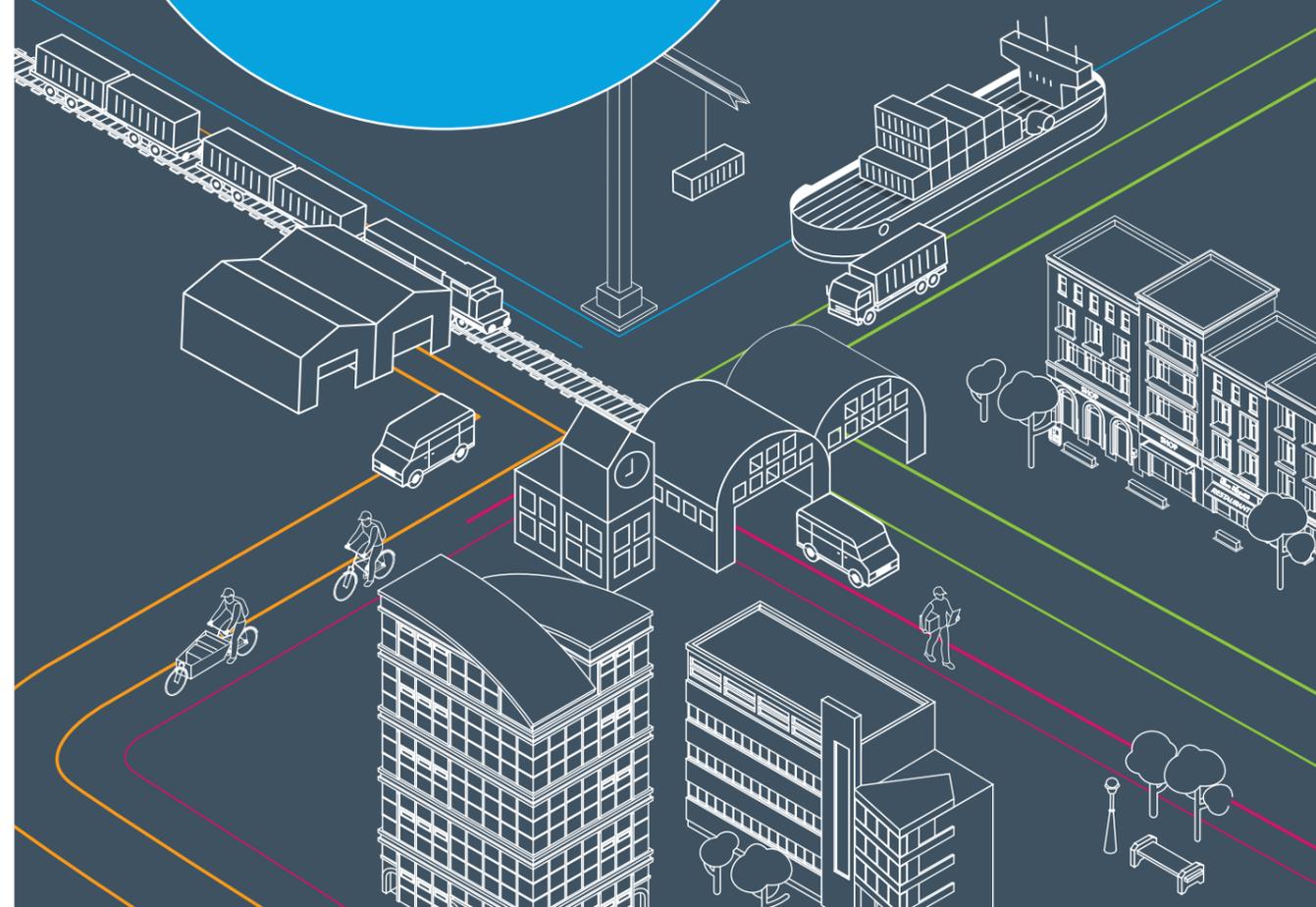


DELIVERING A GREENER FUTURE



Wellington House,
40-50 Wellington Street,
Leeds LS1 2DE

T 0113 251 7204
E info@urbantransportgroup.org
www.urbantransportgroup.org



**URBAN FREIGHT AND
THE DECARBONISATION
OF THE CITY REGIONS**





The Urban Transport Group

represents the seven strategic transport bodies which between them serve more than twenty million people in Greater Manchester (Transport for Greater Manchester), Liverpool City Region (Merseytravel), London (Transport for London), South Yorkshire (South Yorkshire Mayoral Combined Authority), Tyne and Wear (Nexus), West Midlands (Transport for West Midlands) and West Yorkshire (West Yorkshire Combined Authority). The Urban Transport Group is also a wider professional network with associate members in Strathclyde, West of England, Tees Valley, Nottingham, Northern Ireland, Wales, and Cambridgeshire and Peterborough.

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EXECUTIVE SUMMARY

1

Our city regions rely on the smooth movement of goods to keep supermarket shelves stocked, hospitals supplied with medicine and other equipment, to deliver construction materials and support thriving economies. However, the current dominance of road freight, using largely fossil fuelled vehicles, produces many negative impacts for our cities, from road danger to air pollution and carbon emissions, and from damage to highway infrastructure to noise. This report sets out the role for freight in decarbonising city regions and the need for freight to play its part in creating urban areas that are greener, fairer, happier, healthier and more prosperous places.

There are many innovations in the freight sector helping to make operations safer, more sustainable, quieter and more efficient. Our report sets out examples from across the industry including conversion of passenger trains to support high speed parcel delivery to city centres; urban consolidation centres in the public sector; use of riverboat services to deliver medical supplies to the NHS in London; zero emission vehicles in local authority fleets; and the use of technology and data to make deliveries more efficient. However, while there are numerous examples of excellence across the sector, we need sustained support at a local and national level to encourage modal shift to rail and water, decarbonise road freight and improve road safety.

We need to encourage more freight to be moved by rail and water wherever possible. To support this, the fiscal regime for road haulage should be reviewed to ensure the industry covers more of its direct and indirect costs and to incentivise safer and greener operations. This would help to level the playing field with rail and water and improve their competitive position. At the same time, we need a more interventionist approach to rail freight to incentivise the sector to widen the scope and extent of the services it offers. By strengthening the rail and water freight sectors, we can enhance

the resilience of the whole freight sector, improving its ability to manage shocks, such as the driver shortages seen in 2021.

Road freight currently accounts for almost 80 per cent of goods moved in Great Britain and, even with more substantial modal shift to rail and water, road freight will continue to be essential for moving goods. For road freight to play its part in prosperous, decarbonised city regions, there needs to be a rapid shift to low and zero carbon operations. National Government needs to develop a roadmap for the decarbonisation of heavy goods vehicles and for delivering the support infrastructure necessary. Local Authorities have a role to play in decarbonising their own vehicle fleets, supporting local businesses and consumers to make the transition to zero emission vehicles and installing charging infrastructure, with support from central Government. Cycle logistics can also help to reduce the impact of last mile deliveries and continued support for cycle infrastructure can make cycle logistics more attractive, safe and efficient.

Goods vehicles have a disproportionate negative impact on road safety, being involved in a greater number of serious and fatal collisions per distance travelled. A review of the regime for road safety is needed which recognises this. We need a commitment to world leading safety standards and quantitative targets for reducing collisions. Enforcement of standards and measurement against targets requires resources and funding, either through existing institutions, such as the DVLA, or through a new body with responsibility for safe freight operations or for road safety as a whole.

If improvements can be delivered across these key areas, then freight can play its part in decarbonised urban transport systems as well in wider visions for shaping cities that people want to live, work and spend time in.

INTRODUCTION

2

The freight and logistics sectors are the backbone of our economy, transporting goods and materials from point to point. From the food in our supermarkets, to the fuel in our pipelines; office supplies to raw materials; electrical goods to medicines; and from small parcels to bulk consignments. In 2020, 1.27 billion tonnes of domestic goods were lifted within the UK¹.

By road, rail, water, air or pipeline; on cargo-bikes through to heavy goods vehicles and container ships; freight and logistics are essential to our city regions, which are often the ultimate destination for goods. The way these goods reach our cities and how they are

distributed has a profound impact on the quality of places and the lives that people live.

Freight forms part of a much wider debate about what kind of cities we want to live in and how we want them to look and feel. This report presents a vision for safe, smart, clean urban freight which maximises the benefits, and minimises the negative impacts, for local economies, the environment and communities.

We need freight and logistics to play their part in decarbonised city region transport systems and support urban areas that are greener, fairer, happier, healthier and more prosperous places.

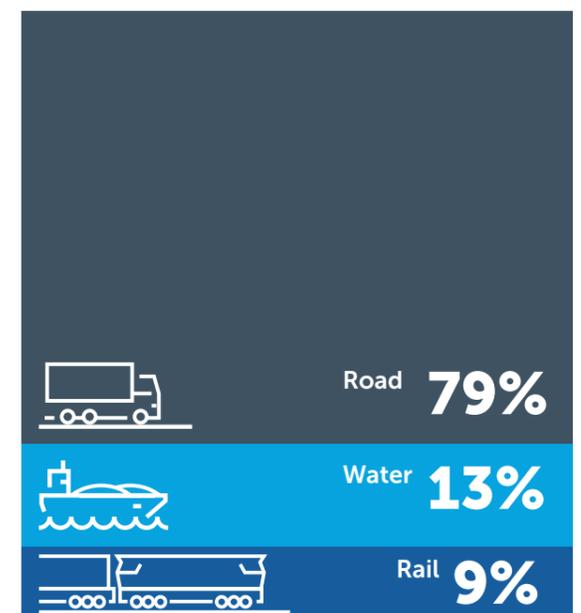
DEFINING FREIGHT

We define freight transport as: *“the carriage of goods between an origin and a destination for commercial reasons because goods available at one geographical location are required at another location for processing, storage or consumption.”*² Freight transport forms part of logistics – a broader concept that involves designing and managing supply chains, including purchasing, manufacturing and storage as well as transport³.

This report focuses on freight transport, rather than logistics, but attention is also paid to how goods are consolidated and stored as these facilities act as important nodes in the wider freight network.

As the chart opposite illustrates, most freight in Great Britain travels by road (79% in 2019)⁴. This has increased since 2015, when road accounted for 74% of goods moved in Great Britain. Rail has remained at the same level as 2015 and water has decreased slightly, from 16% in 2015 to 13% in 2019.

Figure 1 – Great Britain domestic freight transport: proportion of goods moved by mode (billion tonne kilometres) in 2019⁵



WHAT IS URBAN FREIGHT?

The ultimate destination for many goods will be our cities. Many UK city economies are based on the service industries, principally financial services, education, health, public administration and retail. These industries rely on timely deliveries of items such as office supplies, retail goods, medicines, documents and parcels. City regions more widely are also home to a diverse mix of industries, from metalworking to high tech companies, all in need of raw materials and the means to distribute the products they produce.

City regions are also hubs for residential and commercial development projects meaning that

large volumes of construction materials must travel into urban centres. Furthermore, with extensive residential areas come high volumes of e-commerce deliveries.

In addition to the delivery of goods to our cities and city regions, the removal of waste and refuse is also a key component of urban freight. These urban journeys represent the 'last mile' of freight movement, as goods make their way from distribution hubs into the heart of city centres. It is these last mile journeys that generate the greatest benefits, but also concerns, for urban areas.

DELIVERING THE FUTURE - UPDATE

We first published 'Delivering the future – New approaches to urban freight' in 2015. It presented a vision for safe, smart and clean urban freight which maximises the benefits, and minimises the negative impacts, for local economies, the environment and communities. It envisaged that every opportunity should be taken for freight to make its way to urban areas by rail or water, either directly into those areas or into major distribution parks serving them. It argued that those distribution sites should be located to enable goods to travel the last mile(s) into urban centres using zero/low emission modes. These last mile journeys should be achieved as safely, unobtrusively and with as little environmental impact as possible.

We are returning to this report now because, six years on, the challenges and opportunities that freight presents to our city regions remain and have become more pressing.

Since 2015, we have seen a greater recognition of the scale of the climate crisis, with cities across the UK and worldwide declaring a climate emergency and setting ambitious dates for achieving net zero carbon emissions.

We have also faced a global pandemic which has accelerated changes in the way we live, how we work and the ways we receive goods and services. Restrictions associated with the coronavirus pandemic led to a 12% reduction in goods lifted and a 15% reduction in HGV mileage across 2020, with reductions in goods lifted during the first lockdown period of around

25%⁶. While overall freight movements were down in 2020, e-commerce continued to grow⁷, with people staying at home and ordering online, which has implications for freight and particularly last mile deliveries.

In 2020, the UK left the European Union, impacting on movements of goods and people across our borders, affecting vehicle standards in the UK and playing a role in HGV driver shortages.

Furthermore, since our 2015 report, we have seen the rise of the gig-economy; demand from consumers for ever faster turnarounds between ordering and delivery; more attention on air quality and the health impacts of transport emissions; rising concerns about road safety; the emergence of new technologies including further progress towards connected and autonomous vehicles; a renewed push on active travel; and a greater focus on making communities and neighbourhoods more liveable. This updated report reflects upon the changes witnessed over the last six years.

Since the original 'Delivering the Future' report, we also published 'White van cities: Questions, challenges and options on the growth of urban van traffic' in 2018. This looked specifically at the impacts of the growth in van traffic of over 70% in the last 20 years⁸ and highlighted that vans are about more than just the movement of goods, they are also key to service industries and the public sector.

POLICY CONTEXT

Over recent years, the Government has produced a range of strategies and policies which aim to influence urban freight and ensure that deliveries can become more sustainable. The key policy documents are outlined and summarised in the table below.

Table 1 – Key recent policy and strategies for urban freight	
Last Mile	<ul style="list-style-type: none"> In 2018, the Government issued a call for evidence in order to "understand and assess the true scale and potential of⁹ the last mile. They defined last mile as "the moment where trunk freight deliveries are distributed to businesses and consumers across the UK's towns and cities"¹⁰. Key findings included widespread support for e-cargo bikes and the government has subsequently enhanced incentives for e-cargo bikes including grants of up to £1,000 for the purchase of e-bikes¹¹. The call for evidence also found that additional support is needed to shift vans to zero emission options, leading to the extension of the Plug in Van Grant.
Future of urban mobility	<ul style="list-style-type: none"> The UK Government launched its Future of Mobility: Urban Strategy in early 2019¹². Reduction of congestion is a key principle within the strategy and consolidation of freight is proposed as a route to making more efficient use of roads¹³. Other principles apply across the transport system, including that new services should be safe and secure by design, benefit all parts of the UK and drive the transition to zero emissions.
Ten-point plan	<ul style="list-style-type: none"> In November 2020 the Government set out a Ten Point Plan for a Green Industrial Revolution. This included a commitment to phase out the sale of new petrol and diesel cars and vans by 2030, as well as looking at phase out of new diesel HGVs¹⁴.
Gear change	<ul style="list-style-type: none"> In 2020, the Government published 'Gear Change' which sets out a bold vision for walking and cycling¹⁵. This included a commitment to promoting cycling for the carriage of freight and working towards reducing unnecessary motorised freight and servicing traffic. In addition to reiterating their commitment to supporting e-cargo bikes through grants, the Government proposed a pilot of compulsory freight consolidation schemes on the edge of one or two small historic city centres with deliveries being made by cargo bikes and electric vans where possible.
Williams-Shapps Plan for Rail	<ul style="list-style-type: none"> The Williams-Shapps Plan for Rail, published in 2021, set out a new framework for the governance and management of British railways, with the establishment of Great British Railways. In terms of rail freight, Great British Railways will have a mandate to operate in the interest of passengers, freight customers and local communities and will have a statutory duty to promote rail freight in order to secure economic, environmental and social benefits for the nation¹⁶.
Transport decarbonisation plan	<p>The Transport Decarbonisation Plan was published in July 2021 and sets out the roadmap to a net zero transport system by 2050¹⁷. Key commitments around freight in the TDP include:</p> <ul style="list-style-type: none"> Consulting on ending sales of new non-zero emission HGVs by 2035 for vehicles 26 tonnes and under and 2040 for vehicles over 26 tonnes Support for modal shift from road to sustainable alternatives including rail, cargo bikes and inland waterways Setting of a new rail freight growth target Measures to transform the last mile Research into the legal and practical issues around compulsory consolidation centres and setting groundwork for future pilots. Pilots will seek to ensure that the majority of urban deliveries are consolidated and transferred to zero emission modes for the last mile Pilot allowing some local authorities to franchise certain delivery and waste management services to support improved co-ordination. Work across government to consider more opportunities for joint collection of household and non-household municipal waste <p>Alongside the TDP, the Government also published a delivery plan for transitioning to zero emission cars and vans by 2050¹⁸. This includes continued support for the purchase of zero emission vehicles and their charging infrastructure, accelerating infrastructure rollout, including working with local authorities, and supporting research and development into zero emission vehicles.</p>

BENEFITS AND CONCERNS ASSOCIATED WITH URBAN FREIGHT



WHAT BENEFITS DOES URBAN FREIGHT BRING?

The freight and logistics sector underpins most parts of the UK economy and is vital to the daily lives of communities. In 2020 it was estimated that the industry contributed £86.5 billion to the UK's economy.¹⁹ The sector employs more than 2.5 million people, making it the UK's fifth largest employer²⁰. As we seek to shift away from conventional fossil fuelled vehicles, there will be new skills required to build and maintain low and zero emission freight vehicles, potentially creating additional employment opportunities in the freight and logistics sectors.

Often taken for granted, among many other things freight and logistics ensure supermarkets are stocked with food; parcels are delivered to our homes; construction sites have bricks and timber; hospitals have the medicines we require; stationery cupboards are filled with paper and pens; and cafés, bars and restaurants have the ingredients they need.

During the coronavirus pandemic it has become clearer than ever that the freight and logistics sectors are essential and that those working in the sector are valuable key workers, keeping our society running and ensuring that the health and social care sectors could provide vital services. It is expected that, by 2025, over a third of sales will be online, further increasing our reliance on urban logistics for delivery of goods²¹.

WHAT CONCERNS ARE THERE AROUND URBAN FREIGHT?

As freight enters our urban areas, it can cause a number of issues and challenges for people and infrastructure. These include implications for congestion, safety, emissions, road and track maintenance, noise and vibration, quality of life and the urban realm. The following section explores these areas in more detail. It is important to note that many freight operators and other authorities recognise, and are taking steps to, address these issues. Examples of these activities are highlighted throughout this document.

The freight sector contributes £86.5bn to the UK economy & employs 2.5 million people

CONGESTION

Road freight contributes to, and suffers delays from, congestion on our urban road networks. Road congestion is estimated to cost the freight industry £3.7 billion annually²². Vehicle emissions in traffic jams are four times higher than in free-flowing traffic²³. Congestion also has negative impacts for public transport, particularly in terms of journey times and reliability. Go Ahead suggest that a 10% decrease in bus speeds can result in a 10% or greater reduction in patronage²⁴.

