Transport for the South East

FREIGHT, LOGISTICS AND INTERNATIONAL GATEWAYS STRATEGY

Work Package 4 - Technology and Decarbonisation - Technical Report

JANUARY 2022

PUBLIC

Transport for the South East

FREIGHT, LOGISTICS AND INTERNATIONAL GATEWAYS STRATEGY

Work Package 4 - Technology and Decarbonisation - Technical Report

PUBLIC

PROJECT NO. 70079897

DATE: JANUARY 2022

WSP

Three White Rose Office Park
Millshaw Park Lane
Leeds
LS11 0DL

Phone: +44 113 395 6200

Fax: +44 113 395 6201

WSP.com

QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3	Revision 4
Remarks					
Date	30/07/2021	13/08/2021	04/10/21	22/10/2021	04/01/2022
Prepared by	Lawrence Penn	Lawrence Penn	Lawrence Penn Peter Ramsey	Lawrence Penn	Lawrence Penn
Signature	LP	LP	LP	LP	LP
Checked by	Sandy Moller	Sandy Moller	Sandy Moller	Chris Douglas	Sandy Moller
Signature	SM	SM	SM	CD	SM
Authorised by	Chris Douglas	Chris Douglas	Chris Douglas	Chris Douglas	Chris Douglas
Signature	CD	CD	CD	CD	CD
Project number	70079897	70079897	70079897	70079897	70079897

CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

1.1 WORK PACKAGE 4

1.1.1. This technical report is the main output of the Transport for the South East Freight, Logistics and Gateways Strategy Work Package 4 – Technology and Decarbonisation. It identifies key technological developments and their potential implementation and impact on decarbonisation across the Transport for the South East area. It also includes the identification and high-level specification of technology trials, with a strong focus on achieving net zero carbon throughout. The report has been designed to align with the recently published Future Mobility Strategy and it sets out an integrated approach to trialling new modes and services.

1.1.2. This document is supported by dashboards (Appendix A) for each of the key technologies, providing a high-level overview of what the intervention is, its applicability across the region and examples of local, regional, national and international best practice.

1.1.3. The dashboards also include an assessment of the contribution each intervention can make to achieving the vision and objectives, and in moving the industry towards greater operational efficiency. Decarbonisation is a central theme across all of the interventions, whilst the wide variety of technologies reflects the holistic approach required to reduce emissions across the breadth of the sector. Continuous change in freight and mobility.

1.1.4. Technological developments, changing attitudes and new business models are constantly shaping the state of play in freight and logistics. The movement of freight is a key part of a vast mobility ecosystem and has deep, far reaching impacts on the local, regional and national economy, the environment and our communities.

1.1.5. This ecosystem is far from perfect and we are witnessing extensive damage to our natural environment through the emission of greenhouse gases, noxious fumes and particulate matter. Furthermore, increasing numbers of light goods vehicles are impacting negatively on local amenity, by contributing to congestion and causing road traffic collisions, with deep-rooted social and economic consequences. Consequently, effectively managing freight and logistics is integral to realising our ambitions to create a more prosperous, sustainable and socially equitable society - and yet freight is often left largely unconsidered in public sector planning and policy making.

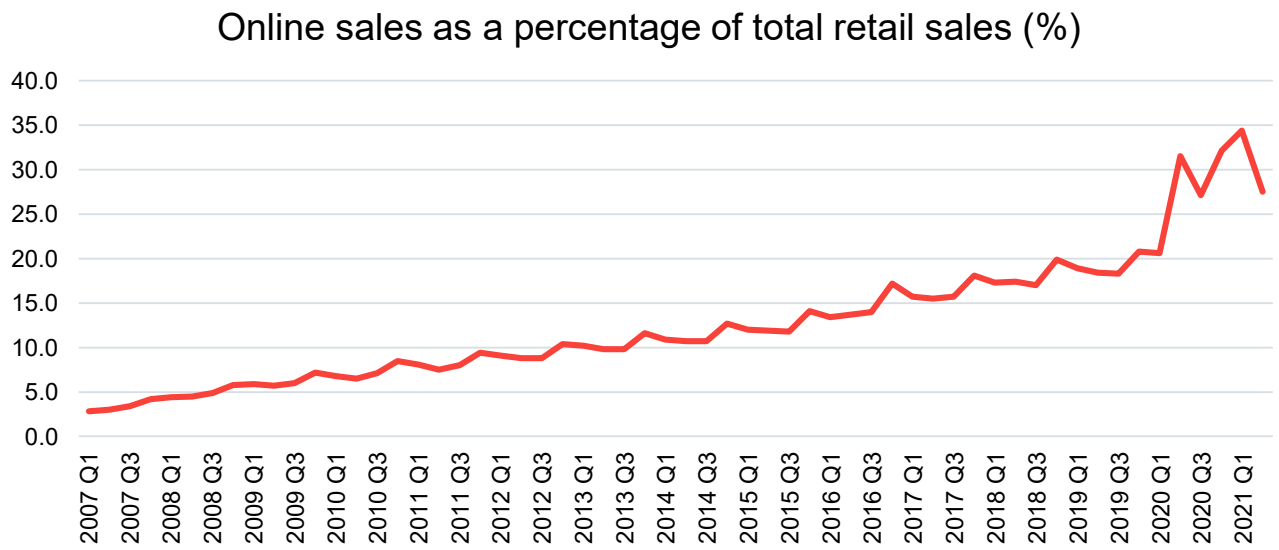
1.1.6. Furthermore, with an increasing imbalance towards customer satisfaction, supporting increasing demands for same-day and even same-hour deliveries, bulk movements of goods are disrupted due to increased congestion resulting from increasing traffic levels, reducing operational efficiency. This results in an increase in costs, meaning that logistics operators must evolve to cater to business and consumer demands to stay competitive in the market.

1.1.7. The Transport for the South East freight strategy will need to acknowledge the evolving trends that influence the mobility ecosystem and enable industry to capitalise on new developments. These include new methods of propulsion, enhanced digital connectivity and new business models. This is essential as society strives to “Build Back Greener” in the wake of the COVID-19 pandemic, and in anticipation of reaching the government’s targets to reduce greenhouse gas emissions by 100% by 2050, relative to 1990 levels. This theme and the need for the freight sector to reduce emissions is especially pertinent in light of the recent Decarbonising Transport Plan released by the Department for Transport (DfT) in 2021.

1.1.8. Decarbonising freight is core to these ambitions and as we reach this pivotal moment, there is an opportunity to install a “new normal” that takes advantage of the positive trends accelerated by the COVID-19 pandemic. Similarly, it is also necessary to mitigate the impacts of the unintended consequences, such as those resulting from significant growth in home deliveries, like increased van use in urban areas, impacting congestion and local communities.

1.1.9. COVID-19 has generated unprecedented growth in online retail sales which, in turn, have resulted in rapid growth of home deliveries. In total, British consumers spent £113 billion online throughout 2020, an increase of 48% on 2019. Household goods experienced a 76% spike, with the total market share of e-commerce in this category increasing from 17% in Q1 to 42% in Q2.[1]

Figure 1-1 - Growth in online retail[2]



1.1.10. Meanwhile, in parallel, the market for new light commercial vehicles hit an all-time high in April 2021, with vehicle registrations up 23.2% on the five-year average.[3] This growth is environmentally unsustainable, and it is locking-in years of harmful emissions, as diesel-powered drivetrains account for approximately 97% of current market share. During the same period, there was also substantial demand for second-hand vans, many of which were older and therefore more polluting, with 58% of vans sold by a major auctioneer in August 2020 Euro 5 standard (2015) or older.[4]

[1] Ofcom: One Nation Report: https://www.ofcom.org.uk/research-and-data/internet-and-on-demand-research/online-nation.

[2] Growth in online retail: https://www.ons.gov.uk/businessindustryandtrade/retailindustry/timeseries/j4mc/drsi.

[3] SMMT: LCV registrations: https://www.smmt.co.uk/2021/05/new-van-market-records-highest-april-registrations-in-history/.

[4] https://cardealermagazine.co.uk/publish/used-van-prices-rise-28-per-cent-as-august-sets-new-record-for-lcv-sales/202524.

1.2 THE FREIGHT STRATEGY

1.2.1. The freight strategy, therefore, aims to assess how the benefits of shifting trends in technology and transport can be maximised whilst ensuring that the unintended consequences are mitigated. This document, in conjunction with the Transport for the South East future mobility strategy, sets out the process to implementing a decarbonised future for freight by setting out the proposals and interventions to deliver in the South East for the years to 2035 and beyond.

1.2.2. Given that the mobility ecosystem is constantly changing, the strategy should be considered as the start of the process, rather than a definition of a future state. It will therefore be necessary to continuously review and update the document as new trends and technologies emerge. This proactive approach will help to ensure that the rapid rate of development is exploited, rather than it leaving policymakers behind. In other words, there is a real, positive opportunity to proactively shape the future freight discourse and plan for decarbonisation.

1.2.3. The nature of future and emergent innovations in freight means that many potential interventions are untested at scale, if at all. Consequently, core to this approach is the process of ongoing monitoring and evaluation, to carefully analyse the deployment of such measures. This is not just the responsibility of Transport for the South East, however. Successful delivery will require close working partnerships with public, private and third sectors, with a culture of openness and sharing between partners.

2 DEFINING THE FUTURE OF FREIGHT AND LOGISTICS

2.1 DEFINITION

2.1.1. Freight management concerns the efficient and cost-effective movement of goods. Whilst it is normal to refer to time and cost efficiencies, increasingly there are pressures on the industry to decarbonise and reduce harmful emissions, with clean and efficient propulsion becoming a top priority. The focus on freight carbon emissions and air quality is most pronounced in urban areas, where freight and logistics interface more closely with the resident population and the negative impacts of transportation are felt more acutely. However, decarbonisation is a priority across all place types and requires action at all stages of the supply chain.

2.1.2. Consequently, new and innovative ways of moving and managing freight are emerging, which aim to decrease the impact which the sector has on the environment and on local amenity. This can be challenging, whilst also trying to ensure that costs continue to stay competitive with those of traditional carriers, but there has already been visible progress. Capitalising on further innovation, however, first requires an understanding of the current direction of innovation in the industry.

2.2 SIGNALS, TRENDS AND TRAJECTORIES

2.2.1. Our understanding of future mobility, by definition, must be live to what is happening now as well as the emerging challenges and solutions.

2.2.2. Key signals, trends and trajectories that affect mobility need to be monitored, not simply new technology but also the global, national and local changes that affect economies and communities and which may influence mobility over the coming years.

2.2.3. We define this thinking as follows;

- **Signals** – the first signs of activity in a new area, which can often easily be missed. For example, the early signs of the coronavirus or new technology, such as hyperloop or flying taxis. For the purposes of this strategy, we consider signals to be immature challenges or issues, or interventions, many of which might be funded by venture capital.

- **Trends** – instances of change, where large numbers of similar pilots are being undertaken or funds are starting to flow from government or private finance to pump prime the market. Current examples include the various automated shuttles in operation around the globe, hydrogen fuel cell deployment or the wider discussion of the rural agenda.
- **Trajectories** – are solutions, services and interventions that are becoming established and a clear route to a new 'business as usual' can be seen. This includes electric cars & vans, DDRT, e-bikes and e-cargo bike deployment and e-scooters (subject to government findings from the pilots).

