commercial environmental and social will is brought to bear on these issues it is very likely that the solutions could be put into practice over the next 3 to 5 years thus supporting the roll out of the Digital 3.

Current Status

10.1.10. The Digital Railway Programme recognises that freight is an important component of the rail transport network. The Digital Railway Programme is working hard at consulting with freight community to ensure their voice is heard. Greater collaboration especially with smaller freight operators, will undoubtedly help in building the consensus and support that is so essential if the Programme is to be a success.

10.1.11. The commencement of freight "first in class" fitment is positive evidence of the development of a digital railway to support freight transport. A long-term fitment programme for freight has been created using initial DfT funding. Siemens Rail Automation has a contract for fitting 750 freight locos. Initially this will be focussed on most heavily used locos. Wider fleet roll out will take place from 2022 onwards. There are 20 FiC designs with a programme from 2022 to 2028. The programme is fully costed with long term price efficiencies secured.

10.1.12. Partnerships and efficient use of rail freight opportunities are important to harness the full potential of the Digital Technology. For example, DHL works closely with rail equipment manufacturers to combine multi-supplier consignments into their factories - inbound-to-manufacturing (I2M) logistics - to effectively reduce the number of freight journeys. This makes the entire inbound supply chain more transparent, improves production planning, and reduces carbon emissions. It is also important to identify return loads. After delivering one
shipment, a carrier can collect another and thus minimise empty runs. For example, after delivering raw materials from a supplier to a rail manufacturer, the same truck can be refilled and dispatched from the plant to deliver finished goods to a warehouse or perhaps scrap metals to a recycling centre.

10.1.13. As part of its long-term partnership with Network Rail, DHL has successfully utilised transportation efficiencies such as these. Within just one year of implementing combined consignments and return loads, Network Rail was able to eliminate an annual 885,000km of road transportation, cutting the equivalent of 750,000kg of CO2 emissions.

International rail freight and case studies

10.1.14. There are a number of very successful applications of Digital Technology which are expanding the use of rail freight. A very successful international example of new technology (specifically the European Train Control System (ETCS) Level 2), serving freight opportunities is the Etihad Rail 264km stage 1 connecting gas fields in southern Abu Dhabi with the port of Ruwais as part of the Gulf Cooperation Council GCC railway programme covering the seven Gulf states. Further extensions which will bring the overall length to over 1000km are already planned or in the pipeline.

10.1.15. European initiatives and a drive to increase rail freight across Europe is an important factor. The European Rail Freight Corridor regulation 913/2010 is committed to the alignment of rail freight corridors with ERTMS corridors.

10.1.16. Examples of European Rail Freight developments are:

- InfraBel the Belgian Train Operator is implementing Digital Technology on the so called European Corridor C connecting port of Antwerp to the European mainland.
- DB Cargo has launched an international project to equip 1200 of its locomotives with ETCS by 2026 with aid grants from the European Union. The vehicles to be fitted will operate on the core network corridors across Germany Belgium and France and in the Netherlands. Further grants from the EU will support fitment of ETCS to freight locomotives in Sweden and Italy from 2018 to 2023.
- Similar alignment plans in the UK to ensure that freight corridors are aligned optimally with the deployment of ETCS and other digital technology would enhance the implementation if rail freight and be a platform to deliver reduced congestion and the subsequent negative environmental impact of road freight transportation.

10.1.17. Another issue affecting freight operation is the axle load or weight of freight locomotives and wagons. Experts from the University of Huddersfield's Institute of Railway Research (IRR) have announced an ambitious plan to double the amount of freight carried by trains across Europe through the development of lighter-weight bogies. This would enable freight to be transported on a wider selection of routes.

Capacity Benefits

10.1.18. Despite all the promise of a wide range of capacity benefits to be delivered by the Digital Railway, there is currently no evidence available to demonstrate the scale of freight capacity improvement, if any.

10.1.19. There is strong evidence that digital signalling can allow passenger services to operate closer together, particularly where the trains concerned all have the same operating characteristics. Modern metro systems could not offer the high frequencies that they do without digital signalling and automatic train control.

10.1.20. However, on mixed traffic railways with numerous junctions and conflicts, there is currently no evidence of the extent of capacity benefits, particularly for freight. Running trains more closely together may deliver additional
paths on busy sections of line, or longer gaps between trains on other lines, but the ability of freight services to utilise the additional capacity needs to be tested.
BIBLIOGRAPHY


Campaign for Better Transport. (2018). Lorries are only paying a third of the costs they impose on us all.

CBRE. (2014). 50% Rise in Gridlock Costs by 2030.

CEBR. (2017). The Economic Effect of Road Investment.


Civitas. (No date). Freight Measures within Norwich’s CIVITAS Project.

Clipper. (Undated). Regent Street Delivery Consolidation Scheme.


DfT. (2017). *Percentage of journeys on Highways Agency roads that are 'on time'*.

DfT. (2017). *Road traffic (vehicle miles) by vehicle type and road class in Great Britain*.


DfT. (Date unknown). *DfT Benchmarking Guide*.


Greater London Authority. (June 2018). LOCAL AGGREGATE ASSESSMENT FOR LONDON.
ITC. (2017). How can we improve urban freight distribution in the UK?


M Winston et al. (2012). *Evaluating truck empty running in construction: a case study from Cape Town, South Africa*.


SKM Colin Buchanan. (2012). Assessment of capacity allocation and utilisation on capacity constrained parts of the GB network.


TfL. (Undated). The London Boroughs Consolidation Centre—a freight consolidation success story.


TTR, JMP. (2010). *Tactran Freight Consolidation*.