Congestion in UK cities in 2020 was much lower than in previous years due to lockdowns associated with the coronavirus pandemic and, as highlighted earlier, freight movements were also reduced in 2020²⁵. The average person in Britain spent 37 hours in traffic in 2020, down from 115 hours in 2019, a decrease of 68%²⁶ whilst UK city centre congestion was down 52%. This adds up to more than £3.4 billion in time savings compared to 2019²⁷. There is still a great deal of uncertainty about how road traffic will recover from the coronavirus restrictions – levels seem to be recovering more quickly than for other modes but peaks are still not so pronounced as pre-pandemic.

HGVs have historically made up a large proportion of morning peak traffic, with the impacts magnified by the physical size of HGVs (impacting capacity), slower speeds and longer braking distances²⁸.

Significant growth in van traffic over recent years has contributed to congestion in urban areas, though van traffic was down 9% in 2020 compared to 2019²⁹. It should also be noted that despite van traffic falling (9%) in 2020, this reduction in miles travelled was much lower than for cars and taxis, for example, which fell 25%. In the decade prior to 2020, van traffic had grown 34%, reaching 55 billion vehicle miles in 2019³⁰.

Demand for ever quicker deliveries is exacerbating problems with van traffic in urban areas, as people expect their goods ordered online to be available the same or next day as they are ordered³¹. This risks undermining efforts to establish more liveable, walkable neighbourhoods, with lower traffic³².

SAFETY

In urban areas, road freight is more likely to come into contact with road users including cyclists, pedestrians and children who may be at greater risk of injuries and fatalities should a collision occur. Designed for moving heavy loads, long distances along arterial routes and motorways, HGVs in particular are ill-suited for operation on streets where people live and work.

In 2019, over 216,000 vehicles were reported in collisions on Great Britain's roads. Over 70% of these involved cars³³. LGVs are involved in 6% of accidents and HGVs 2%³⁴. Across all reported collisions, 1% are fatal, 21% are serious and 77% are slight³⁵. However, collisions involving goods vehicles are more likely to be fatal. For HGVs, 6% of accidents are fatal and 23% are serious, and for LGVs 2% are fatal and 21% serious³⁶.

If we look at the accident rate (which standardises across modes and mileage) HGVs have an accident rate of 655.3 per billion vehicle miles and vans / LGVs have a rate of 386 per billion vehicle miles across all severities in urban areas³⁷. And for fatalities this is 25.9 per billion vehicle miles for HGVs and 2.6 for LGVs. This compares to rates for cars of 944.6 per billion vehicle miles for all severities and 4.9 for fatalities. Figure 2 below shows the accident rate for cars, light goods, and heavy goods vehicles on urban roads in Great Britain in 2019.

This shows that across all collisions in urban areas, cars are more likely to be involved than either HGVs or vans. However, HGVs are involved in more fatal collisions in urban areas, likely due to their size and the impact of a collision with other road users. Research by Transport for London (TfL) found that HGVs are involved in 63% of fatal collisions with cyclists and 35% of fatal collisions with pedestrians, despite only making up 4% of miles driven in London³⁹.

Figure 2 – Accident rate and severity for cars, heavy goods and light goods vehicles on urban roads in Great Britain in 2019³⁸

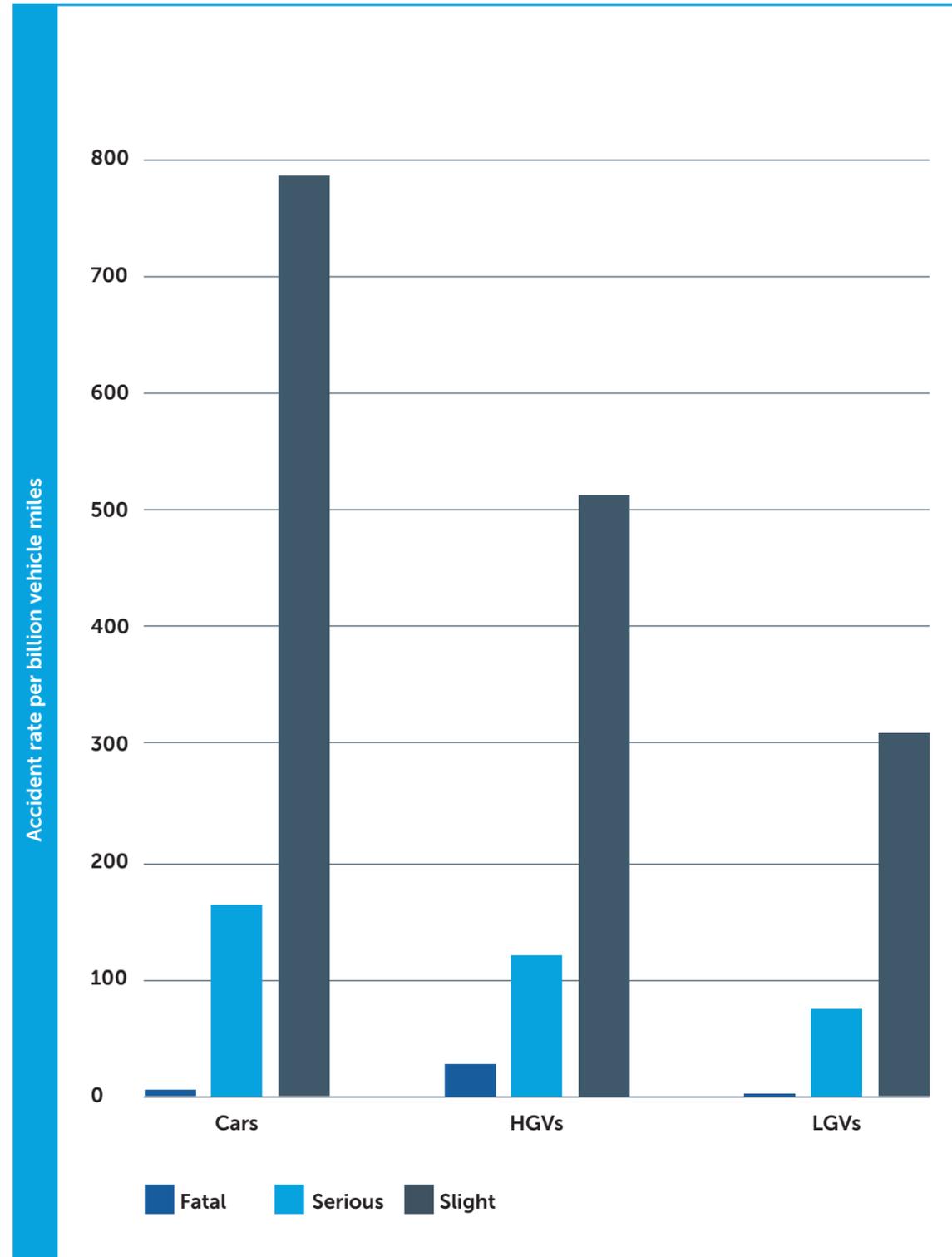


Figure 3, below, shows the total number of deaths involved in each mode of transport, including vehicle user death and other road user deaths⁴⁰. Most road deaths involving HGVs and vans are deaths of other road users.

Figure 3 – Total deaths involved in each mode of transport (Figure adapted from PACTS)⁴¹

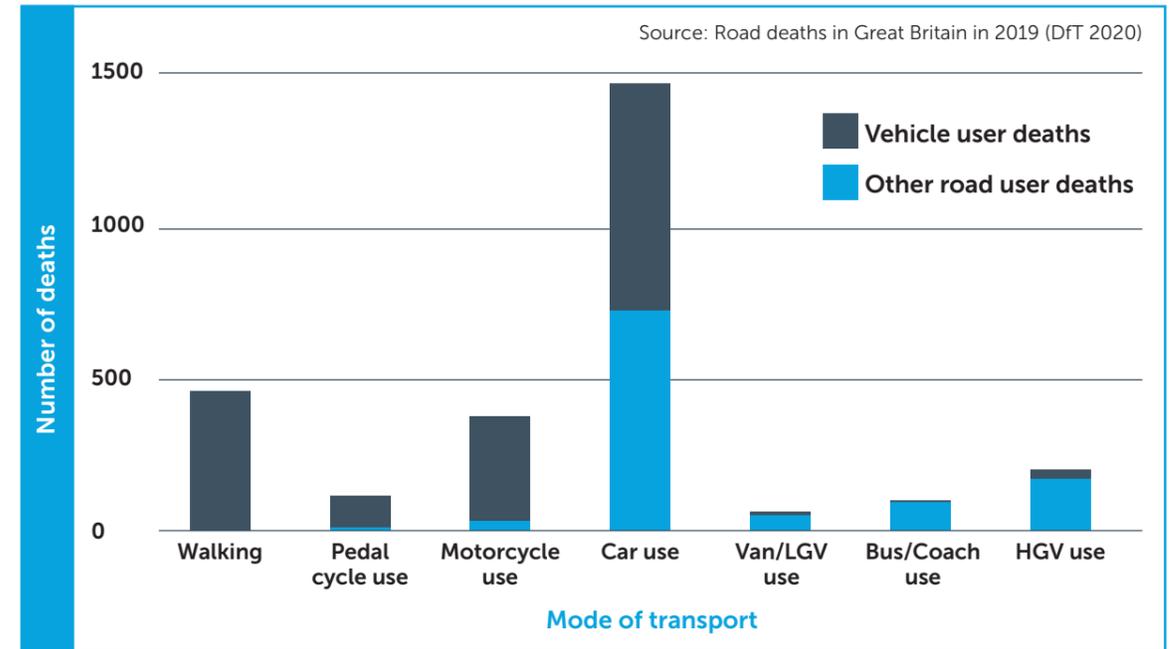
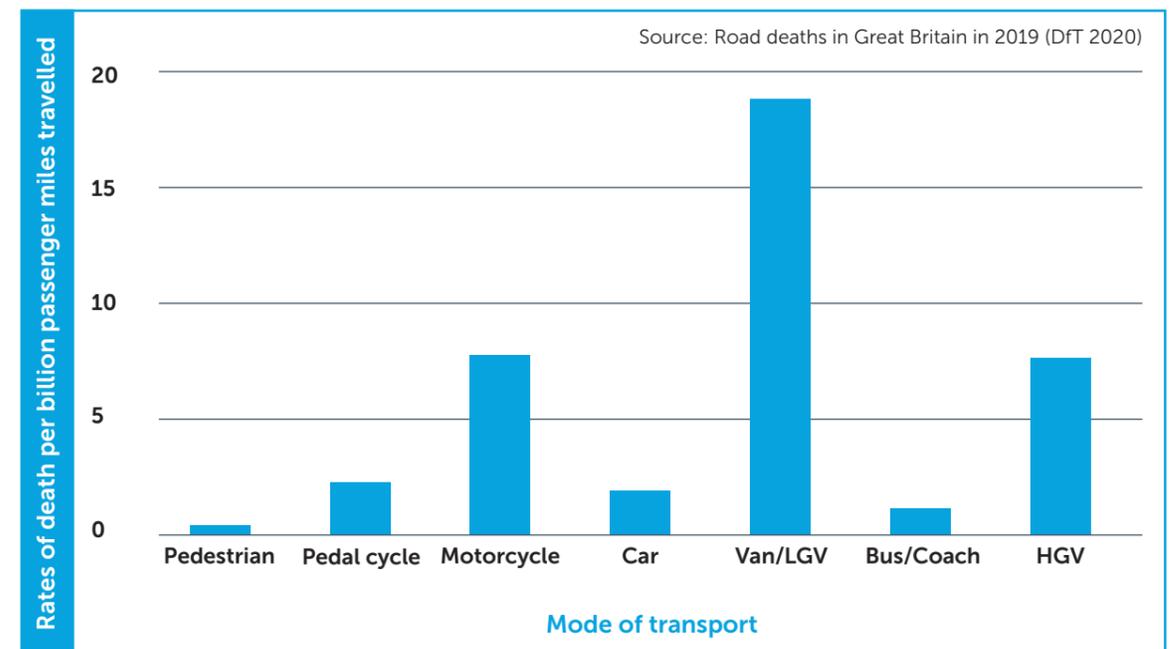


Figure 4 shows the risk to other road users from each mode and illustrates the high rates of road user death associated with vans / LGVs and HGVs per mile travelled⁴². This presents deaths as a rate (per billion passenger miles travelled) thus allowing comparison between the modes more easily, rather than the absolute numbers presented in Figure 3. Taken together, they demonstrate that cars are still involved in the most deaths on the roads but goods vehicles are involved in a disproportionate number of deaths per miles travelled.

Figure 4 – The risks to other road users from each mode, by distance travelled (Figure adapted from PACTS)⁴³



These statistics and figures illustrate the significant role goods vehicles, both vans and HGVs, play in serious and fatal collisions on our roads.

A number of factors contribute to these statistics including:

- Design of vehicles – most lorries have large blind spots which cyclists and pedestrians can easily disappear into. The ‘brick-like’ design of many HGVs also means that cyclists are more likely to be dragged under the wheels in the event of a collision.

- Design of road layouts and junctions.
- Timing and routing of freight deliveries.
- High levels of illegal operation in the industry (including overloading, poor maintenance and careless driving).
- Level of awareness of all road users on how to safely share the road.

The final factor is illustrated by data from the Driver and Vehicle Standards Agency on vehicle enforcement checks. Table 2, below, shows the percentages of heavy and light goods vehicles that are issued with prohibitions as a result of enforcement checks.

Table 2 – DVSA Enforcement checks, 2018-19⁴⁴

	Percentage of HGVs issued with a prohibition	Percentage of LGVs issued with a prohibition
Mechanical checks	24%	49%
Drivers hours checks	3%	2%
Weight checks	40%	70%

We explore the potential role for a more effective safety regulatory regime for the road haulage industry based on higher standards, better enforcement, improved analysis of collisions and sources of risk, as well as industry accreditation and additional training to help improve safety in Section five of this report.

EMISSIONS

Road freight traffic makes a significant contribution to carbon dioxide emissions and air pollution (in the form of nitrogen oxides and particulate matter), harming the environment and public health. In 2019, transport accounted for 27% of the UK’s domestic greenhouse gas emissions, making it the largest emitting sector. Of this, 16% was from HGVs and 16% from LGVs. When compared to 1990 levels, the year against which reductions and targets are measured, HGV emissions have reduced 5% but LGV emissions have increased 65%⁴⁵.

Diesel remains the dominant fuel for both HGVs and LGVs. In 2020, 99% of HGVs were diesel fuelled, with the rest being a mixture of petrol (0.3%), gas (0.2%) and battery electric (0.1%)⁴⁶. For LGVs, 96% are diesel fuelled, 3.1% petrol and 0.4% battery electric. While electric vehicles still make up a small proportion of vans, they have more than tripled since 2016. Table 2 shows the contribution to key air pollutants from HGVs and LGVs.

Road freight traffic makes a significant contribution to carbon dioxide emissions and air pollution

Table 3 – Contribution to key air pollutant emissions from HGVs and LGVs in the UK⁴⁸

	Percentage of total from HGVs	Percentage of total from LGVs
Carbon monoxide (CO)	3%	4%
Nitrogen oxides (NOx)	5%	23%
Particulates (PM ₁₀) – exhaust emissions	2%	5%
Particulates (PM ₁₀) – tyre and brake wear	6%	8%
Particulates (PM ₁₀) – road abrasion	5%	3%
Particulates (PM _{2.5}) - exhaust emissions	2%	7%
Particulates (PM _{2.5}) – tyre and brake wear	5%	7%
Particulates (PM _{2.5}) – road abrasion	4%	2%

When people are exposed to these pollutants, it can cause severe health impacts and this is especially problematic in urban areas with high levels of traffic, particularly van traffic which, as the table above shows, accounts for over one fifth of NOx emissions from domestic transport. Long term exposure to air pollution is thought to contribute to between 28,000 and 36,000 deaths each year in the UK⁴⁹ as well as exacerbating respiratory and cardiovascular diseases. There are also equality issues associated with air pollution. Poorer communities tend to be more exposed to air pollution, due to the proximity to main roads and lack of green spaces⁵⁰.

With increases in demand for deliveries in urban areas, which has been accelerated by online shopping during the pandemic, there is a risk that more people are being exposed to these harmful pollutants, particularly NOx as a result of van traffic in residential areas.

ROAD AND TRACK MAINTENANCE

Many local roads are in urgent need of repair and road maintenance is also a costly burden on local authorities. Decline in revenue funding and competitions for maintenance budgets make it

difficult for local authorities to take a long term, strategic approach to road maintenance, following years of under-investment⁵¹.

Heavy freight vehicles travelling on urban roads and along railways cause more damage than their lighter counterparts. A standard 44 tonne HGV causes 136,000 times the damage to road infrastructure than a Ford Focus⁵².

This can cause issues in pedestrianised city centres where care has been taken to lay attractive paving but loading arrangements mean that heavy vehicles have to travel over them. Damage to road and paved surfaces can create dangerous potholes and trip hazards, making walking, cycling and scooting more hazardous.

A standard 44 tonne HGV causes 136,000 times the damage to road infrastructure than a Ford Focus

EMPLOYMENT AND WORKFORCE CHALLENGES

There are serious shortages of HGV drivers, mechanics, fitters and technicians. Department for Transport statistics show that the number of people employed as HGV drivers fell 7% between 2019 and 2020⁵³. The sector faces a shortage of drivers for a number of reasons, including:

- an ageing workforce that is not being replaced with younger people entering the industry⁵⁴ - the average age of an HGV driver is 50 years old⁵⁵;
- poor health of the workforce linked to the nature of the work, including inactivity and obesity, lack of access to healthy food, exposure to stress and sleep deprivation or disturbance⁵⁶
- difficulties in attracting a wider range of people to work in the sector - in 2020, 99% of HGV drivers were male⁵⁷
- fewer migrant workers as a result of Brexit;
- disruption caused by the coronavirus pandemic - there were 43% fewer HGV driver tests conducted in 2020, due to the pandemic⁵⁸ and many drivers may have been particularly at risk from the virus itself due to their age and underlying health and lifestyle factors noted above⁵⁹.

Logistics UK estimate there is a shortage of 76,000 drivers⁶⁰. During 2021 there were gaps on supermarket shelves and disruption to fuel deliveries as a shortage of drivers hit supply chains⁶¹. If driver shortages cannot be addressed, or alternatives better utilised to add resilience to the sector (such as water or rail), there could be longer term effects on the smooth running of our urban economies.

The sector is seeking to bring in new talent, including through apprenticeship programmes. There were 12,721 new apprenticeship starts in the logistics sector in 2018/19⁶². However, the number of new apprenticeship starts has fallen over the last decade (with a high of 24,419 starts in 2015/16)⁶³, exacerbating the challenges discussed previously.

Another important development in recent years has been a growth in the number of people working in the freight and logistics sector who are 'self-employed partners' rather than direct employees, part of a trend known as the gig economy. In 2018, courier services were the most common activity in the gig economy⁶⁴. While the gig economy can offer flexible work, wages are often low, with many workers earning less than minimum wage⁶⁵, as well as a lack of job security and worker rights. There are also questions and concerns about the level of training received and the implications for road safety.

NOISE AND VIBRATION

Deliveries and collections can generate noise and vibration, a particular issue in urban areas at night when residents' sleep can be disturbed. Recent research has found that noise from road traffic and railways is associated with an increased risk of dementia, amongst other health conditions including heart disease, diabetes and obesity⁶⁶.