CONTINUOUS CHANGE OVER TIME

2.2.4. Over time, technologies and solutions will transition towards a new 'business-as-usual' through developments and refinements to their technical, commercial and operational maturity.

2.2.5. There are a number of key currently visible signals, trends and trajectories that are continuing to affect the future of mobility (rather than within the field itself). These have been identified from research into major environmental, economic and social policy themes, as well as the clear major shock events that the South East, the UK and the wider world faces.

2.2.6. The recent COVID-19 pandemic has demonstrated the need for a resilient operational environment that is adaptable, scalable where necessary and responsive to shifting demands and expectations. Whilst the world went into lockdown, the freight and logistics sector had to carry on and ensure that supermarket shelves were stocked, and that people could still receive (what became ever-increasing) deliveries to their homes.

2.2.7. The resilience of the sector ensured that the worst negative impacts were averted, so people were fed, and many businesses could still stay afloat. However, future shock events could take any form and the sector may once again need to adapt in substantially different ways than before.

2.2.8. Even during times of relative normality, demands and expectations are constantly evolving, as the economy changes. New modes, services, technologies and infrastructure will restructure the way people and businesses consume freight and logistics services. This strategy aims to support the ability of freight and logistics organisations to proactively address these changes, to face new challenges with more confidence.

2.2.9. **Figure 2-1** shows an overview of some of the signals, trends and trajectories that are relevant to the Transport for the South East freight strategy. This list is not exhaustive, as new societal shifts and shocks are continually emerging, meaning that they must therefore be monitored and reviewed continuously.

Figure 2-1 - Signals, Trends and Trajectories

2.3 NATIONAL POLICY CONTEXT

2.3.1. Transport policy is set across all government levels; nationally, sub-nationally, regionally and by local authorities. However, the mobility ecosystem is not just affected by transport policy, it is intrinsically linked to wider economic, spatial, environmental and social policy.

2.3.2. By contrast, freight policy in the UK is designed to be relatively light-touch and it is defined predominantly at a national level. However, as the freight transport sector is essentially operated by the private sector, the government has had relatively little role in directly shaping the industry, beyond its core legislative framework.

2.3.3. Nevertheless, there is an important role for the public sector in enabling and promoting innovation, as it is uniquely placed to have oversight across the industry, as well as other sectors that may be traditionally quite separate to freight and logistics.

2.3.4. The role of the public sector is key for driving the speed and scale of decarbonisation across the industry and the UK more broadly, especially due to the nature of cross boundary freight movements, freight's pan-national contribution towards natural prosperity and the broader, collective requirements to hit emission targets.

NATIONAL FREIGHT STRATEGY

2.3.5. Whilst freight and logistics strategies exist at local, regional and sub-national levels, there is currently no cohesive national freight strategy. At the time of reporting, DfT's Future of Freight team is developing its National Freight Strategy, expected for release in Autumn 2021. The content of this is, as yet, unknown but is expected to be informed by earlier reports from the National Infrastructure Commission (NIC) and other bodies, including other STBs, with which DfT has developed links.

2.3.6. The National Policy on Ports and Airports are available within the public domain[5]. The Airports NPS sets out the Government's policy on the need for new airport capacity in the South East of England and preferred locations and schemes to deliver new capacity including material considerations relevant to a development consent application. Although only a small proportion of UK trade by weight is carried by air, the sector is crucial where goods are of high value or time critical.

2.3.7. To put this in perspective, over £178 billion of air freight was sent between UK and non-European Union (2016), representing over 45% of the UK's extra-European Union trade by value. More specifically, advancing manufacturing components are expected to be one of five major, high value exports by air cargo by 2030.

2.3.8. Likewise, the National Policy Statement for Ports[6], communicates the Government's stance on the need for new port infrastructure based on the available evidence on future demand and advises planning decision-makers on the approach they should take to proposals. This includes highlighting the main issues which will need to be addressed to ensure that future development is fully sustainable. The last 40 years have witnessed a dramatic growth in freight traffic through UK ports

[5] DfT (2018) Airports National Policy Statement: new runway capacity and infrastructure at airports in the South East of England, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/858533/airports-nps-new-runway-capacity-and-infrastructure-at-airports-in-the-south-east-of-england-web-version.pdf

[6] DfT (2012) National Policy Statement for Ports, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/3931/national-policy-statement-ports.pdf

(approximately 75%). In 2010, ports in England and Wales handled 410 million tonnes of goods, out of 512 million tonnes nationally. This corresponds to around 95% of the total volume of UK trade and approximately 75% of its value; with this putting pressure on land, access and infrastructure.

TRANSPORT DECARBONISATION PLAN

2.3.9. In July 2021, the UK government published a landmark strategy document detailing the approach to decarbonising the transport sector by 2050 and setting out the key actions needed in pursuit of this goal. Freight is a key component of the transport system and is rightfully given appropriate consideration in the strategy. Several key goals and initiatives are set out, including:

- The need for over 200 MtCO2e savings to 2050;
- £20 million to support the Mode Shift Revenue Support and Waterborne Freight Grant Schemes;
- Ending sale of new non-zero emission LGVs (<3.5t) by 2030 ('significant' zero-emissions capability needed);
- Ending the sale of new non-zero emission HGVs (<26t) by 2035;
- End the sale of new non-zero emission HGVs (>26t) by 2040; and
- £20 million investment in Zero Emission Road Freight Trials.

2.3.10. A new regulatory framework for these phase-out dates will be delivered, detailing the approach to emissions reductions in the industry and for conventional vehicles. Zero emission HGV technology trials will be delivered in 2021 and they will be supported by extensive investments in enabling infrastructure, such as electric road systems, hydrogen fuel depots and electric vehicle charging points.

2.3.11. There will be additional support to encourage modal shift of freight from road to more sustainable alternatives, such as rail, cargo bike and inland waterways. This will include investments to improve rail network capacity, rail freight growth targets and a 'last mile' package of measures to enable more sustainable freight alternatives in urban areas. This area of logistics is viewed as ripe for innovation and offers many additional benefits on top of decarbonisation.

2.3.12. Other measures identified by the plan include:

- Reviewing the TRO framework to enable dynamic kerbspace and delivery management;
- Exploring the legal and practical issues around mandating the use of consolidation centres;
- Pilots to ensure that many urban deliveries are consolidated and transferred to zero emission vehicles for the last mile;
- Pilots looking into franchising delivery and waste management services to improve efficiency across household and non-household municipal waste; and
- The implementation of Clean Air Zones to accelerate the transition to zero emission vehicles.

FUTURE OF MOBILITY: URBAN STRATEGY

2.3.13. The key central government policy driving mobility is the Future of Mobility: Urban Strategy. An equivalent rural strategy is currently under development. This document sets out the government's approach to maximising the benefits from transport innovation in cities and towns. It presents the principles that will guide government's response to emerging transport technologies and business models.

Figure 2-2 - Key principles of the strategy

2.3.14. The document also presents the six high-level 'key changes' that are fuelling the evolution of mobility:

- **Cleaner transport:** Transport is becoming cleaner as a result of the electrification of vehicle powertrains, both battery electric and hydrogen fuel cell variants. The UK has plans to be at the forefront of the design and manufacturing of zero emission vehicles and the Government has made a commitment to a 2035 phase out date for internal combustion engine vehicles weighing from 3.5 to 26 tonnes and 2040 for vehicles weighing more than 26 tonnes.

  Decarbonisation and improved air quality are central to this strategy and, whilst there may be some interventions that specifically address these issues, the broader strategy should have climate change and improving the quality of the air we breathe at its core.

- **New business models:** New, digitally enabled mobility business models are emerging. For example, online freight brokerage platforms are allowing small independent hauliers to have visibility of a greater variety of consignments and new customer to customer (C2C) models are making use of spare capacity on passenger journeys.

  Fifteen-minute deliveries of groceries are also changing the mobility landscape and are leading to unprecedented customer expectations. The strategy should be focused on supporting development of new models and embedding those that are commercially viable or socially desirable.

- **New modes:** Technology is enabling new ways of transporting people and goods. Drones, e-cargo bikes, e-walkers, droids, and light electric freight vehicles are just a few of the ways in which technological advancements are impacting freight transport.

  New modes place new demands on transport infrastructure and operational structures. This leads to new pressures on the wider mobility ecosystem which must be accommodated and planned for, to mitigate any unintended consequences.

- **Data & connectivity:** The increasing availability of data and improved digital connectivity is enabling operators to have access to more journey information, to inform scheduling and routing strategies, as well as allowing vehicles to communicate with each other and share information with network providers. Sharing of data may have increasing importance as more services are accessed digitally and this data could help shape future freight operations through increased access to information. This will enable operators to monitor and optimise their fleet with respect to the changing ecosystem, including in real-time.

  Digital communications are becoming vital to both how we move goods and how we undertake activities at home or remotely, as well as bringing services to people via digital means, thus avoiding the need to receive physical goods.

- **Changing attitudes:** Societal signals, trends and trajectories may continue to develop and impact attitudes towards mobility and accessibility to 2050. Road travel demand across England and Wales is expected to increase over the coming decades, mainly driven by population growth.

As environmental conscientiousness begins to carry more weight in consumer decision-making, the market may start to demand that more sustainable forms of transport are used in delivery. Furthermore, demonstrating environmental credentials is increasingly being used to differentiate ethical businesses in crowded markets. New technologies are also enabling customers to engage with brands on their terms, increasingly making use of online retail options, whilst favouring a more experiential and curated in-store shopping experience[7]. Trialling and testing will be key to understanding how people interact with such interventions, but wider research should also be undertaken to understand the consumer's (and therefore business's) behavioural responses to new modes, services and infrastructure provision.

- **Automation**: Many vehicle manufacturers have automated the more mundane tasks and they are becoming increasingly advanced through evolution of their capabilities. However, there are also more revolutionary approaches to automation, with companies building and trialling fully autonomous vehicles (AVs), including on UK roads. Nationally, companies are at the forefront of this field with several projects expected to deploy limited numbers of self-driving delivery vehicles on public roads and spaces in the next 2-3 years.

2.3.15. This strategy should aim to support the development of automation as capabilities increase, with partners working to identify the appropriate use cases, opportunities for trialling and the delivery of new modes and services as they become realistic propositions.

2.3.16. In addition to DfT's six key changes, this strategy identifies **aggregation** as the seventh trend.

2.3.17. Consolidated delivery of goods is bringing about greater freight efficiency and consolidation is happening at a greater range of scales, beyond the traditional macro level in distribution centres, at locations such as mobility hubs and micro-urban depots. Furthermore, in some instances, freight is being moved by aggregating with passenger services that have under-utilised capacity. The Transport for the South East freight strategy aims to promote aggregation to make freight more efficient and connected, providing benefits for the environment and local amenity.

2.3.18. The Transport for the South East freight strategy must also embrace the DfT's nine principles, as contained in the Future of Mobility: Urban Strategy, namely:

- **Safe and secure** – Through working with partners to trial new freight and logistics propositions, the South East will help to provide reassurance that modes and services can provide the safety and security that users, communities and operators must have, to ensure they become accepted and embedded as business as usual.
- **Benefits open to all places and people** – The Transport for the South East freight strategy needs to focus on understanding how future freight interventions will affect different places and people and the suite of proposals provide a range of interventions applicable across the South East's communities. By replacing conventional van traffic with zero-emission alternatives, the negative impacts of freight on communities can be reduced.

[7] https://www.ibm.com/thought-leadership/institute-business-value/report/genzshoppers.

- **Active travel** – Supporting first mile/last mile deliveries, encouraging behaviour change and low-car lifestyles by developing a range of shared micro-mobility models, such as providing access to a shared e-cargo bike resource/service. This will be supported by the developing networks of mobility hubs, helping to ensure that freight can be moved alongside the movement of people, and in more sustainable ways.
- **Mass transit** – Exploring the role of public transport in facilitating the movement of freight, as well as passengers, for example using spare capacity on off-peak rail services, coaches, service buses and DDRT.
- **Transition to zero emissions** – Alternative fuel use, both battery electric and hydrogen, is a priority for this strategy and proposals, working with partners, to strongly support the dramatic push to ban sales of conventional petrol and diesel engine vans and cars by 2030, lighter HGVs by 2035 and heavy trucks by 2040.
- **More efficient use of space** – How space is used for mobility will help shape our places and communities over the coming decades. This strategy should aim to set a consistent approach to the allocation and management of road, kerb and loading spaces, as new modes and services start to change the use and demand for space. It will also explore how space can be used more tactically across the 24hr period, using digital systems and dynamic land use planning.
- **Open marketplace** – This strategy should take an open approach to how emerging modes and services are provided by private, public and third sectors. It is vital, however, that there is cross-sectoral co-operation and broad partnerships working together, to deliver new service models and modes that, together, support all the South East's communities.
- **Shared data** – A key role for the South East is to support not only the sharing of data but the wide-spread dissemination of learning from the development of freight solutions. This will enable new modes and services to be viably embedded across the South East, through learning lessons from delivery across our range of partners.
- **Integrated transport system** – This strategy should focus not only on the integration of modes, services and infrastructure but also on thinking, engagement and policy. This is a comprehensive strategy covering both established and emerging modes and service models, building stronger links to the key dependencies of energy and digital communications and delivering a more integrated mobility ecosystem.

2.3.19. This approach is designed to be closely aligned with the priorities set out in the DfT's current policy on the future of mobility. However, as the field continues to evolve, it is expected this strategy will also need to do so too. New policy is expected to be announced in the DfT's rural strategy for future mobility, which will have clear implications for freight and logistics and in detail within DfT's national freight strategy, due for publication later in 2021.

2.3.20. Transport for the South East should work with DfT, other Sub-National Transport Bodies and its constituent local authorities, to continue to shape policy in the face of the rapidly evolving freight and logistics sectors within the wider transport ecosystem.

2.4 SUMMARY

2.4.1. There are clear links between the evolution of the mobility ecosystem and ambitions set out in government policy. The relationship between the two is often complex, as across different sectors, policy is at varying degrees of development in relation to the fast pace of innovation and change in technology. DfT's national freight strategy is eagerly awaited.

2.4.2. Linked to this, is a deliberate move away from the traditional ‘Predict and Provide’ approach, which characterised the transport policy approach pre-millennium. Much like the Transport for the South East transport strategy, this freight strategy moves us towards a Vision and Validate approach, in which policy is centred around desired outcomes for people and places, rather than the most probable outcomes based on current trajectories. However, nothing should be considered in isolation, because, as a part of an ecosystem, any intervention that is trialled will have interfaces with other facets of mobility and, indeed, other interventions being trialled alongside. Increasingly, interactions within this ecosystem are not just physical, but also digital.

2.4.3. As with any new intervention, as well as the proposed benefits, we must also be aware of the potential unintended consequences, including any cross-sectoral trade-offs. For example, benefits realised in one area, such as the introduction of micro consolidation centres for last mile zero emission freight vehicles, could also contribute to congestion on routes to the location, despite the associated improvements in the city centre.

3 FUTURE FREIGHT TECHNOLOGIES

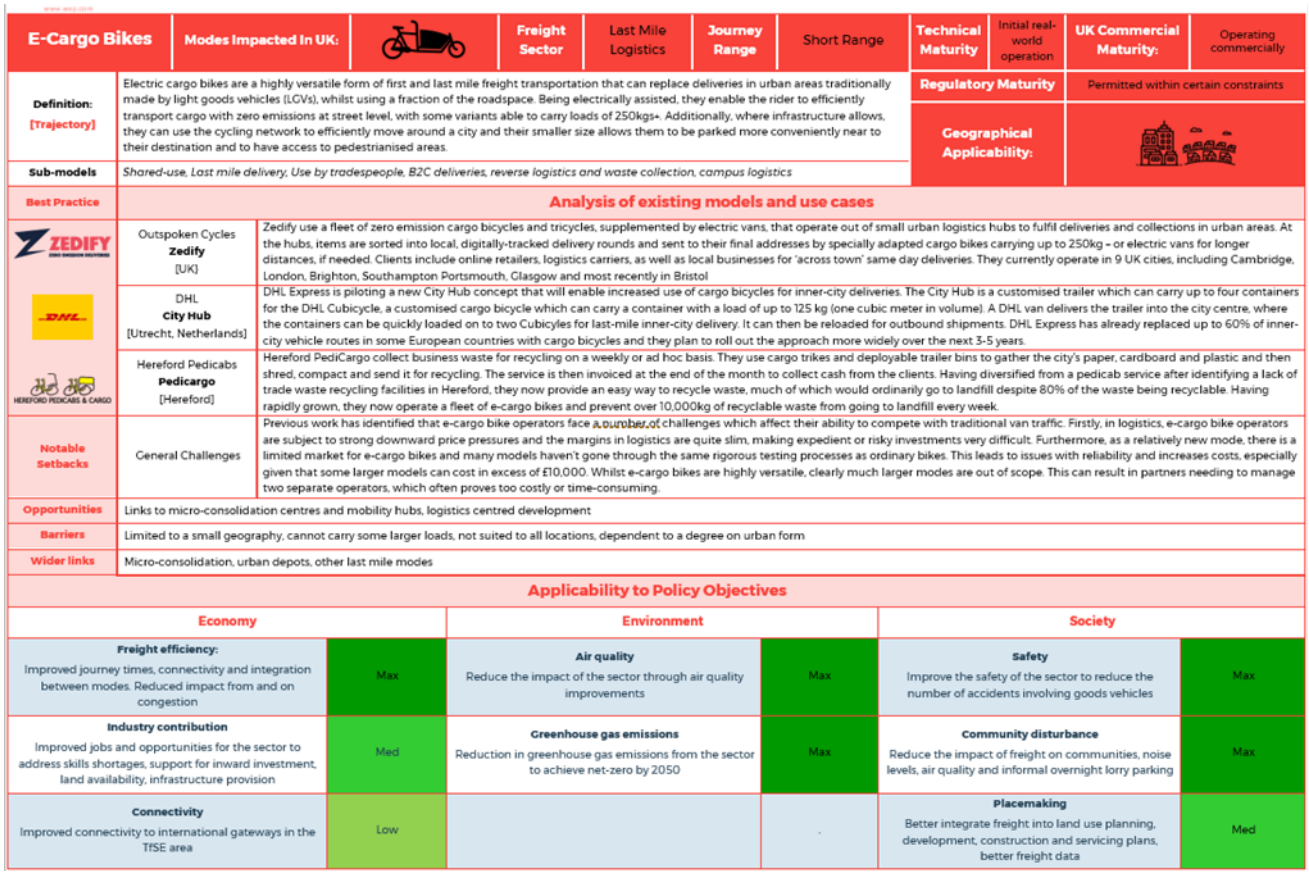
3.1 INTRODUCTION

3.1.1. The aim of this section is to set out a series of future freight technologies that could be trialled across the South East. Each of these is supported by a dashboard that explains in more detail the different existing/potential use cases and examples of best practice, as well as how interventions contribute towards the vision and objectives of the freight strategy.

3.1.2. All the interventions have been selected for their ability to contribute to a decisive move towards decarbonisation in freight and logistics.

3.1.3. The dashboards are included in **Appendix A**.

Figure 3-1 - Example dashboard - E-cargo bikes



E-Cargo Bikes	Modes Impacted In UK:	Freight Sector	Last Mile Logistics	Journey Range	Short Range	Technical Maturity	Initial real-world operation	UK Commercial Maturity:	Operating commercially
Definition: [Trajectory]	Electric cargo bikes are a highly versatile form of first and last mile freight transportation that can replace deliveries in urban areas traditionally made by light goods vehicles (LGVs), whilst using a fraction of the roadspace. Being electrically assisted, they enable the rider to efficiently transport cargo with zero emissions at street level, with some variants able to carry loads of 250kgs+. Additionally, where infrastructure allows, they can use the cycling network to efficiently move around a city and their smaller size allows them to be parked more conveniently near to their destination and to have access to pedestrianised areas.					Regulatory Maturity		Permitted within certain constraints	
Sub-models	*Shared-use, Last mile delivery, Use by tradespeople, B2C deliveries, reverse logistics and waste collection, campus logistics*					Geographical Applicability:			

Best Practice		Analysis of existing models and use cases
ZEDIFY	Outspoken Cycles **Zedify** [UK]	Zedify use a fleet of zero emission cargo bicycles and tricycles, supplemented by electric vans, that operate out of small urban logistics hubs to fulfil deliveries and collections in urban areas. At the hubs, items are sorted into local, digitally-tracked delivery rounds and sent to their final addresses by specially adapted cargo bikes carrying up to 250kg – or electric vans for longer distances, if needed. Clients include online retailers, logistics carriers, as well as local businesses for 'across town' same day deliveries. They currently operate in 9 UK cities, including Cambridge, London, Brighton, Southampton Portsmouth, Glasgow and most recently in Bristol
DHL	DHL **City Hub** [Utrecht, Netherlands]	DHL Express is piloting a new City Hub concept that will enable increased use of cargo bicycles for inner-city deliveries. The City Hub is a customised trailer which can carry up to four containers for the DHL Cubicycle, a customised cargo bicycle which can carry a container with a load of up to 125 kg (one cubic meter in volume). A DHL van delivers the trailer into the city centre, where the containers can be quickly loaded on to two Cubicyles for last-mile inner-city delivery. It can then be reloaded for outbound shipments. DHL Express has already replaced up to 60% of inner-city vehicle routes in some European countries with cargo bicycles and they plan to roll out the approach more widely over the next 3-5 years.
HEREFORD PEDICABS & CARGO	Hereford Pedicabs **Pedicargo** [Hereford]	Hereford PediCargo collect business waste for recycling on a weekly or ad hoc basis. They use cargo trikes and deployable trailer bins to gather the city's paper, cardboard and plastic and then shred, compact and send it for recycling. The service is then invoiced at the end of the month to collect cash from the clients. Having diversified from a pedicab service after identifying a lack of trade waste recycling facilities in Hereford, they now provide an easy way to recycle waste, much of which would ordinarily go to landfill despite 80% of the waste being recyclable. Having rapidly grown, they now operate a fleet of e-cargo bikes and prevent over 10,000kg of recyclable waste from going to landfill every week.
Notable Setbacks	General Challenges	Previous work has identified that e-cargo bike operators face a number of challenges which affect their ability to compete with traditional van traffic. Firstly, in logistics, e-cargo bike operators are subject to strong downward price pressures and the margins in logistics are quite slim, making expedient or risky investments very difficult. Furthermore, as a relatively new mode, there is a limited market for e-cargo bikes and many models haven't gone through the same rigorous testing processes as ordinary bikes. This leads to issues with reliability and increases costs, especially given that some larger models can cost in excess of £10,000. Whilst e-cargo bikes are highly versatile, clearly much larger modes are out of scope. This can result in partners needing to manage two separate operators, which often proves too costly or time-consuming.
Opportunities	Links to micro-consolidation centres and mobility hubs, logistics centred development	
Barriers	Limited to a small geography, cannot carry some larger loads, not suited to all locations, dependent to a degree on urban form	
Wider links	Micro-consolidation, urban depots, other last mile modes	

Applicability to Policy Objectives					
Economy		**Environment**		**Society**	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Max	**Air quality** Reduce the impact of the sector through air quality improvements	Max	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Max
Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Med	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Max	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Max
Connectivity Improved connectivity to international gateways in the TfSE area	Low			**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Med

3.1.4. The complexity and breadth of the freight and logistics ecosystem is recognised by the range of interventions proposed as part of this work. The Vision and Validate approach focuses on outcomes and is considerate of future developments in freight, rather than devising solutions based on currently available tools and technologies.