QUALITY OF LIFE AND URBAN REALM

It is well known that traffic impacts on the overall quality of the urban realm and quality of life for urban communities. Heavy freight vehicles in particular are a poor fit for the places where people conduct their daily lives. Noisy, large vehicles passing through city centres detract from human scale development, obstruct views and can make it difficult to create the smart 'café-culture' environments that many cities seek to emulate.

Freight forms part of a much wider debate about what kind of cities we want to live in and how we want them to look and feel. Will cities of the future be increasingly clogged with van and lorry traffic, or can we find smarter, greener and more efficient means of moving goods around, helping to create places where people want to live, work and do business?

HOW CAN WE MAXIMISE THE BENEFITS OF URBAN FREIGHT AND MINIMISE THE NEGATIVE IMPACTS?

The central policy objective for urban freight should be to ensure the safe, smart, clean, efficient and reliable movement of goods to support economic growth whilst, at the same time, minimising negative impacts on the environment and quality of life. Freight should be part of green, liveable, prosperous city regions, helping to meeting ambitious carbon reduction targets and creating safe streets with clean air.

At present, the harmful costs on society arising from road freight activities are not fully accounted for through taxation or other charges. These wide-ranging negative impacts have been outlined above. In the UK, since 2014, HGVs have had to pay the HGV Road User Levy, which seeks to ensure that HGVs are contributing to the maintenance of roads⁶⁷. The levy varies by vehicle weight and less polluting lorries (Euro VI) are eligible for a 10% reduction in the levy. However, in practice, only non-UK hauliers pay the HGV levy as UK hauliers receive an equivalent reduction in vehicle excise duty. Furthermore, the HGV levy has been suspended from 1st August 2020 to 31st July 2022, to support the sector in the recovery from the coronavirus pandemic.

Whilst some local schemes, including clean air zones, seek to charge the most polluting HGVs and vans, the system as it is currently set up still fails to fully account for the negative costs of road freight. Any future transport taxation system needs to take into consideration how these negative external costs of road freight can be met. Doing so would not only ensure that road freight 'pays its way' but would also level the playing field with other, alternative modes (such as rail and water),

and could be designed to incentivise lower impact, green and safe operations.

This report presents a vision for urban freight where every opportunity is taken for freight to make its way to urban areas by rail or water, either directly into urban areas or into the major distribution parks that serve them. It argues that those distribution sites should be located so that it is practical for goods to travel the last mile(s) into urban centres using low or zero emission modes. These last mile journeys should be achieved as safely, unobtrusively and with as little environmental impact as possible.

The remainder of this report considers how this vision might be achieved, looking at the journey to urban areas; distribution and consolidation enroute; and finally, the last mile into city centres.

THE JOURNEY TO URBAN AREAS



In achieving safe, clean, smart, efficient and reliable movement of freight to support economic growth whilst also minimising negative impacts on the environment and quality of life in urban areas, the first consideration must be how goods make the journey to urban areas from warehouses, depots, ports and other distribution hubs.

As the previous sections demonstrated, road freight dominates distribution, transporting almost 80% of goods, bringing numerous challenges to urban areas. If goods start their journey by road, they are likely to continue to travel in this way right into city centres. For example, a lorry may make its way from a warehouse in Birmingham and travel right through into Newcastle city centre. If the initial long haul journey portions were to be transferred to rail or water, the numbers of lorries and vans on the strategic road network could be reduced and options for the last mile of the journey to be undertaken using smarter, greener modes could be opened up. Every opportunity should be taken for freight to make its way to urban areas by rail or water.

The UK Government has an ambition to grow both rail and water freight, with support grants available for shifting to these modes⁶⁸. Changes to the structure of the railways announced in the Williams-Shapps Plan for Rail in May 2021 also offer an opportunity to accelerate rail freight, with the establishment of Great British Railways, which will have a statutory duty to promote freight and establish a growth target for rail freight.⁶⁹ The Transport Decarbonisation Plan echoes this commitment to both rail and water freight and committed to setting a growth target for rail freight⁷⁰.

It should be noted that in respect of urban environments in the UK, rail – rather than water –

freight offers the greatest potential for modal shift, because not all urban areas are accessible by suitable waterways whereas the rail network is more extensive. However, both can have a role to play depending on local conditions and so are discussed together in the remainder of this section.

THE BENEFITS OF RAIL AND WATER FREIGHT

The rail freight sector delivers around £1.7 billion of economic benefits and supplies £30 billion of goods to customers in Britain each year⁷¹.

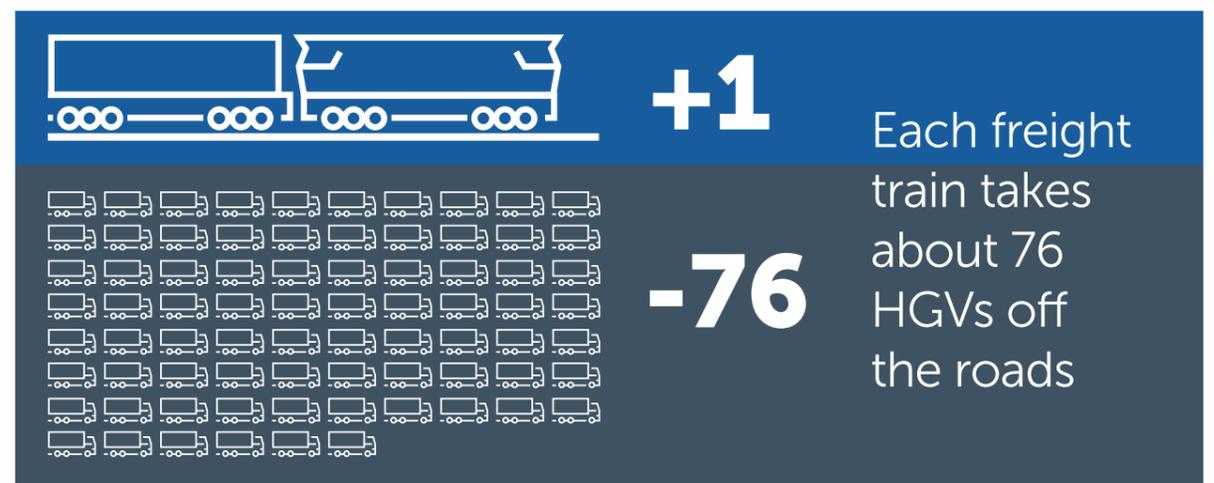
Increased use of rail and water freight has the potential to address many of the concerns outlined in the preceding section.

CONGESTION

Each freight train takes about 76 HGVs off the roads⁷² and in total rail freight removes seven million lorry journeys each year⁷³. This translates to 1.66 billion fewer HGV kilometres a year⁷⁴. This can play a big part in reducing congestion on our roads, both on the strategic road network and in our urban areas.

While there is congestion on the rail networks and freight trains can be delayed, rail freight operators achieve 97% reliability on premium services and can generally match or better road freight reliability.

Meanwhile, in respect of water freight, modern barges can take up to 550 tonnes each in some areas and up to 1,500 tonnes on larger waterways⁷⁶. The most an HGV can carry is 44 tonnes. In congested urban areas, waterborne freight using smaller craft can compete with road as lorries are slowed down by congestion⁷⁷.



CASE STUDY: THAMES TIDEWAY, EVERY BOAT COUNTS

Thames Tideway is the construction of a new sewer to serve London. The project is using the river to remove materials from the tunnelling activities⁷⁸. Their largest barges can carry the same as 93 lorries, thus reducing air pollution and congestion on London's roads and improving road safety. They also produce 90% less CO₂ than an equivalent diesel HGV. They estimate that their use of barges on the river Thames avoids 200 lorry trips a day⁷⁹.



SAFETY

A key advantage of rail and water freight over road freight is that it is largely separated from pedestrians, cyclists and motorists. Pro rata, rail freight has been estimated to remove 42 road deaths, at a value of £78.8m⁸¹.

EMISSIONS

Rail produces around 1% of Great Britain's transport carbon emissions but, pre-pandemic, carried nearly 9% of freight⁸². Each tonne of freight transported by rail reduces carbon emissions by 76% compared to road freight⁸³. As more of the railway is electrified, less diesel could be used for rail freight and the carbon emissions could be further reduced. As the Williams-Shapps Rail Plan notes, rail is 'the only form of transport currently capable of moving both people and heavy goods in a zero carbon way'⁸⁴.

Rail produces up to 10 times less small particulate matter than road haulage and as much as 15 times less nitrogen oxide for the equivalent mass hauled.⁸⁵

Barges are fuel efficient and can use as little as one-quarter of the fuel of lorries, meaning lower carbon emissions⁸⁸.

ROAD AND TRACK MAINTENANCE

Transferring freight movements from road to rail can help to save money on road maintenance. Each year rail freight saves £133m in road infrastructure costs⁸⁹. However, heavy freight trains have a greater impact on the cost of maintaining rail infrastructure than lighter passenger trains.

CASE STUDY: CEMEX

Cemex is increasing the amount of building materials moved by rail freight, moving 2 million tonnes of aggregate across the UK in 2020⁸⁶. This saved 100,000 road movements and 12,500 tonnes of CO₂ compared to road transport. They have also found that rail freight provides a more reliable solution for movement of their goods⁸⁷.

Each tonne of freight transported by rail reduces carbon emissions by 76% compared to road freight



NOISE AND VIBRATION

Water freight generates very little noise. Heavy rail freight trains can be very noisy and cause vibration, however, homes tend to be set further back from train tracks.

QUALITY OF LIFE AND URBAN REALM

Rail and water freight are generally separated from the city centre streets where people shop, socialise and do business and therefore unlikely to negatively affect the quality of the urban environment. Where these facilities are located near to urban areas, measures highlighted later in this report should be employed to minimise impacts on local residents, such as using equipment which facilitates quieter loading and unloading.

EMPLOYMENT

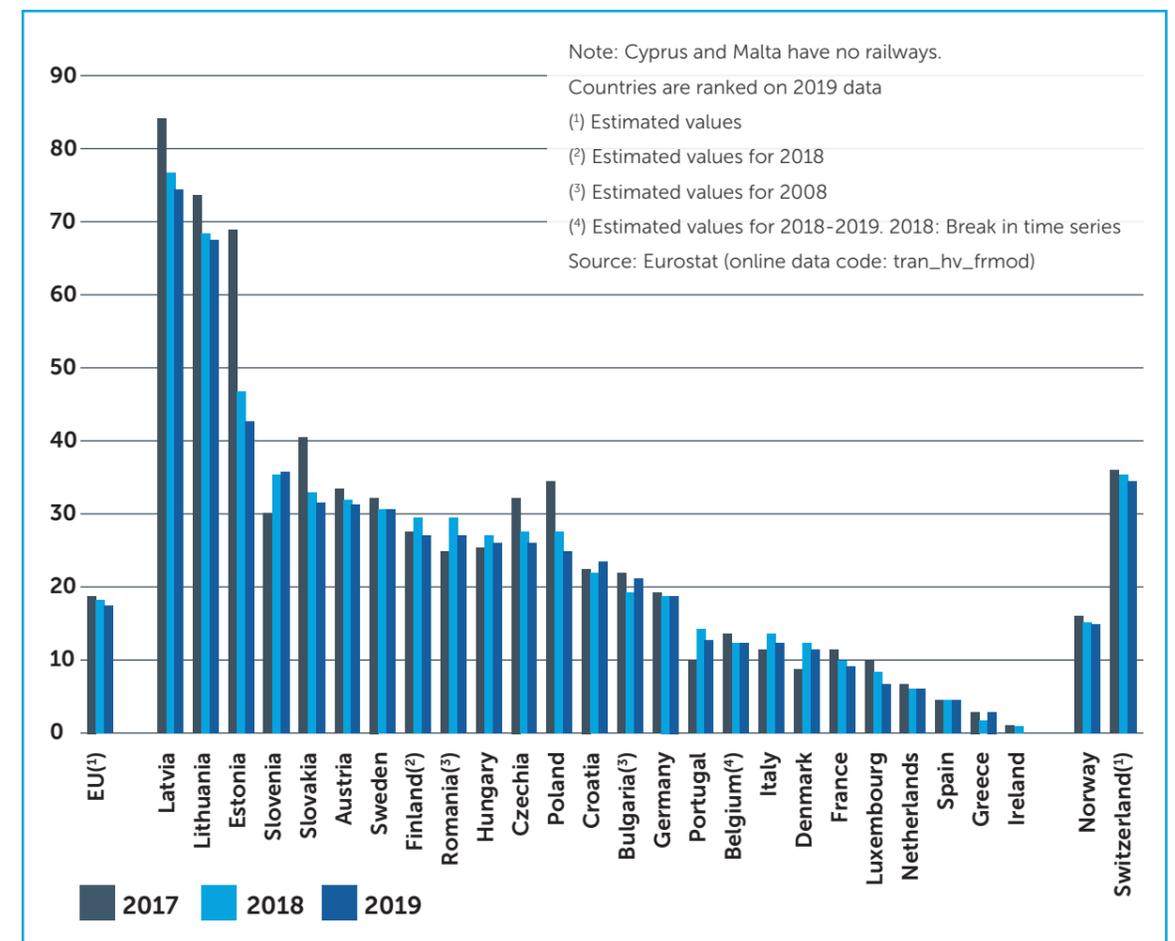
More than 5,000 people are employed by rail freight operating companies and 80% of these jobs are outside the southeast of England, supporting regional growth and levelling up. Rail freight also supports the prosperity of ports, power stations, production centres and retail centres⁹⁰.

TRANSFERRING MORE ROAD FREIGHT TO RAIL AND WATER

The clear benefits of bringing freight into our urban areas by rail and water are increasingly recognised. For example, the new Great British Railways will have a statutory duty 'to promote rail freight to secure economic, environmental and social benefits for the nation'⁹¹. However, the vast majority of freight continues to be moved by road as it has done for decades. Almost nine times as much freight is moved by road as by rail⁹³.

This reflects a much bigger shift from rail to road for freight than has happened in some other comparable European countries where rail retains a larger market share. Figure 5 below shows the share of rail freight across EU countries, with many having a much higher share of rail freight than we have here in the UK. Figure 1 showed the share of rail freight in the UK at 9% of goods moved.

Figure 5 – Share in total inland freight transport, 2008, 2018 and 2019 (% in tonne-kilometres)⁹⁴ (image source: eurostat)



Other countries also still move less than full train loads by rail which allows more industries, businesses, towns and cities to send smaller 'wagonload' consignments of freight by rail, see case study below. Whereas in the UK 'wagonload' freight has all but been eliminated leaving some large cities (like Bradford) without any rail freight facilities or traffic whatsoever. The idea of 'wagonload' freight is that it allows smaller consignments to be sent, so a single wagon or a group of wagons, rather than a whole trainload, which is more suitable for bulk consignments⁹⁵.

CASE STUDY – SBB WAGONLOAD FREIGHT

The Swiss rail freight operator, SBB Cargo, developed a new system for wagonload freight in 2017⁹⁶. This aims to modernise the system for supporting wagonload services to meet the needs of 21st century logistics. As Figure 5 shows, Switzerland has a high share of rail for freight movements, at over 30% and SBB Cargo carries 25% of all goods transported in Switzerland⁹⁷.

The new wagonload system offers collection and delivery up to three times a day, supported by an online booking system, making it easier for customers to identify what services are available and book. The timing of the services avoids conflict with peak passenger services, while still allowing same day deliveries⁹⁸.

Beyond the Swiss borders, SBB are part of the X-Rail Alliance, consisting of seven rail freight operators in northern and central Europe. X-Rail aims to make European Single Wagonload a more competitive and sustainable alternative to road transport⁹⁹. Activities to achieve this aim include improved customer information and interoperability between members to enable a seamless and swift wagonload offer¹⁰⁰.



There is huge potential for rail freight to expand. The Williams-Shapps Rail Plan¹⁰¹ notes that rail freight has diversified beyond the movement of coal and steel to adapt to changing customer needs. Rail freight also plays a key role in other markets such as construction and consumer goods. Freight trains played a crucial role during the pandemic, keeping food and medical supplies moving. Incentives maybe needed to encourage the industry to further expand and diversify the service it offers.

The Rail Freight Group suggests that ambitious growth in the sector could generate between £75-90 billion in environmental and economic benefits in the coming decade¹⁰². They highlight key areas that are necessary to unlock growth in rail freight which include:

- Investment in the strategic freight network to unlock capacity and improve train efficiencies
- Electrification of key routes
- New rail linked facilities and reform of planning law to support greater uptake of rail
- Investment and support for new rail freight services including high speed freight to city centres
- Increased grants and access charge discounts to encourage uptake
- Mainstreaming rail freight in transport and industrial policy
- Future changes to road pricing to support modal shift¹⁰³.

Improvements to local and national passenger rail networks, such as HS2 and rail electrification, present opportunities to simultaneously upgrade the infrastructure to grow rail freight capacity, indeed, these opportunities should be explored as an integral part of the planning process. Furthermore, whilst rail freight will not use HS2 directly, a proportion of the capacity released by migration of passengers onto the new line could be allocated to enable more rail freight, with the potential to take hundreds of thousands of lorries off our roads¹⁰⁴.

Rail freight also suffers from unfair competition from road haulage where far lower safety standards are tolerated and when road haulage does not cover its full direct or indirect costs.

The highly competitive rail freight market is also mostly focussed on competing on price for block movements of heavy freight and there are insufficient incentives to provide a wider service (including wagonload). A more interventionist approach to rail freight at both the national and local level will be needed if more freight is to be moved by rail.

Meanwhile, our extensive networks of inland waterways are a neglected and underused resource in comparison with other European countries where larger inland waterways are used as major freight routes as well as for making deliveries directly to city centre businesses.

For waterways, enhancements could include support for ongoing maintenance and the removal of barriers (such as low bridges or narrow locks) which currently restrict capacity to ensure that they can accommodate more freight traffic.