3.1.5. Each of the interventions outlined in this section is explained in greater detail in the accompanying dashboards included in **Appendix A**. The dashboards also detail the technical and commercial maturity of the interventions, alongside potential geographic applicability.

GEOGRAPHICAL APPLICABILITY

3.1.6. The geographical applicability of each intervention is defined across the four place-based typologies used in the future mobility strategy, with addition of gateways, including ports and airports. These typologies will be used to group the freight interventions into bundles for parallel trialling. The typologies are:

Major economic hubs (MEH)

Urban areas

Rural areas

Remote rural areas

Gateways

3.1.7. Some interventions are relevant to a specific piece of supporting infrastructure, including ports and warehouses. Others are digital interventions or new service models, so could be applied almost anywhere. In the following section, the relevance of each intervention to the above place types will be assessed.

COMMERCIAL MATURITY

3.1.8. Commercial maturity refers to the extent to which, a particular intervention is currently able to operate self-sufficiently within the freight and logistics markets. The most commercially mature interventions are not necessarily those which are the most technologically advanced, as is the case for many more established models. The interventions are categorised as follows:

- Not operating commercially in the UK;
- Commercial testing/piloting;
- Commercial launch;
- Operating commercially; and
- Mature technical operation.

TECHNICAL MATURITY

3.1.9. Technical maturity refers specifically to the degree of technological development of an intervention, rather than its success in the market. For example, an intervention such as delivery drones may operating commercially in the UK but the market providing the technology underpinning their operation is still developing. The interventions are classed as follows:

- Concept;
- Feasibility;

- Piloting;
- Initial real-world operation; and
- Mature technical operation.

REGULATORY STATUS

3.1.10. There are many technologies and interventions that, despite being technologically mature and having been proven commercially elsewhere, are not currently permitted under UK regulations. Furthermore, whilst drones, for example, are legal to use within certain parameters (within visual range), the commercial use case for unmanned and autonomous delivery is not yet regulated.

3.1.11. It is necessary therefore to provide the regulatory status of each intervention as an additional indication of the potential to deploy in the South East. It should be noted, however, that some interventions may be piloted within isolated 'sandbox' environments and, therefore, will not be subject to the same regulatory approvals. Regulatory status can be classed as follows:

- Permitted within certain constraints; and
- Not currently regulated for.

Table 3-1 - Intervention maturity

Intervention	Commercial maturity	Technical maturity	Regulatory status
Alternative fuels	Commercial testing / commercial maturity	Initial real-world operation	Permitted within certain constraints
Real-time fleet management	Mature commercial operation	Mature technical operation	Permitted within certain constraints
Booking systems for port access	Mature commercial operation	Mature technical operation	Permitted within certain constraints
New B2B and C2C models	Commercial Launch	Initial real-world operation	Permitted within certain constraints
Automated / autonomous vehicles	Commercial testing / piloting	Piloting	Not currently legislated for
Delivery drones	Commercial Testing / piloting	Initial real-world operation	Not currently legislated for
Delivery droids	Commercial Testing / piloting	Initial real-world operation	Permitted within certain constraints
Magway	Not operating commercially in the UK	Concept	Not currently legislated for
E-cargo bikes	Operating commercially	Initial real-world operation	Permitted within certain constraints
E-walkers	Commercial launch	Initial real-world operation	Legal status unclear*
Freight on public transport	Mature commercial operation	Mature technical operation	Permitted within certain constraints

Intervention	Commercial maturity	Technical maturity	Regulatory status
Platooning	Commercial Testing / piloting	Piloting	Not currently legislated for
Consolidation	Commercial launch	Initial real-world operation	Permitted within certain constraints
Dynamic kerbspace management	Not operating commercially in the UK	Piloting	Not currently legislated for
VTOL mobility	Not operating commercially in the UK	Piloting	Not currently legislated for
Digital technologies in rail freight	Mature commercial operation	Mature technical operation	Permitted within certain constraints

3.2 PROPOSED INTERVENTIONS

3.2.1. This section provides an overview of the proposed interventions to trial across the South East. A description is provided for each, as well as a high-level proposition for how an intervention might be trialled in the Transport for the South East region. Given that this strategy takes the approach of trialling interventions in bundles, the interdependencies between the interventions and the wider freight environment have also been highlighted.

ALTERNATIVE FUELS

Description

3.2.2. The use of alternative fuels and drivetrains in place of traditional diesel and petrol internal combustion engines is helping to reduce vehicle emissions. A range of alternatives are in development, including battery electric vehicles (BEVs) and hydrogen vehicles, as well as biofuels. Alternative fuels are essential in the decarbonisation of freight transport and in reducing the public health impact of harmful exhaust emissions, however it is also important to consider how they are produced and to ensure that the supply chain for alternative fuels is also decarbonised. The cost of transition to cleaner vehicles should not be underestimated. Freight is a low margin sector and thus adoption to cleaner fuels is constrained.

Role in freight decarbonisation

3.2.3. Alternative fuels and drivetrains will be essential in decarbonising freight. The volume of goods being moved in the UK is growing and demand is set to continue increasing. If left unaddressed, this growth in demand will continue to be satisfied by diesel fuelled vehicles, locking in years of continued carbon emission. However, use of hydrogen and battery electric vehicles will only decarbonise freight if the means of energy production are also low in carbon. Consequently, the success of alternative fuels and drivetrains is predicated on the energy sector being able to decarbonise in parallel through continued investment in renewables, for example – and provision of refuelling networks suitable for large scale commercial fleet operations.

Potential deployment

3.2.4. Alternative fuels could be employed across a range of vehicles designed for different place types (e.g. city centre, rural, inter-urban corridor, etc) given that, in most cases, the form and function of the vehicles may not be significantly changed by the adoption of electrified propulsion (either battery electric or hydrogen electric). However, the greatest benefits could be realised in urban areas where the effects of poor air quality are felt most acutely. Battery electric vehicles are already starting to increase in popularity amongst fleet operators for light commercial vehicles, but the market share is still relatively modest, accounting for only 2.9% of sales in 2020 (up from 1.3% in 2019).[8]

3.2.5. In July 2021, the government announced a £20 million funding boost to accelerate the rollout of zero-emission road freight by pioneering technological trials of vehicles and infrastructure. The market for larger alternatively fuelled freight vehicles is less mature and, whilst some hydrogen and BEV drivetrains are starting to emerge on a small scale, most decarbonisation efforts to date have been focused on swapping diesel fuel for bioethanol. The fuel is derived from energy crops, so is sustainable, however the quantities of fuel required to power the UK's fleet of HGVs would be too great for bioethanol to be considered as a widespread solution, due to the land required to grow sufficient amounts.

3.2.6. Future deployment of hydrogen powered vehicles could start from major trip generators and attractors such as the ports in the South East, where hydrogen hubs could be installed, providing a refuelling point from which hauliers could operate. Additional refuelling locations could be installed at depots and warehousing complexes across the country, as well as within proximity to the Strategic Road Network (SRN), to provide continuous refuelling infrastructure access for goods vehicles on longer distance trips. Table 3-2 shows the applicability of this intervention across the place typologies.

[8] https://www.fleetnews.co.uk/news/latest-fleet-news/fn50-insight-and-analysis/2020/11/29/electric-nibbles-away-at-the-dominance-of-diesel.

Table 3-2 - Alternative fuels applicability

Typology	Very High	High	Medium	Low	Very low
MEH	x				
Urban areas	x				
Rural areas		x			
Remote rural			x		
Gateways		x			

Interdependencies

3.2.7. For alternative fuels to become mainstream, there is significant infrastructure needed, to enable successful commercial operation. Freight transportation offers an opportunity to do so because many hauliers, in particular, operate out of common facilities such as ports, depots and warehouses, where infrastructure such as hydrogen refuelling sites could be constructed and utilised, giving them an additional role as refuelling hubs for use by all commercial vehicles.

3.2.8. The first hydrogen generation site is being constructed in Teesside and promises to produce 1GW of the government's target of 5GW of hydrogen production by 2030. Additionally, Project Cavendish on the Isle of Grain in Medway aims to install 700MW of blue hydrogen (hydrogen refined from natural gas) production capacity in 2026, potentially expanding to 1.75GW by 2030. However, it should be noted that the green hydrogen generation process places large demands on water supplies, an already constrained resource in the South East.

3.2.9. If battery electric freight vehicles are to operate at scale, substantial grid connections will be required to the depots from which they operate, to ensure that the fleet can be charged at a rate fast enough to minimise vehicle downtime. Any infrastructure will have to be delivered ahead of operation, to incentivise uptake of more sustainable drivetrains and to ensure that it is co-located with parts of the grid with connections to renewable or low-carbon energy.

3.2.10. Consideration also needs to be given to 'transitional' 'drop in' fuels that can be more easily adopted and explored by the freight industry, particularly road haulage, to aid the shift towards decarbonisation in the short term. A 'fuel mix' that considers the role of HVO and other biofuels, alongside the short term option to explore Liquefied Natural Gas (LNG), with bunkering facilities at ports, require limited adjustments to drivetrains and therefore can be rolled out quickly.

3.2.11. See the **Alternative Fuels** dashboard for more detail.

REAL-TIME FLEET MANAGEMENT

Description

3.2.12. Fleet management tools can provide operators with real-time visibility of their fleet operations, while helping to increase driver performance and decreasing fuel usage through predictive analytics and accurate reporting. They also help fleet managers ensure that their operations are adhering to the complex regulations on drivers' hours, handling dangerous goods and operator licensing. Fleet management can also improve operational efficiency by assigning and dispatching routes to drivers in real-time, to ensure accurate pickups, deliveries and returns. Solutions include hazard alert services, delivery tracking, and dynamic routing tools.

3.2.13. Importantly, these systems collect data and this real-world operational freight data is potentially extremely valuable to policymakers, land use and transport planners – and to other public sector decision-makers creating the operating environment for the industry. Accessing the data, through industry operators, has significant challenges because of their understandable concerns about commercial confidentiality – but the potential benefits of shared data are huge.

Role in freight decarbonisation

3.2.14. Fleet optimisation helps to ensure that vehicles are utilised to the greatest extent possible, in theory reducing the number of vehicles needed on the road, and the total vehicle kilometres travelled. Route optimisation reduces the stem mileage travelled by fleet vehicles and it can also inform where best to strategically place consolidation and distribution centres. Together, these measures reduce the amount of fuel consumed by an operator's fleet and therefore the amount of harmful emissions.

Potential deployment

3.2.15. Real-time fleet management is increasingly being employed by freight and logistics operators to improve operational efficiency with consequent reductions in emissions per freight-kilometre. Trials deployed in fulfilment of this freight strategy could help smaller logistics operators get access to better data on journey times and access to key freight gateways, enabling them to better optimise their operations.

3.2.16. Traditional fleet management strategies fail when multiple operators make the same optimisation or rerouting decision in response to an event, such as a road traffic collision, resulting in diversion of significant amounts of freight traffic onto alternative, less suitable routes. A more integrated fleet management approach across the South East, involving multiple logistics carriers, would allow for a more coordinated fleet management strategy, with net gains in operational efficiency. Better sharing of data is essential to this intervention and would also bring benefits to other parallel interventions, such as booking systems for port access. Table 3-3 shows the applicability of this intervention across a range of different place typologies.

Table 3-3 - Real-time fleet management applicability

Typology	Very High	High	Medium	Low	Very low
MEH	x				
Urban areas	x				
Rural areas	x				

Remote rural	x				
Gateways			x		

Interdependencies

3.2.17. Real-time fleet management is only as good as the data used to inform the optimisation strategy. It is therefore necessary to ensure that operators have open access to high quality data sources in a way that is easily accessible, such as through APIs (an accessible way of retrieving digital information held on servers). A successful operation will require close partnerships and collaboration between public and private sector bodies, to make fleet optimisation at scale, based on more complete and up-to-date information. In exchange for accessing information, operators should be encouraged to share their own data, to aid in building a more complete picture of activity on the road network.

3.2.18. See the

3.2.19. Real-time **FLEET MANAGEMENT** management dashboard for more detail.

BOOKING SYSTEMS FOR PORT ACCESS

Description

3.2.20. Vehicle Booking Systems (VBS) help to prevent bottlenecks. Truck congestion inside and outside the terminal can lead to serious local environmental problems such as noise and harmful emissions, but also result in major inefficiencies in various operations. The main cause of truck congestion is the fluctuating arrival pattern of vehicles. Truck Appointment Systems (TAS) allow ports to reduce peaks in truck arrivals. Thereby, the operation costs for terminals and the waiting times for trucking companies are reduced. The same principle may also be applied to other sites attracting a large amount of freight traffic, such as at major construction sites.

Role in freight decarbonisation

3.2.21. Bottlenecks, producing truck congestion inside and outside port terminals and construction sites, can lead to serious local environmental problems such as noise and harmful emissions, but also to major inefficiencies in various operations. By managing and mandating the arrival times of vehicles accessing these sites, congestion can be alleviated, and vehicles will spend less time idling, reducing overall emissions.

Potential deployment

3.2.22. Most major container ports in the UK now operate a vehicle booking system. However, if their deployment is to be extended to other international gateways, including airports, it will be important to consider how this technology interfaces with other proposed interventions, such as fleet management systems, and its potential role in controlling access to refuelling/recharging stations. Better integration will allow for improved end-to-end efficiency and further reduce instances of congestion around ports (container and potentially Ro-Ro) and other major logistical sites. Table 3-4 shows the applicability of this intervention across a range of different place typologies.

Table 3-4 - Vehicle booking system applicability

Typology	Very High	High	Medium	Low	Very low
MEH					x
Urban areas					x
Rural areas					x
Remote rural					x
Gateways	x				

Interdependencies

3.2.23. Much like fleet management systems, a Vehicle Booking System will only be successful if it is easily accessible and if port authorities are willing to share their data insights to aid in broader operational optimisation. A transparent system that can be easily integrated into operators' own analytics will encourage greater engagement and therefore efficiency.

See the

Booking Systems for port/SITE ACCESS access dashboard for more detail.

NEW BUSINESS TO BUSINESS (B2B) AND CUSTOMER TO CUSTOMER (C2C) SERVICE MODELS

Description

3.2.24. New and innovative ways of accessing logistics services, through online platforms, have become increasingly available in recent years. There has also been a notable change in consumer behaviour, with a shift away from high street shopping and towards online retail. This trend accelerated during the COVID-19 pandemic but online services are also opening the door to new business models, brokerage models and peer-to-peer services.

Role in freight decarbonisation

3.2.25. New business models are transforming the way freight is being used by making better use of spare capacity in the network. This includes both passenger and freight trips and by providing better visibility of consignments on the network, resources can be more efficiently allocated. Similarly, by aligning freight and passenger movements unnecessary car trips to and from the shops can be replaced by aggregated deliveries using a single van to serve multiple customers, thereby reduce vehicle kilometres travelled and subsequently carbon dioxide emissions.

Potential deployment

3.2.26. The new business models dashboard in Appendix A identifies several emerging business models offering alternative ways of delivering freight. Some are focused on business to business (B2B) deliveries, such as Uber Freight, in which independent hauliers can connect with shippers and freight forwarders through online platforms to fulfil consignments. The service is highly flexible and allows shippers and truck fleet operators to match needs and services, to ultimately deliver the freight where it needs to go, on a one-time basis. In theory, this allows for much better utilisation of available freight capacity on the network, by allowing drivers to carry similarly destined freight, in addition to their existing loads, on an opportunity basis.

3.2.27. Furthermore, customer to customer (C2C) deliveries can enable passengers to make a return on their journeys by carrying a small amount of freight. The process could be coordinated using an online platform, like that devised by Grabr, who operate a business connecting travellers to buyers who want to purchase goods only available abroad. By deploying a similar intervention across the region, the total number of freight trips could be reduced by fulfilling deliveries as a part of existing passenger journeys – making best use of available vehicle resource and unused capacity. Optimising payloads and reducing freight miles (reducing designated vehicle trips) can look to lower the concentration of emissions.

3.2.28. The adoption of aforementioned technologies and business models has an obvious impact on the scale and proportion of private vehicle traffic on the road network. Shifting consumer patterns and changes in travel behaviour can reduce trip chaining activity (the ‘need’ to fulfil various tasks in one trip between multiple sites) and ultimately nudge people towards adopting alternative means of transport for core journeys. This can indirectly influence traffic congestion and mitigate the externalities from car-centric lifestyles, whilst opening up opportunities to adopt sustainable forms of (urban) mobility.

3.2.29. Table 3-5 shows the applicability of this intervention across a range of different place typologies.

Table 3-5 - New business models applicability

Typology	Very High	High	Medium	Low	Very low
MEH	x				
Urban areas	x				
Rural areas	x				
Remote rural	x				
Gateways					x

Interdependencies

3.2.30. Successful C2C business models often require a critical mass of people participating to create a service that can reliably deliver for its users. Consequently, driving customer engagement and working to resolve regulatory barriers will be key in growing a service beyond a minimum viable size. Matching spare capacity with demand at this scale is possible using digital platforms which enable users to locate each other and provide better transparency over potential delivery and collection opportunities. The online platform option to access existing goods vehicle capacity could play a key role in increasing utilisation levels of existing fleets.

3.2.31. See the

3.2.32. New business **MODELS** dashboard for more detail.

AUTOMATED / AUTONOMOUS VEHICLES

Description

3.2.33. Much of the cost of delivery is the cost of drivers' salaries and often deliveries are slowed due to mandatory rest periods, whilst driving/working or delayed by driver failure to show/illness. Furthermore, 95% of accidents are attributed to human error, so with increasing automation it is hoped that road safety and delivery reliability will improve for all users. Connected and autonomous vehicles (CAVs) are considered by many to be key to the future of parcel delivery, due in part to the cost savings that can be achieved by removing the need to pay a driver's salary. There are many pilots underway globally to test different sizes and types of CAVs, which vary from small units that travel to residential areas for last mile delivery, to long distance applications using platoons of HGVs on trunk roads.

Role in freight decarbonisation

3.2.34. By 2050, connected autonomous vehicles could reduce fuel consumption by as much as 44 percent for passenger vehicles and 18 percent for trucks, according to a new study released by the Energy Information Administration. This is due in part to softer acceleration and deceleration gradients and the enabling of vehicle platooning, resulting in less fuel consumption.

Potential deployment

3.2.35. The nature of an automated vehicle trial will vary, dependent on the use case selected. However, the recent announcement in 2021 of new legislation allowing Level 3 automated vehicles to operate on UK roads at speeds of up to 37mph is expected to pave the way for increasing on-road automation in logistics. This will be particularly true for more urban environments, where speeds rarely exceed this threshold and, in theory, a vehicle could spend most of its time navigating autonomously, potentially negating the need for a driver or allowing them to engage in other productive tasks when not in control of the vehicle.

3.2.36. Trials of automated vehicles on the strategic road network (SRN) would enable much more efficient logistics operations because drivers would no longer need to take breaks or spend long periods behind the wheel. In the context of a national shortage of drivers, this would be a welcome development in the industry, amidst a trend for increasing volumes of freight being moved, due to the growth in online retail. Automation would also allow for optimising fuel efficiency, for example through integrated on board systems (telematics) informing ideal tyre pressure requirements.

3.2.37. Table 3-6 shows the applicability of this intervention across a range of different place typologies.

Table 3-6 - Automated vehicles applicability

Typology	Very High	High	Medium	Low	Very low
MEH		x			
Urban areas	x				
Rural areas	x				

Remote rural	x				
Gateways	x				

Interdependencies

3.2.38. Trialling automated vehicles requires a detailed safety case to be developed, which demonstrates that all the safety risks have been identified and appropriate controls have been put in place to minimise the risk of harm. Trials are subject to stringent regulations, including the supervision of a safety driver who must intervene if the vehicle behaves unexpectedly. For test facilities in the public domain, there is a requirement to comply with UK road traffic laws, as well as the requirements of the landowners.

3.2.39. See the

3.2.40. **Autonomous VEHICLES** dashboard for more detail.

DELIVERY DRONES

Description

3.2.41. Urban areas are becoming increasingly congested, which is limiting the speed at which time-critical deliveries can be made. Furthermore, barriers such as bodies of water, terrain impassable by road and railway lines can result in highly circuitous or lengthy trips being made to access geographically close locations. Drones are unique in that they can fly directly to delivery destinations, unaffected by congestion and bypassing obstacles, drastically reducing journey times.

Role in freight decarbonisation

3.2.42. Drones provide the option to resize delivery vehicles in accordance with the load they are carrying. If a small number of packages need to be transported over a distance to a rural area, it is far more economical in environmental and commercial terms to make the deliveries using small drones, rather than sending a much heavier and therefore inefficient van out of its way to make the same deliveries. Furthermore, as they are unaffected by congestion and physical barriers, drones are able to take more direct routes to their destinations, resulting in further efficiency gains.