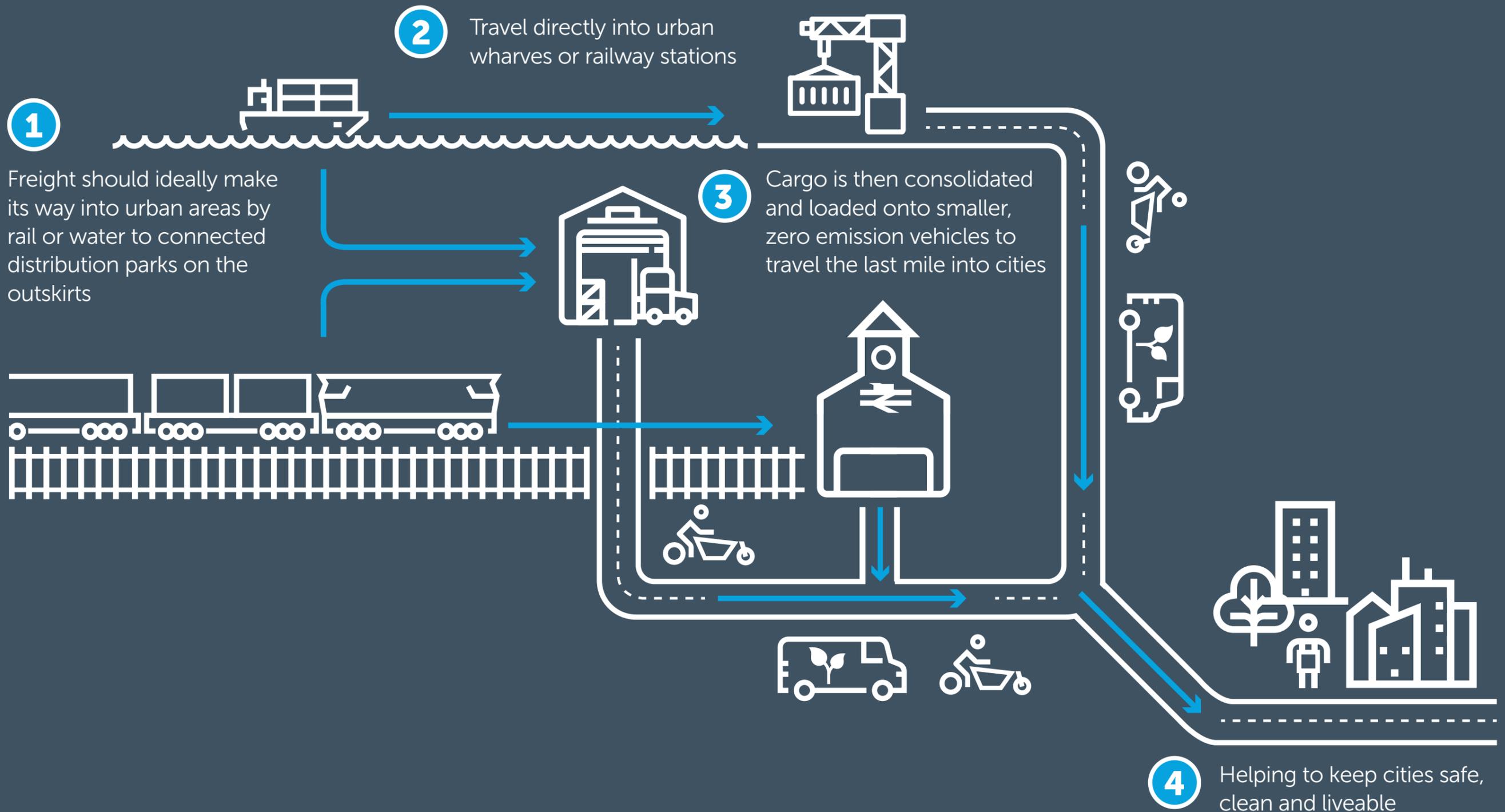
SUMMARY

In achieving safe, clean, smart, efficient and reliable movement of freight in our cities to maximise economic growth and minimise negative impacts, the first step is to look at how goods make their way to urban areas.

This section has argued that freight should ideally make its way to urban areas by rail or water, rather than by road. Doing so has the potential to reduce congestion, improve safety, cut emissions, save on maintenance costs, minimise the impacts of noise and vibration and protect quality of life and the urban realm compared to road alternatives.

In order to transfer more freight onto railway tracks and waterways, a more interventionist approach will be needed including the capacity enhancements necessary to meet and generate demand, addressing unfair competition between road haulage and rail and water freight, and incentivising the rail freight sector to widen the service it offers. It will also be necessary to make better use of urban and city centre rail stations for freight and deliver more rail and water-connected distribution parks, requirements which are discussed in more detail in the next section.

DELIVERING A GREENER FUTURE – THE IDEAL JOURNEY OF FREIGHT INTO DECARBONISED CITY REGIONS



DISTRIBUTION AND CONSOLIDATION

5

Once freight arrives in our urban areas, the distribution and consolidation of goods offer opportunities to introduce efficiencies into the journey, prior to the 'last mile'. The unloading of both rail and water borne freight is key as well as establishing efficient procurement practices, urban consolidation and hub facilities. This section explores these opportunities and provides case studies of innovative approaches to urban freight distribution and consolidation.

URBAN RAIL FREIGHT

The use of goods facilities located in city centres – including within or near to railway stations – made rail a dominant element of urban freight transport in the past. Over time, competition from road transport and a focus on bulk rail

freight movements has meant that such urban rail freight facilities have all but disappeared.

However, city railway stations have great potential as central hubs for freight distribution – these facilities are barely used at night and can be served by trains acting as high-speed mobile warehouses. The fact that all the sorting and loading could take place within the station building helps to minimise the noise and disturbance for local residents. It also opens up opportunities to use short-range low emission vehicles to transport goods over the last mile. In addition, the use of excess capacity on the railways, in terms of empty spaces and seats at times when trains are not fully loaded, can help to extract increased utility from expensive railway assets.

CASE STUDY: FREIGHT ON PASSENGER TRAINS – INTERCITY RAILFREIGHT¹⁰⁵

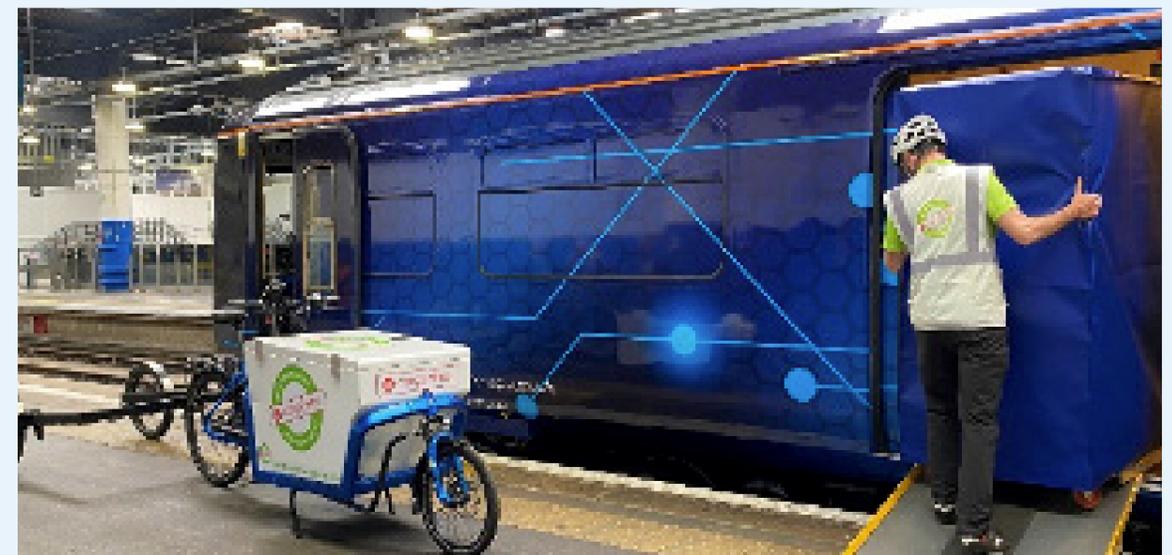
Intercity Railfreight was formed in 2009 with the objective of supporting modal shift of freight from road to rail and working with last mile partners to achieve sustainable deliveries. They aim to use spare capacity on passenger trains to carry goods, including medical consignments and those which require temperature controls such as chilled or frozen samples. During the coronavirus pandemic, Intercity Railfreight has seen an increase in the services they provide, particularly to ship tests on behalf of labs and clinics. The speed and reliability of using passenger trains has been a real benefit for transporting these time critical deliveries.

On arrival at the station, goods are sorted on the platform before being transferred to a fleet of electric vehicles or cargo cycles for the last mile. One of the key benefits of carrying freight on passenger trains is that stations tend to be located in the heart of city centres, often close to their ultimate destination

CASE STUDY: CONVERSION OF PASSENGER TRAINS TO FREIGHT

A number of organisations are looking at the conversion of passenger trains to carry freight, in particular to support high-speed parcel delivery to city centres. Orion Logistics, working with Network Rail, have converted a Class 319 passenger train to a class 769, fitting it out to carry a range of goods¹⁰⁶. Reaching speeds of 100mph, each carriage can carry about the same load as an articulated lorry and it can operate with four, eight or twelve carriages. The trains are bi-mode, so can operate on electrified rail or using a diesel engine. The images below show how goods delivered to a city centre station can be loaded onto cargo cycles for the last mile part of the trip and also illustrates how the carriages have been reconfigured for freight.

Figure 6 – Orion logistics class on test run to Euston station (below) and inside the converted passenger train now able to take freight (below right) (Image source: Network Rail¹⁰⁷)



Eversholt Rail are also converting passenger trains for freight use, with the Class 321 Swift Express. Working with Ricardo and Wabtec, they have refitted the train to carry a range of goods with the aim of providing high speed services between city centres¹⁰⁸.

The growth in online ordering and high-speed deliveries of parcels has created opportunities for rail solutions to provide rapid, reliable urban deliveries.



URBAN WATERBORNE FREIGHT

Infrastructure for the loading and unloading of waterborne freight can also be available in cities that have rivers or canals passing through them, although freight must often compete against potentially more remunerative uses for the land, such as residential and office developments. Furthermore, it is unusual for barges to be used for

last mile deliveries because final origins and destinations are not generally located nearby. However, there are exceptions to this, and waterborne freight can be coupled with zero emission last mile options for a sustainable end-to-end journey as the case studies below demonstrate.

CASE STUDY: DHL RIVERBOAT SERVICE, LONDON

Increasing use of the Thames for freight transport in London was part of the 2018 Mayor's Transport Strategy in order to reduce traffic levels on London's roads¹⁰⁹. In 2020, delivery company DHL launched London's first riverboat parcel delivery service on the Thames, working with Transport for London and the Port of London Authority. Running daily at 7.30am, the boat is loaded from electric vehicles at Wandsworth Riverside Quarter Pier and then travels at high speed into central London, docking at Bankside Pier¹¹⁰. The last mile delivery is made using DHL's courier bikes. This builds on the model DHL established in Venice, Italy. It allows them to make reliable deliveries while reducing congestion and emissions as well as mitigating the other negative impacts of conventional deliveries.

Figure 7 – DHL Riverboat Service (Image source: DHL¹¹¹)



CASE STUDY: WATER FREIGHT ON THE SEINE, PARIS

Fludis have established a new kind of freight service in Paris, using an electric barge on the Seine to bring goods from Gennevilliers port in the west of Paris into central Paris¹¹². They deliver parcels and pallets from clients including Lyreco and Ikea, with the last mile trip made either by cargo cycles which are carried and loaded on board or by zero emission vans. On the return journey electronic waste is carried out of the city. The system is capable of delivering up to 3,000 parcels a day¹¹³.

This helps to alleviate congestion and air pollution by making use of the river in central Paris and using zero emission last mile options. It is estimated that it avoids 300,000 km that would otherwise be driven by vans on Paris' streets, alleviating 12,500 hours of congestion¹¹⁴. The Fludis model also produces 62% less CO₂ emissions than the conventional delivery model¹¹⁵.

CASE STUDY: WATERBORNE FREIGHT FOR THE NHS

A pilot study in London is enabling Guy's and St Thomas' NHS Foundation Trust to receive deliveries via riverboat. Working with CEVA Logistics, Absolutely and Livett's, the three month pilot will see clinical supplies loaded onto boats at Dartford International Ferry Terminal and transported up river to the hospitals, with the last mile trip made by electric cargo bike¹¹⁷. The riverboat service will run twice a day and it is hoped that it will help to meet their net zero carbon emissions targets. If the pilot is successful, the service will be scaled up.

This follows the earlier establishment of a consolidation hub for the hospitals at Dartford, with CEVA in 2019. Prior to the opening of the hub, 160 deliveries were made to the Trust each day, from clinical supplies to bed linen, much of which was stored for future use¹¹⁸. Now, deliveries are made to the Dartford hub and supplies are stored there, with just those that are needed each day transported to the hospitals. This has reduced HGV deliveries to the hospital sites by 90%, removing 36,000 truck deliveries from central London each year¹¹⁹. The Trust is also looking to introduce three large electric trucks to deliver consolidated supplies from their hub¹²⁰.

In the UK, there are currently few examples of freight (other than bulk heavy freight like building materials) being delivered directly into city centres by rail or water, although this is clearly a growing area of interest. There is still untapped potential (particularly in respect of city railway stations and the use of urban waterways) which should be further explored, particularly as we look to decarbonise freight operations.

STRATEGIC RAIL FREIGHT INTERCHANGES

Where it is not possible to deliver freight by rail or water directly into city centres, the focus should be on ensuring that the largest distribution parks serving those areas are rail and/or water

connected. The Government's 2014 National Policy Statement on National Networks acknowledges the need for more Strategic Rail Freight Interchanges (SRFIs), defined as large, multi-purpose rail freight interchanges linked to both the rail and trunk road system.

A significant challenge to the development of more SRFIs is the limited number of suitable locations, however, the Williams-Shapps Plan for Rail commits the Government to exploring ways to enable future Strategic Rail Freight Interchanges to be located across the country. Urban planning authorities could have a role here in protecting the land necessary to facilitate the development of more SRFIs.

ROAD-CONNECTED CONSOLIDATION AND DISTRIBUTION

In addition to rail and water-connected distribution sites, there are a number of other distribution hub formats that can assist in minimising the volume and impact of road freight movements in urban areas.

The road freight and logistics industry has traditionally been highly competitive and efficient on its own commercial terms. However, efficiencies that work well for individual company business models can lead to wider inefficiencies for society as a whole with each logistics company operating its own parallel distribution systems leading to duplicate distribution centres, vehicles and trips. It may also make commercial sense to an individual logistics company to use a much larger than necessary vehicle for delivering goods to city centre locations due to fleet utilisation economies, which, at the same time, generate negative impacts for cities and the people.

Overall, these wider inefficiencies can lead to more vehicle movements and more time on the road than necessary, exacerbating congestion and other harms as outlined earlier in this report.

These inefficiencies could include:

- Low load factors and empty running.
- Multiple vehicles from various companies delivering goods to the same neighbourhoods or businesses.
- A high number of low volume or weight deliveries made to individual premises within a given time period.
- Long dwell times at loading and unloading points, where these are located on-street.

The development of Urban Consolidation Centres (where freight and deliveries for an urban centre can be consolidated and delivered by vehicles which are appropriate for urban streets in the most efficient way), other consolidation hubs at different scales and parcel lockers have the potential to rationalise deliveries and address some of these challenges.

Alongside a fiscal regime for road haulage that encourages greater efficiency there is a key role

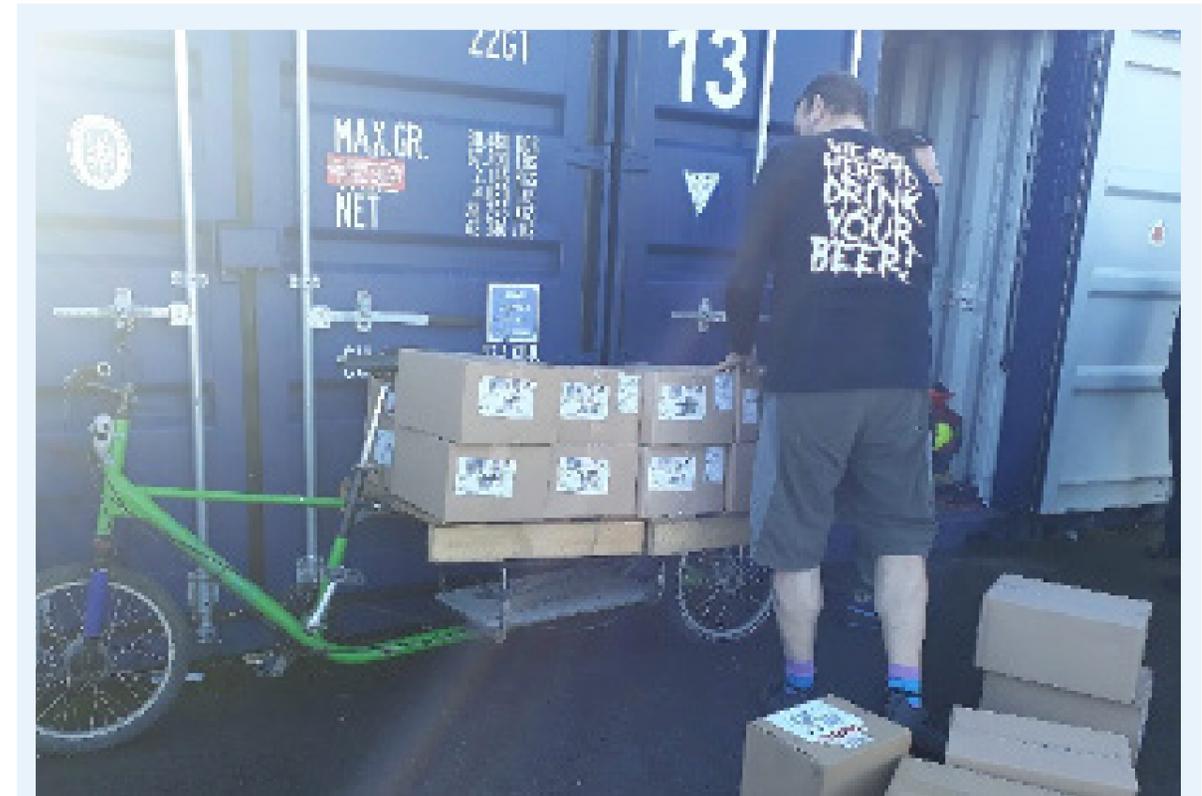
for public sector organisations to support innovative approaches to urban freight, consolidation and distribution, through supporting projects directly and ensuring efficiency in the procurement process. This is highlighted in a number of the case studies below, alongside a number of examples of hubs led by the private sector. In the previous section it was shown how consolidation can reduce the number of deliveries in the NHS and this approach could be adopted by further NHS trusts across the country and coupled with further innovative approaches to their supply chain, as demonstrated by Guy's and St Thomas' use of riverboats, low emission vehicles and cargo cycles.

CONSOLIDATION AND HUBS

The development of Urban Consolidation Centres (UCCs) has the potential to reduce inefficiencies and ensure that low emission modes are a practical option for the last mile. It has been estimated that, at any given moment in time, between 28 and 30% of HGVs are driving empty¹²³. Many of these are on specific logistical tasks, such as tankers which carry oil or milk¹²⁴ and where the opportunities for consolidation are limited but for the delivery of goods to shops, homes and businesses UCCs could help to avoid partially loaded vehicles in urban areas and reduce overall freight traffic in our cities.

Located on the outskirts of urban centres, UCCs receive freight from a number of different transport operators, with loads for a variety of customers in the surrounding urban area. At the UCC, these goods are consolidated into full loads for last mile deliveries using short-range low/zero emission vehicles (such as electric vans or cargo bikes). Benefits could be maximised further if UCCs were also rail or water connected.

Collaboration between logistics operators has been a particular challenge for establishing UCCs and there have been concerns raised around sharing of commercially sensitive data¹²⁵.