Potential deployment

3.2.43. Remote rural locations are likely to benefit most from freight trials of drone technology. Drones could allow people to receive deliveries more quickly and cheaply, providing lifeline support for some of the most isolated communities. Remote locations also present a low-risk environment in which to trial, due to the scarcity of congested areas which present legislative challenges to current trials of the technology. Van deliveries to these locations are highly circuitous and inefficient and vehicular traffic has an adverse effect on the local environment. Drones offer a zero-emission alternative that could minimise the impacts of logistics on ecologically sensitive areas, such as AONBs and national parks.

3.2.44. Drone trials are being conducted as part of the Solent Future Transport Zone, delivering critical medical supplies and samples between hospitals in Portsmouth and Southampton to and from the Isle of Wight. Deliveries to the Isle of Wight by drone significantly cut journey times and have the potential to significantly increase health outcomes. Basic logistics issues such as packaging size and carrying conditions need to be tackled, to ensure drones can be seen as 'just another vehicle'. Broadening the remit to cover a greater variety of deliveries could reduce the constraint of ferry schedules for the Isle of Wight and consider other suitable locations and products for drone deliveries. Table 3-7 shows the applicability of this intervention across a range of different place typologies.

Table 3-7 - Delivery drones applicability

Typology	Very High	High	Medium	Low	Very low
MEH				x	
Urban areas			x		
Rural areas		x			
Remote rural	x				
Gateways					x

Interdependencies

3.2.45. Airspace regulation in the UK is overseen by the Civil Aviation Authority (CAA) and there are extremely tight controls in place to ensure trials use airworthy drones. There are currently limits to remotely piloted and autonomous systems which require piloted or supervised flights by an operator with a clear line of sight. The success of more widespread trials of drone technology will be dependent on the development of Uncrewed Traffic Management (UTM) systems to address the safe and efficient integration of unmanned vehicles into airspace, ensuring safe and efficient drone flights don't conflict with general aviation (everything from powered aircraft to gliders and balloons).

3.2.46. See the

3.2.47. Drone **DELIVERY** dashboard for more detail.

DELIVERY DROIDS

Description

3.2.48. Delivery droids are small autonomous delivery vehicles which can travel on pavements where permitted, or through pedestrianised areas to complete local last-mile deliveries to customers at low cost compared to delivery by human drivers. Their cargo is transported in a locker that can be accessed only by the recipient of the delivery. Droids offer a zero-emission last mile solution and can be employed across an area to replace van trips. Unlike vans, they can also operate in pedestrianised areas, often inaccessible to other modes, such as e-cargo bikes.

Role in freight decarbonisation

3.2.49. Similarly, to drones, droids provide the option to resize delivery vehicles in accordance with the load they are carrying, reducing the need for vans to drive around making deliveries with a suboptimal load utilisation. Making use of the pedestrian footway network, droids may also be able to take more direct routes to destinations in dense urban areas, where the equivalent van would be forced to take a far more circuitous route. Furthermore, droids are battery operated, meaning that they produce no emissions at street level and can be powered using renewable energy sources.

Potential deployment

Initial trials of droids would be well-suited to campus locations such as business parks, universities, ports and airports. Previously, UK trials have been underway in residential areas such as Milton Keynes, where users can receive online grocery orders by delivery droid. The service is accessed via an app and deliveries promptly arrive straight to the front door by making use of the network of footways. A similar trial could be deployed across communities in the South East, in particular delivering food to workplaces and homeworkers during the day, potentially negating the need to travel to a nearby shop by car.

3.2.50. Table 3-8 shows the applicability of this intervention across a range of different place typologies.

Table 3-8 - Delivery droids applicability

Typology	Very High	High	Medium	Low	Very low
MEH	x				
Urban areas	x				
Rural areas				x	
Remote rural					x
Gateways					x

Interdependencies

3.2.51. Given that they can travel along pavements, droids are best suited to urban locations with a high quality, porous walking environment. Droids operate over relatively short distances and therefore need a high density of deliveries within the small area they serve to be commercially viable. They also travel much more slowly than other types of delivery vehicle, meaning that they are best suited to pedestrian areas where vehicle speeds are also low and there will be minimal conflict with other road users. The introduction of droids must be carefully managed, however, as they could become a pavement-based obstacle, introducing an additional threat as they are moving.

3.2.52. See the

3.2.53. **Delivery** **DROIDS** dashboard for more detail.

MAGWAY

Description

3.2.54. The Magway system aims to provide a safer, faster, more reliable and more sustainable way of delivering parcels and other items able to fit within a tote box sized container. The Magway system uses magnetic motors to transport 'vehicles' of goods down dedicated pipelines from distribution hubs to consolidation centres. This eases the installation process as existing techniques and technologies of tunnel boring and pipe installation can be used. Moving around pipe systems that can run below ground, underground or even suspended, Magway's carriages travel just milliseconds apart from each other at speeds of up to 50kph. Automated loading and unloading processes, controlled by advanced computer programming, maintain a steady flow of carriages through the system.

Role in freight decarbonisation

3.2.55. Magway provides a means of circumventing congestion by moving freight through dedicated 1m diameter tunnels on electrically propelled carriages. By replacing up to 3,000 lorryloads per day, a huge number of trips are taken off the network, reducing vehicle emissions in the process and helping to decarbonise the industry.

Potential deployment

3.2.56. Initial deployments of Magway technologies are targeting locations with high levels of freight flows between them, including routes from airport hubs such as Gatwick Airport to distribution centres nearby. Construction work is due to commence around 2023 in London on a network of pipes with route lengths up to 100km. Table 3-9 shows the applicability of this intervention across a range of different place typologies.

Table 3-9 - Magway applicability

Typology	Very High	High	Medium	Low	Very low
MEH	x				
Urban areas		x			
Rural areas				x	
Remote rural					x
Gateways	x				

Interdependencies

3.2.57. Magway is a capital-intensive intervention, as it requires dedicated infrastructure to transport freight efficiently. Magway estimates that pipe networks, rails and freight pods will cost £1.5m per kilometre (about £2.4m per mile), plus a further £1.5m to £3.5m per kilometre for planning, installation and legal costs. This means that scaling up the operation is incredibly expensive, although the costs are expected to be recouped through improvements in operational efficiency over conventional modes.

3.2.58. See the

3.2.59. **MAGWAY** dashboard for more detail.

E-CARGO BIKES

Description

3.2.60. Electric cargo bikes (E-cargo bikes) are a highly versatile form of first and last mile freight transportation that can replace some deliveries in urban areas traditionally made by light goods vehicles (LGVs), whilst using a fraction of the road space. Being electrically assisted, they enable the rider to efficiently transport cargo with zero emissions at street level, with some variants able to carry loads of 250kgs+. Additionally, where infrastructure allows, they can use the cycling network to efficiently move around a city and their smaller size allows them to be parked more conveniently, close to their destination and to have access to low-traffic neighbourhoods (LTNs).

Role in freight decarbonisation

3.2.61. The UK's current fleet of conventionally-fuelled goods vehicles is estimated to be in excess of 400,000 HGVs and over 4,600,000 vans and this reliance is exacerbating congestion, greenhouse gas emissions and noise pollution. E-cargo bikes offer the potential to remove some of these vehicles, particularly vans, from urban areas, with benefits of improved air quality and more sustainable movement of freight as a result.

Potential deployment

3.2.62. E-cargo bikes are best suited to dense urban centres, where they have a competitive edge over traditional van traffic. Towns and cities with more historic centres tend to lend themselves well to E-cargo bikes, as they are typically more congested, giving E-cargo bikes a journey time advantage, thanks to their ability to circumvent traffic using cycling infrastructure. Consequently, conurbations such as Chichester, Winchester and Canterbury would likely be promising locations to trial E-cargo bike logistics. Portsmouth, Brighton and Southampton are also suitable, as evidenced by the existing e-cargo bike operations in these locations.

3.2.63. As a mode, E-cargo bikes are very flexible and can also be employed in adjacent sectors, such as in supporting tradespeople with their work and in reverse logistics, i.e. waste collection. They can also be made available for the local community to use, enabling them to complete trips moving larger or heavier items that would otherwise have required a car. E-cargo bikes, alongside the range of complementary behaviour change projects and infrastructure schemes, can help to normalise the greater role of bikes within society and help unlock the propensity for greater uptake of active travel for other journeys (with indirect benefits on network resilience and capacity).

3.2.64. Table 3-10 shows the applicability of this intervention across a range of different place typologies.

Table 3-10 - E-cargo bikes applicability

Typology	Very High	High	Medium	Low	Very low
MEH	x				
Urban areas	x				
Rural areas				x	

Remote rural					x
Gateways					x

Interdependencies

3.2.65. For E-cargo bikes to work efficiently, many operators choose to operate out of a micro-consolidation centre, acting as a gateway on the edge of an urban area, to intercept parcels bound for the centre. However, light industrial units of the sort well-suited to this purpose are becoming increasingly scarce and therefore expensive to acquire. This is a major barrier for new entrants to the market, so a shared or open access resource should be considered to enable smaller E-cargo bike operators to begin trading with lower capital expenditure. Older retail premises in urban areas may also be suitable facilities for zero emission ops.

3.2.66. There are also policy levers which should be considered to act as triggers for E-cargo bike success, as well as for other zero emission modes covered in this strategy. Clean Air Zones and congestion charge areas tip the balance towards E-cargo bikes to make them more competitive over traditional van traffic, by levying a charge on polluting vehicles.

3.2.67. See the

3.2.68. E-Cargo **BIKES** dashboard for more detail.

E-WALKERS

Description

3.2.69. E-walkers are electrically assisted cargo trailers, designed to be operated by a person on foot (pedestrian-controlled), through pedestrianised areas. The electrical assistance allows the operator to easily move large quantities of cargo and the dimensions of the vehicle allow it to pass through doors to access places such as shopping centres. E-walkers have the potential to service busy congested environments where space is restricted and where it wouldn't be appropriate to use other modes, such as an e-cargo bike.

Role in freight decarbonisation

3.2.70. E-walkers offer another last mile solution to logistics operators, enabling them to make zero emission deliveries across dense urban areas and negating the need to use a van. E-walkers can also access premises directly, removing the need to drive around to find a suitable location for loading. Together, these factors reduce van mileage and therefore carbon emissions.

Potential deployment

3.2.71. Towns and cities with pedestrianised centres inaccessible to motorised traffic would be well suited to e-walkers. Such examples in the region include Chichester, Canterbury, Brighton, Royal Tunbridge Wells, as well as large shopping centres such as Portsmouth's Gunwharf Quays and Cascades and Southampton's Westquay shopping centre.

3.2.72. It is also worth considering that even delivery drivers in vans can just as easily be termed 'walkers' as 'drivers', as a recent FTC 2050 study found that delivery vans spend around 60% of their time parked at the kerbside, with 30% of the total distance travelled on foot[9]. There is potentially a role, therefore, for e-walkers to enhance foot porterage capacity, to reduce the dependence on van mileage during delivery rounds by reducing the need for a driver to repeatedly find new parking spaces on multiple occasions. This would lead to reduced interactions between van traffic and vulnerable road users and less impact on local amenity. Table 3-11 shows the applicability of this intervention across a range of different place typologies.

Table 3-11 - E-walkers applicability

Typology	Very High	High	Medium	Low	Very low
MEH	x				
Urban areas		x			
Rural areas					x
Remote rural					x
Gateways					x

[9] http://www.ftc2050.com/reports/City_of_London_Freight&Servicing_SPD_Consultation-FTC_2050_response.pdf.

Interdependencies

3.2.73. Like other last mile modes, e-walkers need to be matched to the correct urban form to be commercially viable and competitive over more traditional forms of delivery. Due to their short range, e-walkers also need to operate out of some form of micro-consolidation centre or urban depot. Some operational models use vans as mobile depots to load the e-walkers from loading bays near to pedestrianised areas or shopping districts.

3.2.74. See the

3.2.75. **E-WALKERS** dashboard for more detail.

FREIGHT ON PUBLIC TRANSPORT

Description

3.2.76. Train stations act as major transport interchanges and offer unparalleled direct access to city centres and low journey times into central urban areas, compared to travel by road. This is potentially a major benefit to logistics, as it is to passengers and could allow E-cargo bikes to collect parcels offloaded from trains for onward delivery as part of a 'hub & spoke' approach to urban and rural mobility and logistics activity.

3.2.77. Similarly, many buses are running below capacity and supplementing the movement of people with freight would add another much-needed revenue stream for the service. The routing algorithms that underpin DDRT could also factor in both people and freight, to create the most efficient routes that do not compromise customer experience or journey times.

Role in freight decarbonisation

3.2.78. Many public transportation services run with spare capacity during off-peak periods. This capacity could be used to support the movement of freight between urban centres, and in the process remove HGV and van trips from the network, which reduces vehicle emissions. Furthermore, direct access to urban centres provides the opportunity to transfer freight to zero emission last mile modes for delivery across the urban centre.

Potential deployment

3.2.79. DDRT proposals being developed as part of the Solent FTZ could be extended to cover wider reaches of the South East and to allow for a more extensive network of routes that can be exploited. Furthermore, spare capacity on traditional bus services covering rural locations could also be exploited, potentially with links to mobility hubs to act as micro-consolidation points.

3.2.80. DDRT routes could serve several rural locations and can be easily adapted to balance route consistency with flexibility. Moving parcels by DDRT would be beneficial to the most remote locations that are least well-served by traditional bus services and that are most at risk of being affected by goods vehicles travelling through the area. Potential trial locations include the South Downs National Park and the six Areas of Outstanding Natural Beauty in the South East.

3.2.81. Making use of off-peak rail services would also help to move freight in a more sustainable way by carrying cargo directly to urban centres, without the same disruption created by road traffic and with significantly reduced emissions. Overnight services especially would be in scope for consideration, given the very low rail patronage during these times, and the potential interface with urban depots, enabling freight to be forwarded in advance of delivery rounds conducted by last mile modes. Operators are known to be considering these options for commercial parcel flows. Table 3-12 shows the applicability of this intervention across a range of different place typologies.

Table 3-12 - Freight on public transport applicability

Typology	Very High	High	Medium	Low	Very low
MEH		x			

Urban areas		x			
Rural areas		x			
Remote rural	x				
Gateways					x

Interdependencies

3.2.82. Moving freight on public transportation is not a new concept – but it will require new collaborations between logistics companies and public transport operators. Whilst, in the past, freight was frequently moved alongside people on buses and trains, the needs of both diverged throughout the years and have since become very separate. Reuniting the two will require careful consideration of regulations and ensuring that the passenger experience is not adversely affected by the movement of freight. Additional infrastructure may also be required to enable transport interchanges to serve as consolidation points and for freight to be handled safely when being loaded or unloaded.

3.2.83. See the

3.2.84. Freight on public **TRANSPORT** dashboard for more detail.

PLATOONING

Description

3.2.85. In truck platooning, highly advanced vehicle to vehicle (V2V) and sensor technology allows two or more wirelessly connected trucks to drive at a short distance apart. Using the driving information from the first truck in the platoon, the following vehicles can automatically accelerate, brake and steer. While platooning, when the lead vehicle brakes, the following vehicles automatically brake, with no noticeable reaction time, significantly increasing road safety. This enables the gap between truck combinations to be reduced as much as possible, which, due to slipstreaming, can save approximately 10% in fuel, with an equivalent reduction in CO2 emissions.

Role in freight decarbonisation

3.2.86. Vehicle platooning enables significant fuel savings by exploiting the aerodynamic efficiency gains achieved when vehicles drive in one another's slipstream. Tests to date have indicated that efficiency gains of between 5% and 10% can be achieved, which, if applied at scale, could make significant contributions to decarbonising the industry. There are, however, questions about how scalable this solution is within the context of the UK's roads and how effective this measure would be in practice.

Potential deployment

3.2.87. The Department for Transport have provided a TRL-led consortium with £8 million of funding to run trials of platooning technology. Subject to the findings from these trials, Transport for the South East could play a role in facilitating multi-brand platooning to spark a more rapid deployment and greater interoperability, leading to improved efficiency benefits. Table 3-13 shows the applicability of this intervention across a range of different place typologies.

Table 3-13 - Platooning applicability

Typology	Very High	High	Medium	Low	Very low
MEH					x
Urban areas					x
Rural areas			x		
Remote rural		x			
Gateways					x

Interdependencies

3.2.88. For this intervention to be a success, it will have to support multi-brand platooning, in other words, different vehicle types and potentially different operators. This requires setting up protocols that can be shared between truck manufacturers and a mechanism for sharing the benefits between different operators. Platooning will be highly technical because the sheer size of a truck places higher demands on the technology than in cars, as do moving combined parts of the vehicle (tractor unit

and semi-trailer) in an articulated combination. This intervention will therefore require extensive planning and coordination between stakeholders, to provide assurance to local authorities and other road users that the trials are safe.

3.2.89. See the

3.2.90. **PLATOONING** dashboard for more detail.

FREIGHT CONSOLIDATION

Description

3.2.91. Freight consolidation exploits the economies of aggregation by combining multiple shipments destined for a geographic region into a single load. Where local micro-consolidation is used, the combined shipment is broken into smaller consignments for onward delivery across the locality, potentially by zero emission option, such as by E-cargo bike or foot porter. Consolidation can happen at all scales, manifesting differently at various points in the logistical chain and can reduce externalities from traffic congestion by re-moding the last leg of a supply chain journey.

Role in freight decarbonisation

3.2.92. Consolidation has the potential to remove a large number of trips from urban centres by aggregating deliveries bound for similar locations onto a single vehicle, rather than deliveries arriving in multiple. This helps to ensure that vehicles are running at optimum capacity, effectively reducing the fleet size required to service an area and the subsequent impacts on carbon emissions.

Potential deployment

3.2.93. There is an opportunity for Transport for the South East to support freight consolidation at multiple stages of the logistical chain by investing in/supporting shared consolidation centres. The logistics hubs can be exploited by multiple operators in multiple locations, allowing businesses to locate their stock closer to its end destination, reducing overall vehicle mileage and optimising logistics networks. Ideal locations for logistics hubs have good access to the SRN and international gateways, such as major ports and airports.

3.2.94. At the smaller scale, micro-consolidation centres located on the edge/within urban areas allow for the re-moding of freight onto zero emission vehicles for local delivery across the last mile. Table 3-14 shows the applicability of this intervention across a range of different place typologies.

Table 3-14 - Freight consolidation applicability

Typology	Very High	High	Medium	Low	Very low
MEH	x				
Urban areas	x				
Rural areas			x		
Remote rural			x		
Gateways					x

Interdependencies

3.2.95. Freight consolidation is an intrinsic part of the logistical chain and therefore has many interdependencies. It is particularly important for re-moding freight, with many of the last mile interventions covered in this work package requiring some form of consolidation to be successful.

3.2.96. Additionally, retiming of delivery outside of peak periods is a natural consequence of consolidation and has implications for fleet management software which can use consolidation to maximise efficiency by running vehicles as close to capacity as possible. Consolidation also offers an opportunity for load sharing to be exploited, where similarly timed and destined deliveries from multiple sources can be aggregated to move more freight, with fewer vehicles. There is undoubtedly, however, an issue relating to who pays for the facility and its additional handling requirements. If there are no constraining factors, such as heavy congestion and access restrictions, voluntary schemes rarely, if ever, succeed. Open access shared consolidation centres therefore need to make commercial and logistical sense, as well as help to reduce local environmental impacts.

3.2.97. See the **Consolidation** dashboard for more detail.

DYNAMIC KERBSPACE MANAGEMENT

Description

3.2.98. Dynamic kerbspace management allows spaces to be booked through a connected digital system. This enables the creation of virtual loading bays and for the use of kerbspace to be changed throughout the day to better suit local demand. It also enables dynamic pricing structures to manage demand for parking/loading/unloading spaces across urban areas and to ensure that the roadside is clear, ahead of essential works or events. Ultimately, the measure can also offset vehicle 'coasting' activity that contributes towards added levels of congestion and concentrated levels of air quality in sensitive areas.

Role in freight decarbonisation

3.2.99. Dynamic and digitised kerbs can increase the efficiency of the freight networks by managing access to congested areas and changing the use of space in response to shifts in demand. This reduces the amount of time that vehicles spend circulating, searching for loading or parking space. This intervention may also be used as a policy lever which restricts access to urban areas during certain periods to encourage freight to be shifted on to more sustainable modes such as e-cargo bikes.

Potential deployment

3.2.100. This technology could be trialled across urban centres in the region to reduce the disruptive impact of logistics and to build on the findings of previous trials conducted in Dublin by GRID Smart Cities. Collaboration with highway authorities will be essential in the trialling of the technology as it necessarily requires flexible amendments to Traffic Regulation Orders and permitted loading areas. Furthermore, reallocation of the kerbspace will have implications for parking and travel demand management strategies. Table 3-15 shows the applicability of this intervention across a range of different place typologies.

Table 3-15 - Dynamic kerbspace management applicability

Typology	Very High	High	Medium	Low	Very low
MEH	x				
Urban areas		x			
Rural areas					x
Remote rural					x
Gateways					x

Interdependencies

3.2.101. Dynamic kerbspace management could be used in conjunction with fleet management software to automatically book loading spaces and more accurately adjust booking windows, based on a vehicle's location and estimated time of arrival. This will allow more efficient use of the kerbside in urban areas and allow the space to be freed up for other purposes during periods of low utilisation.

See the **Dynamic kerbspace management** dashboard for more detail.

VTOL MOBILITY

Description

3.2.102. Vertical take-off and landing (VTOL) technology is allowing freight to be transported to and from hard-to-reach locations. Requiring very little infrastructure, VTOL aircraft can provide cost-efficient freight solutions and are opening up new delivery markets and business models. Increasingly, the aircraft are being powered by electric powerplants or by using hybrid technologies to maximise efficiency and provide decarbonised alternatives. The VTOL technologies described in this dashboard operate similarly to drones but can carry much larger payloads and over longer distances, catering therefore to different use cases and business models.

Role in freight decarbonisation

3.2.103. VTOL Mobility promises to enable cargo to be transported more directedly by circumventing congestion and flying over physical barriers. In some cases, this could result in emissions saving, contributing to decarbonising the industry. However, VTOL mobility is much more energy intensive than moving the equivalent load by road, so its application should be targeted and limited to the use cases where it can be environmentally competitive with existing modes of transportation. Increasingly, electric concepts are emerging which promise to be much less damaging to the environment that ICE equivalents.