CASE STUDY: GREEN LINK

Green Link offers emission free deliveries in Darlington, York and Luton in the UK. They offer a range of consolidation and delivery services including for businesses serving the local authority, business to business deliveries and business to customer deliveries. They typically carry around 60-70 parcels a day. Parcels are consolidated at their centres and then the last mile deliveries are made using a range of different cargo cycles, depending on the job¹²⁷.

Green Link started operating in Darlington in 2005 and since then they have created five jobs and avoided over 8,000 van miles. This has resulted in savings of almost three tonnes of CO₂ a year.



The following video shows how services changed as a result of the Covid-19 pandemic, including making contact free deliveries: Darlington cycle courier delivery vlog during coronavirus lock down 2020 with Green Link Couriers - [YouTube](#)

CASE STUDY: CITY OF LONDON LAST MILE LOGISTICS HUBS

The City of London Corporation is establishing five Last Mile Logistics Hubs by 2025 to support its ambitions for net zero carbon emissions by 2040¹²⁸. The first of these was announced at the end of 2020 and will be delivered by Amazon Logistics. The hub will take over 39 car parking spaces in an underutilised facility, with the last mile trips been made either by e-cargo bike or on foot. This will remove 85 vehicles off City of London's roads every day and help to improve air quality and road safety. This also demonstrates how underutilised transport infrastructure, in this case a car park, can be repurposed to support more efficient freight operations.

CASE STUDY: CHAPPELLE INTERNATIONAL LOGISTICS HOTEL, PARIS

In Paris, as with many other urban areas, warehouses often lack access to rail infrastructure. A new 'Logistics Hotel' opened in 2018 near to Gare du Nord rail station on the north side of central Paris. At present, the facility is not linked to the railway infrastructure, but its location will enable this in the future¹²⁹. It has been built in a largely residential area and is a multi-use site which includes:

- An urban farm and tennis courts on the roof;
- Offices and a data centre; and
- An urban distribution terminal¹³⁰.

The mixed-use nature of the site enables a range of revenue sources for the owners, as warehouse spaces often attract lower rents than other urban land uses¹³¹. Its central location offers opportunities for goods to be sorted and delivered onwards to the local neighbourhoods and on into the heart of Paris¹³². The company which developed the facility is Sogaris, which is owned by the city of Paris.

The primary objective for UCCs from a public sector point of view is to maximise load factors in delivery vehicles so that fewer trips have to be made in city centres and consequently vehicle kilometres, emissions and road congestion are reduced. The use of smaller vehicles also reduces safety and quality of life concerns for communities. For these reasons, UCCs in Europe have often been subsidised, for example, by providing grants towards the costs of vehicles or short-term operating subsidy for an operator. Integrating plans for UCCs with Clean Air or Low Emission Zones can help increase the attractiveness of such schemes to freight operators¹³³. There is the opportunity for local authorities, who are delivering ambitious and strategic approaches to reducing emissions, to explore options for UCCs as part of this.

There are a number of examples of public sector led consolidation centres, which have demonstrated considerable benefits. The case study of the London Boroughs Consolidation Centre below demonstrates the positive impacts of local authorities working on an ambitious scheme together. The earlier case study of Guy's and St Thomas' NHS Trust also demonstrated the considerable benefits of consolidation, as they have achieved a 90% reduction in their deliveries as a result of the consolidation hub established at Dartford¹³⁴. However, it can require both cultural change across organisations and long-term support to deliver consolidation solutions.

As well as UCCs and hubs, there is a case for consolidation as part of procurement practices within organisations, in both the private and public sectors. This means that rather than individuals or teams ordering products and supplies or arranging collections on an ad hoc basis, they are routed through a central system and submitted as less frequent, consolidated orders or collections. This can reduce the number of deliveries and collections made, helping to make urban freight more sustainable. This approach could be taken within a single business or local authority or collectively, for example, across a group of nearby public sector bodies or across members of a Business Improvement District.

Transport for London evaluated a number of freight consolidation demonstrator projects and found key areas of potential and key factors for success including:

- Strong advocacy and leadership are key to successful schemes.
- Working through existing structures can drive projects forward, such as Business Improvement Districts (BIDs).
- Consolidation of commercial waste is a key area of opportunity.
- Collaborative procurement and pedestrian portage can offer significant benefits without the need for a UCC¹³⁷.

CASE STUDY: THE LONDON BOROUGHS CONSOLIDATION CENTRE

The London Boroughs Consolidation Centre bought together deliveries from a range of suppliers for the boroughs of Camden, Enfield, Islington and Waltham Forest. A range of benefits were achieved including:

- 46% reduction in the number of vehicle trips delivering to council sites
- 45% reduction in total distance travelled by delivery vehicles
- 41% reduction in CO₂ emissions
- 51% reduction in NO_x emissions
- 61% reduction in PM emissions
- 70% vehicle capacity utilisation achieved¹³⁵

Key findings from the programme suggested that consolidation should be procurement led and incorporated into tender documents and staff behaviour change is needed to embed a culture change within the organisation¹³⁶

PARCEL LOCKERS AND CLICK AND COLLECT LOCATIONS

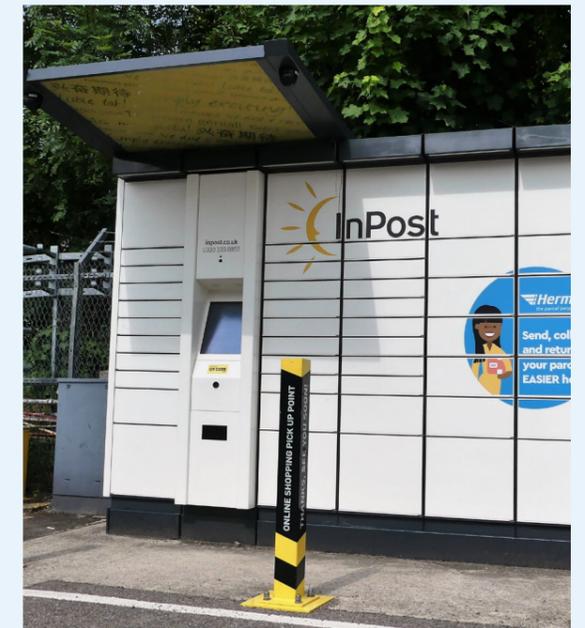
Parcel lockers and click and collect are now ubiquitous in our urban centres, with vehicles making deliveries for multiple customers to single click and collect locations or banks of parcel lockers. Customers can then pick up their parcels up, ideally on foot or by public transport to further reduce the amount of traffic on the road. Integration benefits are maximised where these facilities are located within or close to public

transport or mobility hubs, or at other locations that people are visiting anyway, such as shops and supermarkets.

The case studies below show how transport authorities can support urban freight collection by working with logistics providers to install parcel lockers and other click and collect facilities that are integrated with public transport infrastructure.

CASE STUDY: TRANSPORT FOR LONDON PARCEL LOCKERS

Transport for London has been working with boroughs, businesses and the freight sector to improve deliveries in the capital in order to improve road safety and air quality. This includes installing click and collect parcel lockers across the Tube network and exploring options for micro-distribution centres¹³⁸. In 2021, TfL announced that it would be working with InPost to install over 60 parcel lockers at Tube or rail stations to support customers and help to reduce delivery trips¹³⁹.



CASE STUDY: MOBILITY HUBS

Parcel lockers, or other kinds of click and collect hubs, could be integrated into the design of mobility hubs, which could bring together a range of shared transport modes with public transport as well as an improved urban realm. The image below shows how mobility hubs could work and how last mile freight solutions could be integrated¹⁴⁰. Mobility hubs could be implemented at a range of scales, from small local neighbourhood hubs to large scale hubs at major transport interchanges¹⁴¹. This means they can be installed close to where people live and work, thus offering local options for collection of parcels.

There are a number of plans for mobility hubs in the UK, including in city regions such as Greater Manchester and West Yorkshire. Integration of parcel collection in plans for mobility hubs could help address last mile delivery challenges and improve sustainability for urban freight.

Figure 8 – Mobility hub (Image source: CoMoUK)



Research by London First showed that people were more likely to use click and collect services where they reduce the negative impacts of deliveries, including on congestion, air quality and carbon emissions¹⁴². Convenience and costs were also other key factors influencing whether customers were likely to use a click and collect solution¹⁴³.

SUMMARY

Before reaching their ultimate destination, every opportunity should be taken to ensure that bulk freight travels as far as possible by rail or water. This section has shown how, prior to the last mile, bulk freight can be consolidated to reduce the number of journeys into urban areas or to ensure remaining journeys can be made using lower impact vehicles.

This section has also shown the potential of Strategic Rail Freight Interchanges, city centre railway stations, waterborne freight and Urban Consolidation Centres and hubs. It has also demonstrated the role the public and private sector can play in consolidating its deliveries and collections. There is also potential for the private sector to innovate around micro urban distribution centres, click and collect points and cycle logistics operations.

By taking every opportunity to reduce the number of freight journeys and, wherever possible, get freight carried by alternatives to HGVs (particularly in built-up areas) there are major benefits to be realised in safer, less congested, greener and more liveable streets. Innovation by both the private and public sector in making the last mile of freight delivery smarter and greener is happening already. The right public policy framework could rapidly accelerate these positive developments, creating new jobs in the dynamic and entrepreneurial freight and logistics sector in the process.

The following section looks in more detail at how last mile deliveries, which will usually be made by road, can be achieved with minimal negative impacts on urban environments and communities.

MAKING THE LAST MILE GREEN, SAFE, SMART AND UNOBTRUSIVE



Most freight travels by road and this mode will continue to play a key role in distribution networks in the future, particularly for the last mile. Rail and water networks will never have the capacity or coverage to take over from road freight, not least because these modes lack the flexibility to deliver to the door of the customer.

As the previous section illustrated, cargo cycles are playing a growing role, but their carrying capacity will always be limited compared to lorries and vans, again meaning that these kinds of vehicles will still be required to some extent. It is therefore vital that lorry and van journeys into city centre environments are made as green, safe, smart and unobtrusive as possible, both now and in the future. This section considers each of these areas in turn and also provides an overview of fleet standards and accreditation schemes which can help to measure and accelerate progress against environmental and safety criteria.

MAKING THE LAST MILE GREEN

Reducing the environmental impact of last mile freight activities requires a shift to low and zero emission HGVs and LGVs as well as increased use of cargo cycles where possible. Reducing contributions to transport CO₂ emissions and air pollution from the freight and logistics sector is critical if we are to meet our ambitious local and national climate targets and mitigate the public health impacts of poor air quality.

LOW, ULTRA-LOW AND ZERO EMISSION VEHICLES IN THE FREIGHT SECTOR

We have explored the potential to shift more goods to rail and water earlier in this report, which will have significant benefits for decarbonisation of the freight sector, as well as much wider benefits.

This report has also shown how consolidation of goods prior to their arrival in city centres makes it possible to reduce the number of individual vehicle trips as well as make the use of zero emission modes for the last mile, like cargo bikes, more viable.

However, we have also recognised that a significant proportion of freight continues to be moved by diesel fuelled HGVs and LGVs and this will be the case for some time. For road freight to play its part in decarbonised, prosperous city regions, and to achieve sustainable last mile trips, these vehicles will have to shift to low, and ultimately zero, emission vehicles.

Increasingly Clean Air, Low or Ultra Low Emission Zones are being established in cities to reduce air pollution and CO₂ emissions. These tend to charge vehicles which do not meet emission standards to enter the zone and support measures are often available for businesses and sometimes individuals to make the shift to cleaner, more sustainable vehicles.

Historically there has been a shortage of low, ultra-low and zero emission goods vehicles, and additional challenges where technology like refrigeration is required onboard. However, in the light duty vehicle market, there are increasing options for low and zero emission solutions, including battery electric vehicles, plug in hybrids, biogas, biodiesels and hydrogen fuel cells¹⁴⁴.

The UK Government has committed to ending the sale of all new petrol and diesel cars and vans by 2030 and set out their delivery plan in 'Transitioning to zero emission cars and vans'¹⁴⁵. Support will include continued grants for the purchase of vehicles and charging infrastructure, accelerating infrastructure rollout, including working with local authorities and research and development into zero emission vehicle

technology. Electric cars and vans are expected to achieve price parity with conventional fossil fuelled equivalents by the mid-2020s.

The HGV market is more difficult to decarbonise because of their weight and the long-haul journeys that they undertake. The EU has set targets for manufacturers of heavy-duty vehicles to reduce their CO₂ emissions by 15% by 2025 and 30% by 2030 against a 2019 baseline¹⁴⁶. The UK Government has transferred these requirements into UK law¹⁴⁷. In November 2021, the UK Government also announced that all new HGVs will be zero emission by 2040. New non-zero emission goods vehicles up to 26 tonnes will be phased out by 2035 and all new HGVs will be zero emission by 2040.

Zero emission alternatives for HGVs are emerging and many trials are underway to accelerate the development of this technology. Overhead charging for electric lorries is to be trialled on a 20 km stretch of the M180 in Yorkshire, with the installation of overhead power lines¹⁴⁸. The project, led by Costain, also involves Siemens Mobility and is part of a £20m government programme to support the shift to zero emission road freight.

Local authorities, and the wider public sector, can play a key role in shifting to low and zero emission light and heavy goods vehicles. They can take the lead in transitioning their own vehicle fleets, including vans and those vehicles used in refuse collection, as well as other vehicles they operate. The case study of Nottingham City Council opposite demonstrates how they have introduced electric vehicles across their fleet. Local authorities can also support local businesses to shift to low and zero emission vehicles as the case study of Leeds City Council overleaf demonstrates.

CASE STUDY: NOTTINGHAM CITY COUNCIL

Nottingham City Council has the most ambitious carbon reduction targets of any city in the UK, with a target of achieving net zero carbon emissions by 2028¹⁴⁹. The council is leading the way with the shift to ultra-low and zero emission vehicles in its own fleets, with more than 140 vehicles now fully electric. They introduced the UK's first battery-electric cage tippers in 2019, which are used to collect rubbish from bins in the city centre¹⁵⁰. In 2020 they purchased two of the world's first fully electric refuse collection vehicles which reduce carbon emissions by 52 tonnes a year each and save taxpayers £32,000 per year on running costs compared to diesel equivalents¹⁵¹. One of the key ways that the council has made the case for buying electric vehicles is by looking at the costs over a longer time horizon. So, while the vehicles have higher upfront costs, the running costs are much lower, so the business case stacks up over several years.

Figure 9 – Battery-electric cage tippers used for refuse collection in Nottingham (Image source: Nottingham City Council)



CASE STUDY: LEEDS CITY COUNCIL LOW EMISSION VANS

Leeds City Council has the ambition to transition its whole vehicle fleet to zero or ULEV by 2025 and already has 300 electric vehicles in its corporate fleet. In addition, they have made a further 44 electric vehicles available to SMEs, public sector, third sector and other businesses including private hire drivers to trial for up to two months. This enables people and organisations across the city to experience using an EV and to understand how it would work for them. The trial launched in September 2020. 118 organisations have taken part so far, and according to feedback from 86 participants, 7% have gone on to lease or

purchase an electric vehicle and a further 47% are looking to purchase or lease an electric vehicle.

Furthermore, Leeds City Council is delivering a rapid charge network across the area with up to 100 sites being supported by dual rapid chargers as well as enhancing the provision across Park & Ride sites, utilising On-street Residential Chargepoint Scheme grant funding to deliver more residential charging in 2021 and working with the commercial sector to encourage further investment in charging infrastructure.

Figure 10 – Leeds City Council electric van



As the case study above illustrates, in addition to greening their own fleets, there is a role for local and regional authorities in providing charging and refuelling infrastructure for zero emission vehicles. London is currently developing a strategy for providing EV charging across the city, including unlocking public sector land for the installation of charge points¹⁵². However, ongoing funding commitment is required from central Government to support authorities rolling out EV charging infrastructure and to grow consumer and business confidence in the technology and availability.

CARGO CYCLES

Cargo cycles have the potential to complete many last mile freight trips in urban areas. New research for charity Possible analysed data from cycle logistics company Pedal Me and found that their cycle deliveries are on average about 60% faster than van deliveries in London¹⁵³. Furthermore, across European cities, research has shown that half of all motorised trips associated with the transport of goods could be shifted to bike or cargo bike¹⁵⁴.

Case studies earlier in this report showed how cargo bikes can provide the last mile deliveries of freight that has been long hauled by rail or water or delivered to urban consolidation centres. E-cargo bikes, which make it easier to carry heavy loads, have been found to cut carbon emissions by 90% when compared to diesel vans or 33% when compared to electric vans¹⁵⁵. Cargo bikes also have the advantage of being quieter than motorised vehicles and contribute to improved road safety.

Local and city region transport authorities can play a key role in promoting cargo cycles for urban freight. This can be directly by supporting organisation and businesses who may be looking to switch to cargo bikes for their activities. In addition, supporting cycling infrastructure can help make cargo cycles more attractive and speed up deliveries by cargo bike, helping to make them a more competitive alternative to vans.

PORTERING

Portering, completing more of the 'last 200m' of a delivery on foot, can help to make these deliveries more sustainable. A trial in London worked with Gnewt zero emission freight operators and Ford Last Mile Delivery to develop software to identify the optimal drop-off points for vans to transfer parcels to a pedestrian porter or cycle courier for the last stage of the delivery¹⁵⁶. They suggest that by using this operating format, one van in a busy city centre, with a team of four porters or couriers, could do as much as five vans operating in the conventional way¹⁵⁷. In fact, their research found that the more time a van driver spends walking the greater the correlation with increased efficiency.

This also reduces fuel consumed and associated air pollution and emissions¹⁵⁸. Factoring in more walking for van drivers could also help improve driver's health and wellbeing. This approach is linked to making the last mile 'smart', as it uses new applications of software and data to manage deliveries in a dynamic way.

E-cargo bikes have been found to cut carbon emissions by 90% when compared to diesel vans or 33% when compared to electric vans. Cargo bikes are also quieter than motorised vehicles and contribute to improved road safety.



MAKING THE LAST MILE SAFE

Road safety is a critical issue for everyone and has grown in prominence since the first version of this report was published in 2015. Goods vehicles are a significant cause of injury and death on urban roads, despite making up a smaller proportion of traffic, as earlier sections of this report explained. There are also high levels of illegal operation as demonstrated by the number of prohibitions issued by the DVSA, shown in Section two. Making the last mile safe is important for freight to play its part in sustainable, liveable cities, now and in the future.

At present, road haulage is regulated in a 'light touch' way, particularly when compared to the rail sector, for example. The DVSA, which is responsible for enforcing the national minimum standards, is under resourced and under funded, meaning illegal operation remains widespread across the sector. A lack of quantitative targets for collision reduction coupled with a lack of data and analysis on incidents, mean that progress is held back and valuable learning is not taking place.

To make the last mile safe, we need a review of the regime for road safety that reflects the disproportionate impact of goods vehicles and is supported by a commitment to world leading vehicle and safety standards and ambitious quantitative targets for reducing collisions across modes. Enforcement of standards, collection of data and measurement against targets will require adequate resources and funding, whether routed through DVSA or through a new body with responsibility for safe freight operations or for road safety as a whole. Whichever body holds this responsibility should also seek to analyse the data collected and seek to learn and share lessons from collisions, something that is crucial to the wider Safe System approach which is described later in this section. These elements should form part of a new UK road safety strategy.

In the absence of a national road safety strategy, London has led the way in reducing the risk freight movements pose on the streets of the capital, with other cities looking to follow suit. Public outrage at the death toll among cyclists in London has

been among the factors leading to a major push to improve the safety of all road users in the capital. Brought together under a 'Vision Zero' banner, this effort has been wide-ranging, spanning – for example – a new Direct Vision Standard and safety permit for heavy goods vehicles (HGVs), fleet safety standards, junction improvements and speed reductions. The standards introduced in London and elsewhere are outlined below.

Spurred on by London's approach, Mayors and city cycling commissioners outside of the capital are also demanding action. For example, Chris Boardman, Manchester's cycling commissioner, has pledged to turn the city into Britain's safest place to cycle and walk¹⁵⁹.

VISION ZERO

First introduced in Sweden in 1997, Vision Zero aims to achieve a highway system with no fatalities or serious injuries involving road traffic. The core principle of the vision is that:

'Life and health can never be exchanged for other benefits within society'

Unlike the conventional cost-benefit analysis approach, where a monetary value is placed on life and health, these factors instead override all other considerations – including speed and convenience.

Vision Zero goes hand-in-hand with Safe System approach. Safe System frames road safety and the reduction of crashes as a shared responsibility between those who design, build manage and use roads and vehicles and those who provide post-crash care. All parts of the system must be strengthened in combination to multiply their effects and so that if one part of the system fails, all road users are still protected.

The pillars of Safe System are:

- Safe road use
- Safe vehicles
- Safe speeds
- Safe roads and roadsides

- Post-crash response¹⁶⁰

Local transport authorities have a key role to play, particularly on safe roads and roadsides; safe speeds; and safe road use but also on safe vehicles. London - together with other UK cities, including Manchester, Blackpool, Brighton and Hove, Edinburgh and Bristol - is working towards Vision Zero.

The Parliamentary Advisory Council for Transport Safety (PACTS) also supports Vision Zero and Safe System and is calling on the Government to do the same by adopting a long-term vision and strategy for a safe transport system free from death and serious injury¹⁶¹.

VEHICLE DESIGN

The design of goods vehicles has profound impact on the outcomes of any collision. The Safe System approach advocates for vehicle design that is forgiving when collisions occur. In early 2019, the EU relaxed restrictions on truck cab lengths but enhanced protections in cab design including improvements to field of vision,

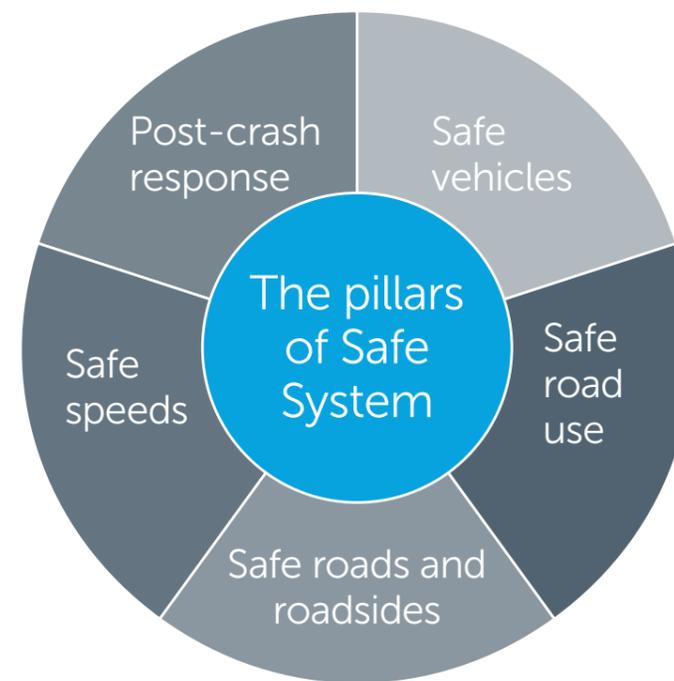
and enhancements around indirect vision including cameras¹⁶². The new vehicle designs will be more aerodynamic, improving fuel efficiency¹⁶³. It is unclear whether these changes will be incorporated into UK law, following Brexit. However, these changes would make it easier for trucks to meet London's Direct Vision Standard, which are outlined in detail below¹⁶⁴. It is estimated that the changes could prevent up to 1,200 pedestrians and cyclists being killed or seriously injured in the EU over the next ten¹⁶⁵. Now outside of the EU, the UK should continue to strive for world leading safety standards.

SAFETY AND STANDARDS

Good industry standards, and enforcement of these standards, are the foundation for safe, clean and effective freight operations. Whilst many operators are committed to maintaining high standards and undergoing continuous improvement, without clear guidance it can be challenging to achieve consistency across the sector. Furthermore, data from the DVSA has shown that many issues remain around maintenance and overloading. This can result in the kinds of issues around safety and environmental performance discussed in Section Two of this report.

There are a range of voluntary standards and accreditation schemes for fleet operators, and they are summarised below. Local authorities can play a key role in driving forward standards in the freight sector by requiring accreditation and participation in such schemes or enhanced training as a condition of their procurement processes. They can also lead by example by becoming members or supporters of a number of schemes themselves.

However, whilst these schemes can improve operations in the sector, they are no substitute for strengthened national standards, enforcement and targets which could deliver the safe operations required across the freight sector, not just those with a desire to improve their operations. The worst offenders within the sector are unlikely to engage with these initiatives and therefore must be targeted with enforcement activity.



FREIGHT STANDARDS AND ACCREDITATION SCHEMES

Fleet recognition schemes are one way in which operators can be supported and incentivised to maintain high standards. Such schemes provide operators with a framework against which they can judge their performance, ensure they are meeting the required legal standards and identify areas for improvement, including how they can go beyond legal compliance and demonstrate best practice. In doing so, they can work towards minimising any negative effects on communities and the environment.

The schemes often recognise and reward operator performance, for example, in the form of star ratings and certificates that they can display or in providing them with a competitive advantage when it comes to winning contracts. Some tendering organisations require potential contractors to actively participate in such schemes before they can bid for work. There are a number of vehicle and fleet recognition schemes and standards already in operation across the country. The focus of these schemes varies. Some, for example, centre primarily on safe operations, others on improving environmental performance. Examples are presented below.

FLEET OPERATOR RECOGNITION SCHEME (FORS)

FORS is a voluntary accreditation scheme for fleet operators which aims to raise the level of quality within fleet operations and to demonstrate which operators are achieving high standards in safety, efficiency and environmental protection¹⁶⁶. There are over 4,600 accredited members and over 100,000 accredited vehicles¹⁶⁷. FORS was introduced by Transport for London (TfL) in 2008 with the aim of making the capital's roads safer, cleaner and less congested, but has since been taken over by a concession and runs nationally. Participants in the scheme can apply for bronze, silver or gold accreditation, with progression dependent on the fulfilment of a range of criteria covering management, vehicles, drivers, emissions, safety and operations¹⁶⁸. A growing number of 'Champions' require FORS participation and accreditation as a contractual or procurement requirement in their supply chain, including TfL and many large construction companies¹⁶⁹.

CONSTRUCTION LOGISTICS AND COMMUNITY SAFETY (CLOCS)

In 2012, TfL commissioned the Transport Research Laboratory to conduct a review of the construction sector's transport activities to understand their role in cyclist fatalities involving HGVs. They found that blind spots were larger on construction vehicles than other HGVs, there was a lack of consideration of road safety, a lack of understanding of the impacts of construction activity on road safety and no common standard for the industry to work to in order to manage work related road safety. CLOCS brings together the construction logistics industry to manage work related road risk and embed a road safety culture across the industry.

CLOCS has four primary goals: zero collisions between construction vehicles and the community; improved air quality and reduced emissions; fewer vehicle journeys; and, reduced reputational risk¹⁷⁰.

The CLOCS scheme is aligned to FORS, so any FORS silver operator will be automatically compliant with CLOCS.

ECO STARS

ECO Stars is a fleet recognition scheme that aims to help operators improve efficiency, reduce fuel consumption and emissions and make cost savings¹⁷¹. The scheme recognises progress in reducing environmental impact and offers practical advice.

It was set up in 2009 in South Yorkshire, when Barnsley, Doncaster, Sheffield and Rotherham councils wanted to reduce air pollution. ECO Stars has since been adopted by a number of other local authority areas in the UK as well as several European cities. There are now over 500 members, encompassing more than 14,000 vehicles.

TRUCK AND VAN EXCELLENCE

Logistics UK has both Truck and Van Excellence accreditation schemes. The Truck Excellence Scheme aims to:

- Demonstrate consistent attainment of high levels of compliance by road freight transport operators with the operator licence undertakings
- Create a recognised compliance quality mark for

use by members with other parties

- Provide equivalence to comparable schemes and alternative means of achieving them¹⁷².

The Van Excellence Scheme is built around a code that covers the driver, the vehicle, safe working practices and record keeping¹⁷³.

TRANSPORT FOR LONDON, LEADING THE WAY

As well as initiating both FORS and CLOCS, Transport for London has developed several additional schemes to improve safety for HGVs in London, that have wider implications for vehicle design and safety elsewhere.

In 2015, TfL launched the Safer Lorry Scheme. This required vehicles over 3.5 tonnes to be fitted with additional mirrors and side guards, including those that were exempt from these modifications under national legislation¹⁷⁴. This was followed by the introduction of the Direct Vision Standard (DVS)

and safety permit for heavy goods vehicles (HGVs) in 2021, which measures how much an HGV driver can see through their cab windows and the level of risk to road users such as pedestrians and cyclists near the vehicle¹⁷⁵. Where a vehicle does not meet the vision standard required, additional safe system technology will be required to be eligible for a permit to drive in Greater London. The standards are becoming more stringent over time in order to drive improvements. HGVs found to be in breach of the permit scheme will be issued with fixed penalty notices.

Additional training for goods drivers can support improving safety in the sector, particularly for drivers navigating urban areas where they may encounter more cyclists and pedestrians. The case study below illustrates such training.

CASE STUDY: SAFE URBAN DRIVING TRAINING

Safe urban driving training provides practical additional training for professional drivers in urban areas, including those in the freight sector. This can be part of standards and accreditation schemes outlined below. Nottingham charity RideWise provides safe urban driver training, through practical cycling awareness sessions to show drivers how to reduce the possibility of collisions¹⁷⁶. This includes classroom sessions and practical on road cycling sessions with cycle instructors to support drivers in sharing space in the urban environment.

Figure 11 – Drivers undertaking safe urban driver training with RideWise in Nottingham (Image source: RideWise)



MAKING THE LAST MILE SMART

Since we published the first version of this report in 2015, a range of new technological developments have impacted on the freight sector and there are further developments on the horizon that could make the last mile smarter. These include the use of data to optimise deliveries, the shift to more connected and autonomous vehicles (CAVs), management of kerbsides and the development of delivery drones. These are explored in more detail below.

THE ROLE OF DATA

Enhanced use of data offers opportunities to improve the efficiency of deliveries and make more effective use of vehicles. Advanced algorithms coupled with routing data, could allow deliveries to be optimised, making the best use of resources and avoiding congestion. However, data can also be a contentious topic in the freight sector, with operators concerned about the risks of sharing commercial data. This has often been identified as a barrier to innovation including consolidation activities.

CASE STUDY: UPS ON-ROAD INTEGRATED OPTIMISATION AND NAVIGATION

In the USA, UPS developed ORION (On-Road Integrated Optimisation and Navigation) which uses expansive fleet telematics and advanced algorithms to organise and optimise the routes of their drivers, who make on average 100 stops a day. They calculate that it now saves 100 million miles a year and reduces CO₂ emissions by around 100,000 metric tonnes¹⁷⁷.

CONNECTED AND AUTONOMOUS VEHICLES

Connected and autonomous vehicle (CAV) technology could transform the way deliveries are made and many companies are exploring how autonomous vehicles could offer commercial opportunities. At present, there is considerable uncertainty about whether or when fully autonomous vehicles will be widely available. However, vehicles are becoming increasingly connected, with Bluetooth, GPS, sat nav, internet connections and vehicle manufacturer cloud connections¹⁷⁸.

There could be wide ranging and complex impacts (both positive and negative) if full automation of deliveries occurs, which are beyond the scope of this report but which are explored more fully in our 'Automatic for the people?' report on CAVs¹⁷⁹.

Enhanced use of data offers opportunities to improve the efficiency of deliveries and make more effective use of vehicles



CASE STUDY: DRIVERLESS DELIVERIES

In 2017 as part of the GATEway Project (led by TRL and funded by the UK government), Ocado Technology (a division of UK grocery company Ocado) completed a two-week trial of autonomous grocery deliveries, using a 'CargoPod' vehicle developed by Oxbotica¹⁸⁰¹⁸¹. Accompanied at all times by human minders, the small electric vans were designed to carry eight crates and to be ideal for areas where larger vehicles are unsuitable. Unlike regular grocery deliveries, customers were required to go to the van to collect their shopping, rather than having it delivered to the door in person¹⁸².

Meanwhile, robot food¹⁸³ and package¹⁸⁴ delivery pods (resembling small boxes on wheels) by Starship are navigating the streets of Milton Keynes (with human chaperones). The design of Milton Keynes favours small delivery bots. It is criss-crossed with underpasses and overpasses meaning that there is less need for the robots to negotiate traffic. As of March 2020, the robots had completed 100,000 deliveries, travelled over 500,000 miles and completed over 5m road crossings worldwide¹⁸⁵. During the coronavirus pandemic, they supported people to get deliveries during the lockdown periods¹⁸⁶.

MANAGEMENT OF THE KERBSIDE

The issue of the management of kerb space has become increasingly prominent in recent years, with the expansion of networks of cycle lanes, increased demand for loading and unloading of vehicles, space for shared transport and electric vehicle charging infrastructure¹⁸⁷. Proposals for smart solutions to kerb space management focus on flexible use of the kerb at different times of day in order to facilitate a range of uses while protecting pedestrians and cyclists.

The International Transport Forum recommend¹⁸⁸ that public authorities should anticipate and plan for the revenue impacts of shifting kerb use from car parking to pick-up/ drop-off points. They suggest authorities consider whether they wish to price kerb usage and explore which instruments they might use (although acknowledge that these instruments have yet to be developed in many cases). They say that *'Pricing curb use can help cities retain the ability to manage traffic and transport demand by replacing parking pricing mechanisms.'*

Smart technology and connected vehicles could mean that these spaces are *'no longer static, inflexible installations. Instead curb use will resemble dynamic, highly flexible, self-solving puzzles.'*¹⁸⁹ Booking, allocating and controlling the use of spaces for different purposes and at different times of the day could all be done dynamically and in real time, with the infrastructure communicating with vehicles to control access

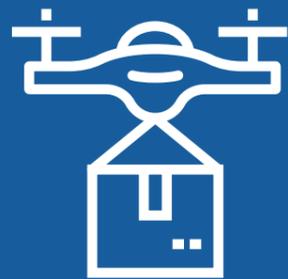
Local authorities already play a key role in managing access to the kerbside (through parking policies for example) and could further develop this, in particular where they want to meet wider policy objectives such as encouraging active travel and management of deliveries. The approach outlined in the case study below offers one such model for doing so.

CASE STUDY FLEXKERBS BY ARUP¹⁹⁰

FlexKerbs proposes to manage the kerbside dynamically, safely and intelligently, changing use based on different times of the day and different days of the week. The management would be led by local policy. The dynamic management could, for example, create wider footways during peak commuting times and open up space for drop off and pick up of goods late at night or early in the morning to incentivise off peak deliveries.

The idea was simulated on Cheapside in the City of London, with an illustrative 24 hour schedule based on demand and local policy measures, which was then run through a transport model. The results showed that FlexKerbs could reduce delays to motorised traffic, provide a safer cycling environment, offer improved space for pedestrians and, in future, offer sufficient space for CAV pickups and drop offs. This shows how smart management of the kerbside, led by local authority priorities, could deliver improved outcomes for people and vehicles

Delivery drones could meet specific freight and logistics needs but are prone to disadvantages such as safety risks, noise and privacy concerns



CASE STUDY: DRONES DELIVER MEDICAL EQUIPMENT TO THE ISLE OF WIGHT

A trial involving Solent Transport, the University of Southampton and Isle of Wight NHS Trust is using delivery drones to transport medical supplies to the island¹⁹³. This is part of the Department for Transport funded Solent Future Transport Zone. The drone can carry up to 100kg, though initially it is carrying loads of up to 40kg of 'benign cargo'¹⁹⁴. The flights helped to support the NHS in their response to Covid-19 in 2020. The drone can remain on standby and supplementing the carriage of medical supplies via ferry, and it is hoped in the future that it will be able to transport blood and donor organs, improving the movement of time-critical supplies¹⁹⁵. It can make the crossing in about 10 minutes.



DELIVERY DRONES

An additional development that has emerged since the first version of this report was published is the idea of using drones for deliveries. This has been pursued by global logistics firms and Amazon has invested resources in the development of drone deliveries. Challenges around regulations have slowed progress, as currently drones are banned from flying beyond the line of sight of their pilots under most circumstances, although Civil Aviation Authority has granted permission for a number of drone delivery trials¹⁹¹.

Delivery drones could meet specific freight and logistics needs, including in industrial settings, and the case study above shows how a trial is using drones to deliver NHS supplies to the Isle of Wight. This trial involves local authorities and other public sector bodies, and there may be opportunities for the public sector to identify further roles for delivery drones as the technology develops. However, flying drones in an urban environment is challenging and it is unlikely we will see delivery drones at scale in urban areas soon¹⁹². There are also a number of potential disadvantages to drone deliveries, particularly in urban areas, which include safety risks, noise and privacy concerns.

MAKING THE LAST MILE UNOBTRUSIVE

Last mile deliveries in urban areas can affect local residents through the noise created and the impact on the urban realm and local environment. Night-time deliveries are often preferable, as they allow vehicles to travel at less congested times of day and allow shops to be restocked for the next day. However, night-time deliveries can be disruptive to those living nearby. Low and zero emission vehicles, and cargo cycles offer quieter alternatives to conventional fossil fuelled vehicles. There are also a range of additional measures that can help to reduce noise from deliveries.

Transport for London has established a Code of Practice for quieter deliveries which is outlined in the case study below. Re-timing of deliveries also offers benefits for road safety, as vehicles are less likely to come into contact with pedestrians and cyclists if they are operating at quieter times of day.

CASE STUDY: TFL CODE OF PRACTICE FOR QUIETER DELIVERIES¹⁹⁶

Transport for London is keen to encourage freight operators to shift more delivery times, to avoid peak hours and enable the needs of businesses to be met whilst minimising disruption to local residents. They have set out guidance on how to minimise noise for freight operators and those receiving deliveries. Suggested measures and good practices include:

- Using newer and quieter equipment such as quiet roll cages, rubber floor mats, soft-close doors and low-noise refrigeration units
- Ensuring equipment is well maintained
- Liaising with colleagues and other businesses to minimise the likelihood of more than one vehicle arriving at once

- Switching off external bells at delivery points
- Think about how to minimise contact between hard surfaces, particularly metal on metal, during the unloading / loading processes
- Ensure colleagues do not shout or whistle to get the attention of the driver
- Switching off engines immediately when not manoeuvring

This shows how small changes in loading and unloading activities, combined with quieter and well-maintained equipment can ensure that night-time deliveries are made with minimal disruption to neighbours.

The aforementioned CLOCs scheme also provides guidance on re-timing of deliveries, including guidance on the roles local authorities can play¹⁹⁷. This includes identifying opportunities for re-timing of deliveries to a specific site, liaising between businesses and local residents to manage any challenges that emerge and ensuring that facilities for quieter deliveries are included in planning applications, to build in best practice at new developments from the outset.

SUMMARY

Setting aside efforts to encourage more freight onto rail and water as well as those to promote innovation and efficiency in urban distribution, this section has focused on how we might ensure that last mile journeys using vans and lorries are as safe, green and unobtrusive as possible. It has argued that the foundation for this is a review of the regime for road safety including ambitious goals for reducing deaths and injuries caused by road freight on urban streets and underpinned by robust, adequately funded enforcement action and a culture of learning.

In addition, it discusses the need to address a number of specific areas in respect of improving safety and environmental performance namely pressing ahead with improvements to vehicle design, enhanced driver training, steps to encourage greater take-up of green vehicle technologies and potential application of smart technologies in the freight sector.

Local authorities have a key role to play across these areas. From supporting businesses to shift to low and zero emission vehicles, and transitioning their own vehicle fleets, to being involved in trials of smart approaches to managing urban freight and promoting safe systems and quiet deliveries, local authorities are well positioned to influence across this agenda. However, without adequate resources and funding to support these activities, the ability of local authorities to ensure that freight plays its part in decarbonised, sustainable city regions will be limited. It will also be necessary to work closely with national government, freight operators and businesses to ensure progress and maintain advances in activities.

CONCLUSIONS AND RECOMMENDATIONS**7**

Freight is vital to the effective functioning of the UK economy, bringing great benefits in terms of economic output, employment and ensuring we have access to goods when and where we need them.

The ultimate destination for many of these goods are our cities. As this report has illustrated, the way in which these goods are delivered has the potential for both positive and negative impacts on the places that people live, work and spend time in. To maximise the positives and minimise the negatives, we need to make the greening of urban freight and logistics central to wider national and urban decarbonisation strategies and to make freight work for cities in a way that is safe, smart, clean and good for local economies, the environment and communities. This report has set out how.

INVESTING IN THE INFRASTRUCTURE WE NEED FOR MODAL SHIFT

Freight should make its way to urban areas by rail or water wherever possible. To facilitate this, the capacity of these modes must be enhanced and a more extensive network of rail and water connected distribution sites established. To increase rail capacity, this report has argued that an integral part of the planning process for major rail projects (such as HS2 and the electrification programme) should be to explore the potential to undertake simultaneous improvements to grow rail freight. For waterways, there could be more support for ongoing maintenance and the removal of barriers which currently restrict capacity.

To support capacity enhancements, a more extensive network of rail and water-connected distribution sites is required. Greater use of city centre opportunities – such as making more use of city railway stations as freight hubs – should be explored and, beyond this, the largest distribution parks serving urban areas should be rail and/or water connected.

Alongside, rail and water-connected sites, other distribution hub formats should be explored with a view to minimising the volume and impact of road freight movements in urban areas. Backed by the right incentives and policies to make them

economically viable, Urban Consolidation Centres (UCCs) could substantially reduce the volume and impact of deliveries by road in urban centres.

The public sector (education, local government, the health service) can play a major role by adopting policies which aim to reduce the volume and impact of the deliveries and collections they generate. This can be done through both consolidation of orders internally (fewer people ordering the goods the organisation needs and doing so in a more concentrated way using low impact means of delivery) and through external consolidation such as through the use of consolidation centres.

Urban planning authorities also have a key role in planning for modal shift by protecting the land necessary to facilitate it (such as for rail or water based distribution centres).



INCENTIVISING MODAL SHIFT

The freight and logistics sector is highly competitive and efficient in its own terms. However, what works commercially can cause wider inefficiencies which impact on society in terms of duplicated facilities and trips and the wider problems of congestion, pollution and damage to road surfaces. In addition, road haulage does not pay for all of the indirect costs that result from its operation. This in turn can give it an unfair advantage against other modes (like rail and water) and can further discourage the sector from acting in a way which minimises its broader impacts. Meanwhile, compared to other countries, a largely commercial approach has been taken to rail freight, without intervention or support, which has led to a relatively low market share and a focus on bulk, long-distance freight. This has led to the neglect of other potential markets, such as consumer goods, deliveries into urban centres or smaller 'wagonload' consignments. Cities as large as Bradford have been left with no rail freight facilities or traffic whatsoever.

In order to level the playing field between road, rail and water freight, there is a need for a review of the fiscal regime for road haulage to ensure it covers more of its indirect and direct costs and which incentivises safer and greener operation. This would also improve the competitive position of rail and water. At the same time, a more interventionist approach to rail freight is required to incentivise the rail sector to widen the scope and extent of the service it offers. This should relate to a national target for the growth in rail freight as set out in the Government's transport decarbonisation plan. By strengthening the rail and water freight sectors, we can also enhance the resilience of the whole freight sector, improving its ability to manage shocks such as the impact of driver shortages seen in 2021.



THE GREENING OF URBAN FREIGHT

For the freight sector to play its part in prosperous, decarbonised city regions and in meeting net zero targets, there needs to be a rapid shift to low and zero carbon operations. National Government has a key role to play and has committed to phasing out new non-zero emission HGVs by 2040. They should now develop a clear plan for delivering these zero emission HGVs and the infrastructure necessary to support them.

Local government and the wider public sector can lead by example by decarbonising its own fleets. Local Authorities can also support local businesses to shift to zero emission vehicles and support the rollout of charging and fuelling infrastructure for zero emission vehicles. This requires funding and

commitment from national Government and an expansion of capacity at a local level to accelerate provision.

Cycle logistics also has a key role to play in making the last mile greener. Continued support and expansion of cycle infrastructure in urban areas can make cycle logistics more attractive to operators and riders, and more efficient as there may be fewer challenges navigating traffic. This should be considered in development of wider active travel strategies.



IMPROVING THE SAFETY OF URBAN FREIGHT

Road safety is a critical issue for everyone and freight vehicles are a significant cause of injury and death on urban roads, despite making up a smaller proportion of traffic. There are also high levels of illegal operation as demonstrated by the number of prohibitions issued.

We need a review of the regime for road safety that reflects the disproportionate impact of goods vehicles. We need a commitment to world leading safety standards and quantitative targets for reducing road collisions. Enforcement of these standards and measurement against these targets requires resource and funding, either through the existing route via the DVSA or through a new body with responsibility for safe freight operations or road safety as a whole. Data and analysis of risks is an important aspect of learning from collisions which is missing at present. This should be part of a new UK road safety strategy and will help to deliver on targets for collision reduction.

Vehicle standards should incorporate world leading technology to reduce the risk of collisions with pedestrians and cyclists. Transport for London has driven substantial progress in this space with Direct Vision Standard and safety permit for heavy goods vehicles (HGVs), and world leading standards for vehicle safety should be reflected at a national level.

In the absence of an ambitious set of standards at a national level, voluntary accreditation schemes do help to drive progress in the freight sector. Local authorities can play a part in this by requiring FORS or other accreditation schemes in their procurement processes and contracting. However, such schemes will still miss the worst offenders, highlighting the need for robust, adequately funded standards and enforcement at national level.



REFERENCES

8

- 1 Department for Transport (2021) Domestic Road Freight Statistics, United Kingdom 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1006792/domestic-road-freight-statistics-2020.pdf
- 2 MDS Transmodal for Pteg (2013) Freight in the city regions <https://www.urbantransportgroup.org/system/files/general-docs/Freight%20in%20the%20City%20Regions%20Final%20Report.pdf>
- 3 Ibid.
- 4 Department for Transport (2021) Domestic freight transport by mode (TSGB0401) <https://www.gov.uk/government/statistical-data-sets/tsgb04-freight> Date accessed 04/05/2021
- 5 Ibid. Note that in the original report, pipeline transport was presented, but data for pipeline transport is not available after 2013
- 6 Department for Transport (2021) Domestic Road Freight Statistics, United Kingdom 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1006792/domestic-road-freight-statistics-2020.pdf
- 7 Alvarez and Marsal (2021) The shape of retail: The true cost of online https://www.alvarezandmarsal.com/sites/default/files/true_cost_of_online.pdf
- 8 Urban Transport Group (2018) White van cities: Questions, challenges and options on the growth of urban van traffic <https://www.urbantransportgroup.org/system/files/general-docs/White%20Van%20Cities.pdf>
- 9 Department for Transport (2019) Government Response to Call for Evidence – The Last Mile – Delivering goods more sustainably https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/786879/last-mile-call-for-evidence-government-response.pdf
- 10 Ibid.
- 11 Ibid.
- 12 Department for Transport (2019) The Future of Mobility: Urban Strategy https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/846593/future-of-mobility-strategy.pdf
- 13 Ibid.
- 14 HM Government (2020) The Ten Point Plan for a Green Industrial Revolution https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936567/10_POINT_PLAN_BOOKLET.pdf
- 15 Department for Transport (2020) Gear Change – A bold vision for cycling and walking https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904146/gear-change-a-bold-vision-for-cycling-and-walking.pdf
- 16 Department for Transport and Williams Rail Review (2021) Great British Railways – The Williams-Shapps Plan for Rail https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994603/gbr-williams-shapps-plan-for-rail.pdf
- 17 Department for Transport (2021) Transport decarbonisation plan <https://www.gov.uk/government/publications/transport-decarbonisation-plan>
- 18 Department for Transport (2021) Transitioning to zero emission cars and vans: 2035 delivery plan <https://www.gov.uk/government/publications/transitioning-to-zero-emission-cars-and-vans-2035-delivery-plan>
- 19 HGV Alliance (2020) Fun Logistics Facts & Stats <https://www.hgvalliance.com/Haulage-Facts>
- 20 Ibid.
- 21 Alvarez and Marsal (2021) The shape of retail: The true cost of online https://www.alvarezandmarsal.com/sites/default/files/true_cost_of_online.pdf
- 22 DfT. (2015). Road Investment Strategy: for the 2015/16 – 2019/20 Road Period, referenced in WSP for the National Infrastructure Commission (2018) Future of Freight – Managing Congestion Future-of-Freight_Managing-Congestion_WSP.pdf (nic.org.uk)
- 23 Local Government Association (2017) A country in a jam: tackling congestion in our towns and cities https://www.local.gov.uk/sites/default/files/documents/5.16_Congestion_report_v03.pdf
- 24 Go-Ahead Group (2021) Written Response to Transport Select Committee Inquiry on Zero emission vehicles and road pricing <https://committees.parliament.uk/writtenevidence/22865/pdf/>
- 25 Department for Transport (2021) Domestic Road Freight Statistics, United Kingdom 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1006792/domestic-road-freight-statistics-2020.pdf
- 26 Inrix (2021) INRIX Scorecard 2020: After a year of lockdowns, UK city centre congestion down 52% <https://inrix.com/press-releases/2020-traffic-scorecard-uk/>
- 27 Ibid.
- 28 WSP for the National Infrastructure Commission (2018) Future of Freight – Managing Congestion Future-of-Freight_Managing-Congestion_WSP.pdf (nic.org.uk)
- 29 Department for Transport (2021) Road Traffic Estimates: Great Britain 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/981967/road-traffic-estimates-in-great-britain-2020.pdf
- 30 Department for Transport (2021) TRA0101: Road traffic (vehicle miles) by vehicle type in Great Britain <https://www.gov.uk/government/statistical-data-sets/road-traffic-statistics-tra#traffic-volume-in-miles-tra01> date accessed 30/07/2021
- 31 Madden P (2021) The instant city: how the desire for speedy gratification is reshaping our urban lives <https://pmadden.medium.com/the-instant-city-how-the-desire-for-speedy-gratification-is-reshaping-our-urban-lives-fda8f4603045>
- 32 Ibid.
- 33 Department for Transport (2020) Vehicles involved in reported accidents by accident severity and vehicle type, Great Britain, 2019, Table RAS20003 Reported road accidents, vehicles and casualties tables for Great Britain – GOV.UK (www.gov.uk) date accessed 02/08/2021
- 34 Ibid.
- 35 Ibid.
- 36 Ibid.
- 37 Department for Transport (2020) Vehicles involved in reported road accidents, Table RAS20005 <https://www.gov.uk/government/statistical-data-sets/ras20-drivers-riders-and-vehicles-in-reported-road-accidents> date accessed 02/08/2021
- 38 Ibid.
- 39 Transport for London (2019) Press Release: The Mayor and TfL launch major plan to help freight deliver for Londoners <https://tfl.gov.uk/info-for/media/press-releases/2019/march/the-mayor-and-tfl-launch-major-plan-to-help-freight-deliver-for-londoners>
- 40 PACTS (2020) What kills most on the roads? <https://www.pacts.org.uk/wp-content/uploads/PACTS-What-kills-most-on-the-roads-Report-15.0.pdf>
- 41 Ibid.
- 42 Ibid.
- 43 Ibid.
- 44 DVSA (2020) Vehicle enforcement checks at roadside and operators' premises (date accessed 03/06/2021) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/856001/dvsa-enf-01-vehicle-enforcement-checks-at-roadside-and-operators-premises.csv/preview
- 45 Department for Transport (2020) Energy and environment data tables ENV0201 (TSGB0306) (date accessed 03/06/2021) <https://www.gov.uk/government/statistical-data-sets/energy-and-environment-data-tables-env>
- 46 Department for Transport (2021) Heavy Goods Vehicles VEHO503 (date accessed 03/06/2021) <https://www.gov.uk/government/statistical-data-sets/veh05-licensed-heavy-goods-vehicles>
- 47 Department for Transport (2021) Light Goods Vehicles VEHO403 (date accessed 03/06/2021) <https://www.gov.uk/government/statistical-data-sets/veh04-licensed-light-goods-vehicles>
- 48 Department for Transport (2020) Energy and environment data tables ENV0301 (TSGB0308) (date accessed 03/06/2021) <https://www.gov.uk/government/statistical-data-sets/energy-and-environment-data-tables-env>
- 49 Public Health England (2018) Guidance - Health matters: air pollution <https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution>
- 50 Race Equality Foundation (2017) Air quality and equalities, <http://raceequalityfoundation.org.uk/wp-content/uploads/2017/11/air-quality-and-equalities-final-1.pdf>
- 51 Urban Transport Group (2018) Evidence Submission to the Transport Select Committee: Inquiry on local roads funding and governance <https://www.urbantransportgroup.org/system/files/general-docs/Local%20roads%20UTG%20response%20FINAL.pdf>
- 52 Edmunds (2018) Heavy goods vehicles are not paying their way on the roads. It's time for distance-based charging <https://citymonitor.ai/transport/heavy-goods-vehicles-are-not-paying-their-way-roads-it-s-time-distance-based-charging-3806>
- 53 Department for Transport (2021) Domestic Road Freight Statistics, United Kingdom 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1006792/domestic-road-freight-statistics-2020.pdf
- 54 Johnson and Holdsworth (2020) Transport and logistics during the Covid-19 pandemic <http://blog.policy.manchester.ac.uk/posts/2020/04/transport-and-logistics-during-the-covid-19-pandemic/>
- 55 Logistics UK (2020) Skills and Employment Report 2020 <https://logistics.org.uk/CMSPages/GetFile.aspx?guid=86764e99-6b36-4517-a93d-f567ebfa0ada&lang=en-GB>
- 56 Johnson and Holdsworth (2020) Transport and logistics during the Covid-19 pandemic <http://blog.policy.manchester.ac.uk/posts/2020/04/transport-and-logistics-during-the-covid-19-pandemic/>
- 57 Department for Transport (2021) Domestic Road Freight Statistics, United Kingdom 2020.
- 58 Logistics UK (2021) The Logistics Report Summary 2021 <https://logistics.org.uk/CMSPages/GetFile.aspx?guid=68631c02-c41f-40e8-99b3-fa9b60832742&lang=en-GB>
- 59 Johnson and Holdsworth (2020) Transport and logistics during the Covid-19 pandemic <http://blog.policy.manchester.ac.uk/posts/2020/04/transport-and-logistics-during-the-covid-19-pandemic/>
- 60 Logistics UK (2020) Skills and Employment Report 2020 <https://logistics.org.uk/CMSPages/GetFile.aspx?guid=86764e99-6b36-4517-a93d-f567ebfa0ada&lang=en-GB>
- 61 Topham (2021) Call for action as UK driver shortage hits supermarket shelves in The Guardian <https://www.theguardian.com/business/2021/aug/03/call-for-action-as-uk-driver-shortage-hits-supermarket-shelves>
- 62 Logistics UK (2020) Skills and Employment Report 2020 <https://logistics.org.uk/CMSPages/GetFile.aspx?guid=86764e99-6b36-4517-a93d-f567ebfa0ada&lang=en-GB>
- 63 Ibid.
- 64 Department for Business, Energy and Industrial Strategy (2018) THE CHARACTERISTICS OF THOSE IN THE GIG ECONOMY https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/687553/The_characteristics_of_those_in_the_gig_economy.pdf
- 65 Ibid.
- 66 Gregory (2021) Transport noise linked in increased risk of dementia, study finds, in The Guardian <https://www.theguardian.com/society/2021/sep/09/transport-noise-linked-to-increased-risk-of-dementia-study-finds>
- 67 Department for Transport (2021) HGV Road User Levy <https://www.gov.uk/government/collections/hgv-road-user-levy>
- 68 Department for Transport (2021) Rail and water freight grants <https://www.gov.uk/government/collections/freight-grants>
- 69 Rail Freight Group (2021) 'Opportunity of a Lifetime' to Grow Freight if Rail Reform Delivers on Promise <http://www.rfg.org.uk/opportunity-lifetime-grow-freight-rail-reform-delivers-promise/>
- 70 Department for Transport (2021) Transport decarbonisation plan <https://www.gov.uk/government/publications/transport-decarbonisation-plan>
- 71 RDG (2019) "Rail Freight: Delivering for Britain", https://www.raildeliverygroup.com/files/Publications/2019-05_rail_freight_delivering_for_britain.pdf
- 72 Network Rail (2021) Rail freight <https://www.networkrail.co.uk/industry-and-commercial/rail-freight/>
- 73 ORR (2019) Freight Rail Usage, (Impact on Road Haulage, Table 13.8) (online). Available at: <https://dataportal.orr.gov.uk/media/1699/impact-on-road-haulage-table-138.xlsx>
- 74 Network Rail (2021) Rail freight <https://www.networkrail.co.uk/industry-and-commercial/rail-freight/>
- 75 Rail Freight Group (2021) Why use rail freight? <http://www.rfg.org.uk/rail-freight/why-use-rail-freight/>
- 76 Commercial Boat Operators Association (2021) The Case for Water <http://www.cboa.org.uk/introduction.html>
- 77 Ibid.
- 78 Tideway (2021) Every Boat Counts <https://www.tideway.london/every-boat-counts/>
- 79 Tideway (2020) Every Boat Counts <https://vimeo.com/375396467>
- 80 Building Work Thames Tideway Tunnel Super Stock Photo (Edit Now) 2006114714 (shutterstock.com)
- 81 Freight on Rail (2014) Facts and Figures <http://www.freightonrail.org.uk/FactsFigures.htm> referenced in Pteg (2015) Delivering the future : New approaches to urban freight <https://www.urbantransportgroup.org/system/files/general-docs/Delivering%20the%20future%20FINAL%20020315.pdf>
- 82 Department for Transport and Williams Rail Review (2021) Great British Railways – The Williams-Shapps Plan for Rail https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994603/gbr-williams-shapps-plan-for-rail.pdf
- 83 Department for Transport (2016) Rail Freight Strategy https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/552492/rail-freight-strategy.pdf
- 84 Department for Transport and Williams Rail Review (2021) Great British Railways – The Williams-Shapps Plan for Rail https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994603/gbr-williams-shapps-plan-for-rail.pdf

- 85 Rail Freight Group (2021) Why use rail freight? <http://www.rfg.org.uk/rail-freight/why-use-rail-freight/>
- 86 Rail Freight Group (2020) Newsletter 145 – December 2020 <http://www.rfg.org.uk/wp-content/uploads/2020/12/RFG-News-145-December-2020.pdf>
- 87 Rail Freight Group (2020) Cemex rail moves two million tonnes across UK <https://www.railfreight.com/railfreight/2020/12/15/cemex-rail-moves-two-million-tonnes-across-uk/>
- 88 Commercial Boat Operators Association (2021) The Case for Water <http://www.cboa.org.uk/introduction.html>
- 89 Freight on Rail (2014) Facts and Figures <http://www.freightonrail.org.uk/FactsFigures.htm> referenced in Pteg (2015) Delivering the future: New approaches to urban freight <https://www.urbantransportgroup.org/system/files/general-docs/Delivering%20the%20future%20FINAL%202020315.pdf>
- 90 Rail Freight Group (2021) Why use rail freight? <http://www.rfg.org.uk/rail-freight/why-use-rail-freight/>
- 91 Department for Transport and Williams Rail Review (2021) Great British Railways – The Williams-Shapps Plan for Rail https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994603/gbr-williams-shapps-plan-for-rail.pdf
- 92 Department for Transport (2021) Domestic freight transport by mode (TSCB0401) Freight (TSCB04) – GOV.UK (www.gov.uk) Date accessed 04/05/2021
- 93 Department for Transport and Williams Rail Review (2021) Great British Railways – The Williams-Shapps Plan for Rail https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994603/gbr-williams-shapps-plan-for-rail.pdf
- 94 Eurostat (2021) Freight transport statistics - modal split, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Freight_transport_statistics_-_modal_split#inland_freight_transport_performance_-_the_need_to_adjust_road_transport
- 95 X-Rail (2021) Single Wagonload <https://www.xrail.eu/wagonload-intro>
- 96 Green (2017) SBB Cargo pioneers 21st century wagonload freight, https://www.railjournal.com/in_depth/sbb-cargo-pioneers-21st-century-wagonload-freight
- 97 Ibid.
- 98 Ibid.
- 99 X-Rail (2021) About Xrail? <https://www.xrail.eu/intro>
- 100 Ibid.
- 101 Department for Transport and Williams Rail Review (2021) Great British Railways – The Williams-Shapps Plan for Rail https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994603/gbr-williams-shapps-plan-for-rail.pdf
- 102 Rail Freight Group (2020) What level of ambition is achievable and worthwhile for rail freight? <http://www.rfg.org.uk/level-ambition-achievable-worthwhile-rail-freight-2/>
- 103 Ibid.
- 104 HS2 (2020) Capacity – more freight by rail <https://www.hs2.org.uk/why/capacity/capacity-more-freight-by-rail/>
- 105 InterCity Rail Freight (2021) Home <https://www.intercityrailfreight.com/>
- 106 Network Rail (2021) Press Release – Passenger trains converted to deliver parcels to city centres <https://www.networkrailmediacentre.co.uk/news/passenger-trains-converted-to-deliver-parcels-to-city-centre-stations>
- 107 Ibid.
- 108 Rail Freight Group (2021) July Newsletter – Class 321 Swift Express Freight Train now ready <http://www.rfg.org.uk/wp-content/uploads/2021/07/RFG-News-July-2021-Issue-148.pdf>
- 109 Greater London Authority (2018) Mayor's Transport Strategy <https://www.london.gov.uk/sites/default/files/mayors-transport-strategy-2018.pdf>
- 110 DHL (2020) DHL Express delivers on the river with new Thames Service <https://dhlguide.co.uk/riverboat-thames-service/>
- 111 [dhl-express-riverboat-on-river-with-st-pauls.jpg](https://www.dhl.com/uk/en/press/press-releases/2020/05/dhl-express-riverboat-on-river-with-st-pauls.jpg) (4256x2832) (dphd.com)
- 112 Dablanc L (2019) Logistics Hotels and Rail Freight Logistics in French Cities, presentation to Berlin-Brandebourg Logistics Cluster https://www.lvmt.fr/wp-content/uploads/2019/11/Logistics-hotels-Berlin-presentation-Dablanc-Nov-2019_cp.pdf
- 113 Todd (2019) Electric barge delivers shipments to heart of Paris <https://www.lloydloadinglist.com/freight-directory/news/Electric-barge-delivers-shipments-to-heart-of-Paris/75108.htm#YQwJst-SmM->
- 114 Ibid.
- 115 Fludis (2021) Homepage <https://fludis.eu/?lang=en>
- 116 Tindall (2021) Logistics firms team up to offer Thames riverboat service to NHS Foundation Trust, <https://motortransport.co.uk/blog/2021/06/17/logistics-firms-team-up-to-offer-thames-riverboat-service-to-nhs-foundation-trust/>
- 117 Ibid.
- 118 Guy's and St Thomas' NHS Foundation Trust (2019) Guy's and St Thomas' to stop 36,000 truck deliveries to cut pollution <https://www.guysandstthomas.nhs.uk/news-and-events/2019-news/october/Guy's-and-St-Thomas'-to-stop-36000-truck-deliveries-to-cut-pollution.aspx>
- 119 Ibid.
- 120 Guy's and St Thomas' NHS Foundation Trust (2021) First NHS trust pilots riverboat delivery service <https://www.guysandstthomas.nhs.uk/news-and-events/2021-news/june/20210617-first-nhs-trust-pilots-riverboat-delivery-service.aspx>
- 121 Department for Transport (2014) National Policy Statement for National Networks https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387223/npsnn-web.pdf
- 122 Department for Transport and Williams Rail Review (2021) Great British Railways – The Williams-Shapps Plan for Rail https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994603/gbr-williams-shapps-plan-for-rail.pdf
- 123 Oldham P (2016) UK Freight – In for the long haul? Institute of Mechanical Engineers <https://www.imeche.org/docs/default-source/1-oscar/reports-policy-statements-and-documents/uk-freight---in-for-the-long-haul.pdf?svrsn=0>
- 124 Ibid.
- 125 Oldham P (2016) UK Freight – In for the long haul? Institute of Mechanical Engineers <https://www.imeche.org/docs/default-source/1-oscar/reports-policy-statements-and-documents/uk-freight---in-for-the-long-haul.pdf?svrsn=0>
- 126 MDS Transmodal (2013) Freight in the City Regions <https://www.urbantransportgroup.org/system/files/general-docs/Freight%20in%20the%20City%20Regions%20Final%20Report.pdf>
- 127 Green Link (2021) Homepage <http://green-link.co.uk/>
- 128 City of London Corporation (2020) City of London Corporation teams up with Amazon to cut delivery vehicles and improve air quality <https://news.cityoflondon.gov.uk/city-of-london-corporation-teams-up-with-amazon-to-cut-delivery-vehicles-and-improve-air-quality/>
- 129 Marshall (2020) In Paris, Ecommerce Warehouses Get a Chic Makeover, Wired <https://www.wired.com/story/paris-ecommerce-warehouses-get-chic-makeover/>
- 130 Dablanc L (2019) Logistics Hotels and Rail Freight Logistics in French Cities, presentation to Berlin-Brandebourg Logistics Cluster https://www.lvmt.fr/wp-content/uploads/2019/11/Logistics-hotels-Berlin-presentation-Dablanc-Nov-2019_cp.pdf
- 131 Marshall (2020) In Paris, Ecommerce Warehouses Get a Chic Makeover, Wired <https://www.wired.com/story/paris-ecommerce-warehouses-get-chic-makeover/>
- 132 Ibid.
- 133 Transport Systems Catapult for the Department for Transport (2018) Consolidating public sector logistics operations https://s3-eu-west-1.amazonaws.com/media.ts.catapult/wp-content/uploads/2018/07/13095627/Public-Sector-Logistics-Consolidation_On-Line-Report-web.pdf
- 134 Guy's and St Thomas' NHS Foundation Trust (2019) Guy's and St Thomas' to stop 36,000 truck deliveries to cut pollution <https://www.guysandstthomas.nhs.uk/news-and-events/2019-news/october/Guy's-and-St-Thomas'-to-stop-36000-truck-deliveries-to-cut-pollution.aspx>
- 135 Transport for London (no date) The London Boroughs Consolidation Centre – a freight consolidation success story <http://content.tfl.gov.uk/lbcc-case-study.pdf>
- 136 Ibid.
- 137 Transport for London (2019) Evaluation of Freight Consolidation Demonstrator Projects <https://content.tfl.gov.uk/steer-assessment-of-demos-report-oct-2019.pdf>
- 138 Transport for London (2019) Press Release: The Mayor and TfL launch major plan to help freight deliver for Londoners <https://tfl.gov.uk/info-for/media/press-releases/2019/march/the-mayor-and-tfl-launch-major-plan-to-help-freight-deliver-for-londoners>
- 139 Retail Technology Innovation Hub (2021) TfL and InPost deliver parcel lockers across London <https://retailtechnovationhub.com/home/2021/3/18/tfl-and-inpost-deliver-parcel-lockers-across-london>
- 140 CoMoUK (2019) Mobility Hubs Guidance <https://como.org.uk/wp-content/uploads/2019/10/Mobility-Hub-Guide-241019-final.pdf>
- 141 Ibid.
- 142 London First (2021) Innovation in online deliveries can help tackle emissions, says London First, but freight Czar needs to take charge <https://www.londonfirst.co.uk/news-publications/news/innovation-in-online-deliveries-can-help-tackle-emissions-says-london-first>
- 143 Ibid.
- 144 Low Carbon Vehicle Partnership (2018) The Low Emission Van Guide https://www.zemo.org.uk/assets/reports/Low_Emission_Van_Guide_2019_Update.pdf
- 145 Department for Transport (2021) Transitioning to zero emission cars and vans: 2035 delivery plan <https://www.gov.uk/government/publications/transitioning-to-zero-emission-cars-and-vans-2035-delivery-plan>
- 146 Society of Motor Manufacturers and Traders (2020) 2020 UK Automotive Sustainability Report <https://www.smmmt.co.uk/wp-content/uploads/sites/2/SMMT-Sustainability-Report-Oct-2020.pdf>
- 147 Department for Transport (2020) Consultation outcome – Government response to consultation on proposals to regulate carbon dioxide emissions performance standards for new heavy duty vehicles in the UK <https://www.gov.uk/government/consultations/regulating-co2-emission-standards-for-new-heavy-duty-vehicles-after-transition/outcome/government-response-to-the-consultation-on-proposals-to-regulate-carbon-dioxide-emission-performance-standards-for-new-heavy-duty-vehicles-in-the-uk>
- 148 CIHT News (2021) Trucks in Yorkshire set to receive overhead power <https://www.ciht.org.uk/news/trucks-in-yorkshire-set-to-receive-overhead-power/>
- 149 Nottingham City Council (2021) Carbon Neutral Nottingham 2028 <https://www.nottinghamcity.gov.uk/cn2028>
- 150 Nottingham City Council (2019) Cleaner streets, cleaner air – electric sweepers take to the streets <https://www.mynottinghamnews.co.uk/cleaner-streets-cleaner-air-electric-sweepers-take-to-the-streets/>
- 151 Nottingham City Council (2020) World's first OEM electric refuse collection vehicles come to Nottingham <https://www.mynottinghamnews.co.uk/worlds-first-electric-refuse-collection-vehicles-come-to-nottingham/>
- 152 Transport for London (2021) London's 2030 electric vehicle infrastructure strategy – Draft summary October 2021 <https://luc.content.tfl.gov.uk/londons-2030-electric-vehicle-ev-infrastructure-strategy-exec-summary.pdf>
- 153 Verlinghieri et al (2021) The Promise of Low Carbon Freight – Benefits of cargo bikes in London <https://static1.squarespace.com/static/5d30896202a18c0001b49180/t/61091edc3acfa2f4af7d97f1627987694676/The+Promise+of+Low+Carbon+Freight.pdf>
- 154 Wrighton and Reiter (2016) CycleLogistics – moving Europe forward! In Transport Research Procedia 12, pp 950-958 <https://www.sciencedirect.com/science/article/pii/S2352146516000478>
- 155 Verlinghieri et al (2021) The Promise of Low Carbon Freight – Benefits of cargo bikes in London <https://static1.squarespace.com/static/5d30896202a18c0001b49180/t/61091edc3acfa2f4af7d97f1627987694676/The+Promise+of+Low+Carbon+Freight.pdf>
- 156 FTC2050 (2021) FTC2050 impact and influence – Portering put into practice <http://scc-ftc2050-web.lanccs.ac.uk/ftc2050-impact-and-influence/>
- 157 Ibid.
- 158 Bates et al (2018) Transforming Last-Mile Logistics: opportunities for more Sustainable Deliveries in CHI '18: Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems <https://doi.org/10.1145/3173574.3174100>
- 159 Collins (2019) Olympic cycling champion Chris Boardman plans road safety in black and white in memory of his mother <https://www.thetimes.co.uk/article/olympic-cycling-champion-chris-boardman-plans-road-safety-in-black-and-white-in-memory-of-his-mother-5cc68b778>
- 160 PACTS (2021) Safe system <https://www.pacts.org.uk/safe-system/>
- 161 PACTS (2021) PACTS' campaign priorities for road safety <https://www.pacts.org.uk/download/664/>
- 162 Industry Europe (2020) Greener Safer Trucks Closer to Reality <https://industryeurope.com/sectors/transportation/greener-safer-trucks-closer-to-reality/>
- 163 Ibid.
- 164 Ibid.
- 165 Ibid.
- 166 Fleet Operator Recognition Scheme (2021) What is FORS and why is it for you? <https://www.fors-online.org.uk/cms/>
- 167 Ibid.
- 168 Ibid.
- 169 Fleet Operator Recognition Scheme (2021) FORS Champions <https://www.fors-online.org.uk/cms/suppliers-and-supporters-champ/>
- 170 CLOCS (2019) CLOCS Standard Version 3 – Ensuring the safest construction vehicle journeys https://www.clocs.org.uk/resources/clocs_standard_march_2019_single_page_view.pdf
- 171 ECO Stars (2021) Introduction <https://www.ecostars-uk.com/about-eco-stars/introduction/>
- 172 Logistics UK (2021) Truck Excellence <https://logistics.org.uk/services/consultingandstandards/truck-excellence>
- 173 Logistics UK (2021) Van Excellence <https://logistics.org.uk/CMSPages/GetFile.aspx?guid=36df6a8c-67de-4348-9542-0c7e20932b1f&lang=en-GB>
- 174 Transport for London (2021) Safer Lorry Scheme <https://tfl.gov.uk/info-for/deliveries-in-london/delivering-safely/safer-lorry-scheme>
- 175 Transport for London (2021) HGV safety permit guidance – for operators entering London <https://content.tfl.gov.uk/hgv-safety-permit-guidance-for-operators-entering-london2.pdf>
- 176 RideWise (2021) Safe Urban Driver Training <https://www.ridewiseforbusiness.com/safe-urban-driver-training>
- 177 UPS Pressroom (2017) ORION Backgrounder [online] <https://pressroom.ups.com/pressroom/ContentDetailsViewer.page?ConceptType=FactSheets&id=1426321616277-282>
- 178 Urban Transport Group (2020) Automatic for the people? Issues and options for transport authorities on connected and autonomous vehicles <https://www.urbantransportgroup.org/resources/types/reports/automatic-people-issues-and-options-transport-authorities-connected-and>
- 179 Ibid.
- 180 Oxbotica (2017) UK First: Autonomous Grocery Delivery Trials in Greenwich <https://www.oxbotica.com/insight/uk-first-autonomous-grocery-delivery-trials-in-greenwich/>
- 181 Burges (2017) Autonomous 'milk floats' are now delivering Ocado shipping in London <https://www.wired.co.uk/article/autonomous-shopping-greenwich-ocado-oxbotica-trial>
- 182 Kleinman (2017) Ocado trials driverless delivery van in London <http://www.bbc.co.uk/news/technology-40421100>
- 183 Lee (2018) These delivery robots braved the British snow to deliver hot takeaway grub, <https://www.alphr.com/robotics/1008722/just-eat-robot-delivery>
- 184 Field (2018) World's first robot delivery service launched in Milton Keynes <https://www.telegraph.co.uk/technology/2018/10/31/worlds-first-robot-delivery-service-launched-milton-keynes/>
- 185 Hern (2020) Robots deliver food in Milton Keynes under coronavirus lockdown <https://www.theguardian.com/uk-news/2020/apr/12/robots-deliver-food-milton-keynes-coronavirus-lockdown-starship-technologies>
- 186 Ibid.
- 187 Sipe (2019) Competition for the kerb is rising, and cities are going to have to manage it <https://theconversation.com/competition-for-the-kerb-is-rising-and-cities-are-going-to-have-to-manage-it-117410>
- 188 International Transport Forum (2018) The Shared-Use City: Managing the Curb https://www.itf-oecd.org/sites/default/files/docs/shared-use-city-managing-curb_5.pdf
- 189 Ibid.
- 190 Arup (2018) FlexKerbs – Evolving Streets for a Driverless Future
- 191 Georgiadis (2021) UK regulator gives green light to delivery drone trials, in Financial Times <https://www.ft.com/content/66487d88-a6b3-4e46-9b8a-00e38e93d3af>
- 192 Ibid.
- 193 University of Southampton (2020) Drone successfully completes first delivery of medical equipment to the Isle of Wight <https://www.southampton.ac.uk/news/2020/05/drone-trial-delivery.page>
- 194 Ibid.
- 195 BBC News (2021) Isle of Wight drone NHS-supply trials resume <https://www.bbc.co.uk/news/uk-england-hampshire-56322350>
- 196 Transport for London (2018) TfL Code of Practice for quieter deliveries <http://content.tfl.gov.uk/codeofpractice.pdf>
- 197 CLOCS (no date) Getting the timing right – Making the most of quieter times for deliveries <https://www.clocs.org.uk/casestudies/Getting-the-timing-right-ea37b6.pdf>