Potential deployment

3.2.104. VTOL aircraft are best suited to areas where there is demand for larger consignments of cargo that need to be delivered to places with very little infrastructure. Deployment could build on drone trials which are moving freight to and from the Isle of Wight, thus eliminating the need for some freight flows to travel by ferry. Time-critical and high value deliveries that are too large to be moved by a drone could be in scope for delivery via VTOL aircraft, especially those destined for remote rural areas, where equivalent trips by road would be highly circuitous. Table 3-16 shows the applicability of this intervention across a range of different place typologies.

Table 3-16 - VTOL mobility applicability

Typology	Very High	High	Medium	Low	Very low
MEH				x	
Urban areas				x	
Rural areas		x			
Remote rural	x				
Gateways					x

Interdependencies

3.2.105. Much like drones, seamless inter-aircraft communication demands effective integration of the existing airspace management systems with unmanned aircraft systems. Traffic management will be required to enable operators to interact with multiple vehicles flying simultaneously in a way that is safe. The regulation is not yet mature, and it may be some years until a formalised system is employed at scales that will enable widespread operation. Until then, small scale applications with pre-approved flight plans may be feasible as demonstrators of the technology.

3.2.106. See the

3.2.107. VTOL **MOBILITY** dashboard for more detail.

DIGITAL TECHNOLOGIES IN RAIL FREIGHT

Description

3.2.108. The rail industry is constantly innovating to produce technologies that improve operational efficiency and safety. Many solutions are focused on making data more transparent, more efficient to collect and more easily shared. Technology can also be applied to the signalling systems whilst helping to ensure the smooth running of the railway network.

3.2.109. Signals upgrades can allow more trains to run by, allowing for a greater degree of coordination, less stop-starting and therefore additional capacity that can be used to run more freight services. Better digital scheduling for trains (including times for service perturbation) can also be explored to minimise 'stop starting' and improve fuel and operational (trip) efficiency. Technology can ultimately help to support seamless strategic trips on the network and along designated freight paths.

3.2.110. Technology can also be an enabler of new business models, as better oversight of freight movements may enable operators to identify new opportunities for aggregation or consolidation onto more efficient wagon loads.

Role in freight decarbonisation

3.2.111. Digital technologies in freight are helping to increase the operational efficiency of the freight network, which is making rail a more attractive mode compared to transportation by road. As a consequence, a greater share of freight can be expected to shift to rail, which is a far more environmentally friendly mode of transportation, resulting in reduced emissions of harmful gases.

Potential deployment

3.2.112. Increasing digitisation of rail freight is leading to improved operational efficiency and better visibility of consignments as they move through the logistics network. This visibility could enable operators to spot new opportunities to move freight by rail as part of an intermodal journey, eliminating where possible the need to transport freight by more damaging modes, such as a diesel-powered lorry or van. Table 3-17 shows the applicability of this intervention across a range of place typologies.

Table 3-17 - Digital technologies in rail freight applicability

Typology	Very High	High	Medium	Low	Very low
MEH			x		
Urban areas			x		
Rural areas			x		
Remote rural			x		
Gateways				x	

Interdependencies

3.2.113. Despite the opportunities for improvements in operational efficiency, there remains a fundamental problem unresolved, in that, according to the rail freight strategy, only around 5% of the current rail freight fleet is powered by electric traction. This is likely to improve over time, as more lines become electrified, but it remains a major barrier to meeting decarbonisation targets.

3.2.114. See the

3.2.115. **Digital technologies in rail** **FREIGHT** dashboard for more detail.

3.3 SUMMARY

3.3.1. This section has presented some of the key emerging technologies and services in freight and logistics which can contribute to decarbonising the sector and deliver increased operational efficiency across the supply chain.

CONTRIBUTION TO OBJECTIVES

3.3.2. The table below summarises the assessments of each intervention's contribution to the freight strategy's objectives, with each being classified as having a minimum, medium or maximum effect. The efficacy of each intervention has been considered with respect to the domain in which they would be expected to be introduced, rather than across the full spectrum of the sector. For example, e-cargo bikes are expected to make significant contributions to reducing greenhouse gases, but this is only applicable to the urban areas where they are most commonly deployed.

Minimum effect **Medium effect** **Maximum effect**

Table 3-18 - Contribution of interventions to objectives

Interventions	Freight efficiency	Industry contribution	Connectivity	Air quality	GHG emissions	Safety	Community disturbance	Placemaking
Alternative fuels								
Real-time fleet management								
Booking systems for port access								
New B2B and C2C models								
Automated / autonomous vehicles								
Delivery drones								
Delivery droids								
Magway								
E-cargo bikes								
E-walkers								
Freight on public transport								

Interventions	Freight efficiency	Industry contribution	Connectivity	Air quality	GHG emissions	Safety	Community disturbance	Placemaking
Platooning								
Consolidation								
Dynamic kerbspace management								
VTOL mobility								
Digital technologies in rail freight								

3.3.3. From the table above, it can be seen that the most versatile interventions relevant across the most freight strategy objectives are:

- Magway;
- E-cargo bikes; and
- E-walkers.

3.3.4. With regards to **decarbonisation** specifically, the best performing interventions are:

- Magway;
- E-cargo bikes;
- E-walkers;
- Freight on public transport; and
- Alternative fuels.

KEY TECHNOLOGIES FOR DECARBONISATION

3.3.5. Magway, e-cargo bikes and e-walkers have therefore emerged as key technologies to be prioritised for delivery across the South East region. However, whilst the latter two technologies are already starting to become technologically and commercially mature in the UK, commercial deployment of Magway at any scale is still many years away from being a reality, with only prototype demonstrators in existence currently. If successful, however, Magway technology (and variations of it) could be transformative in decarbonising the industry and improving operational efficiency as it begins to mature.

3.3.6. The results show that some of the best scoring interventions are related to the introduction of new modes. This is perhaps reflective of the scarce choice of modes within freight currently, limited mostly to HGVs and vans. Whilst these modes are operationally efficient over longer distances, they are poorly suited to delivering across dense urban areas. The hierarchy of modes should therefore

be extended to include some of the aforementioned 'last mile' interventions such as e-cargo bikes, e-walkers and drones.

3.3.7. It should also be noted that whilst some of the interventions did not score so highly, all of them (potentially in combination, as packages of measures) will still be instrumental in delivering a decarbonised future for freight. Supporting interventions such as fleet management systems, consolidation and other digitised and automated services will be needed to complement the new modes which have been scored as making the greatest contributions.

3.3.8. Furthermore, the freight and logistics sector is formed of a complex network of interdependent parts. No single intervention, therefore, will offer a complete solution to decarbonising the industry and a range of measures must be deployed to suit a variety of place types and activities. In other words, future freight interventions should be packaged and implemented in a coordinated fashion.

BARRIERS TO IMPLEMENTATION

3.3.9. Piloting and mainstreaming new technologies and services is a complex and often time-consuming process which presents a number of challenges to freight operators. There is currently a great degree of confidence and familiarity with established modes and technologies such as vans and HGVs, and a reluctance, therefore, to try new approaches which may not guarantee immediate results or profitability.

3.3.10. The introduction of new modes especially can be highly disruptive to existing operations, requiring significant operational adaptation to integrate them into a wider fleet, or to replace vans/HGVs in existing delivery schedules. Another barrier is cost. Due to some interventions being less mature than more established technologies, they may not yet be priced competitively and the expertise to implement them at scale across the industry may not exist.

3.3.11. Additionally, as described in Section 2, the freight industry and wider transport ecosystem is in a constant state of flux and is continuously changing in response to the emerging signals, trends and trajectories. Whilst this can present opportunities, it also presents a number of challenges that the industry must be responsive to if it is to ensure it stays on the correct trajectory towards decarbonisation. Consequently, the list of interventions and their applicability to the region must be continually reviewed and updated.

3.3.12. A more equitable transition will also be required which recognises the financial and practical challenges faced by the industry, particularly smaller organisations, for decarbonising and adopting new technologies at pace. Inevitably there will be a backlash against business as usual and the potential ramifications of businesses being unable or unwilling to cooperate out of fear of risk of losing market share or due to the capital investment required to respond to emerging signals, trends and trajectories. This is where TfSE can play a coordinating, assistive and informative role in steering future change across the sector and to liaise with trade bodies and industry on the most timely, sensitive approach.

4 SPECIFICATION FOR TECHNOLOGY PILOTING

4.1.1. The role of technology in helping the UK achieve its decarbonisation targets will be significant, however, it is important that new innovations and services are introduced in a way that is structured and monitored throughout, to ensure that the desired outcomes from each intervention are achieved. This aim of this section is to present a high-level specification for piloting freight and logistics technologies within the Transport for the South East area.

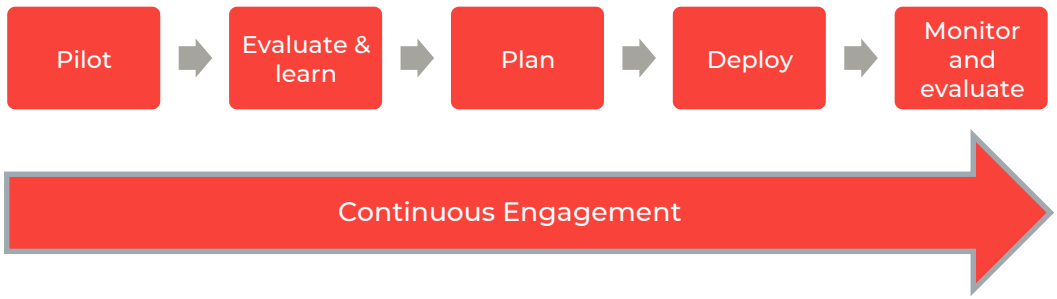
4.2 FUTURE MOBILITY STRATEGY

4.2.1. The Transport for the South East future mobility strategy places a strong emphasis on piloting and trialling of future mobility modes, service models and infrastructure. It sets out a five-stage process to delivering the future of mobility across the area.

4.2.2. The approach is designed to be integrated throughout, with a focus on delivering pilots that will be evaluated at an early stage, to identify initial outcomes and learnings. These will shape future plans for wider deployment of the technology or service, supported by continued monitoring and evaluation, to iteratively improve the trials based on emergent findings. At all stages, continuous engagement between stakeholders will be critical to ensure that all views are captured and that learnings are disseminated effectively.

4.2.3. The strategy notes that this framework is not intended to stifle innovation nor the rapid adoption of solutions. But the same principles would apply for new deployments in any given place and Transport for the South East would seek to maximise learning for all its partners through a monitoring and evaluation programme, even if that had not gone through the earlier pilot stages.

Figure 4-1 - Five stages of delivery



4.2.4. New technologies will inevitably ‘arrive’ in the South East at different stages of their development. Some may be early concepts which have yet to be piloted, while others will be ready for deployment, having been developed to pilot stages and beyond elsewhere. All five stages do not have to be applied to each technology arriving in the South East, rather they will enter the five stages at the point most appropriate to their stage of development.

4.2.5. It should also be noted that the five stages may be applied differently to private sector and public sector-led delivery. Differing approaches to corporate risk management may mean that the private sector may be more willing to skip stages of delivery or undertake them more quickly in order to speed up the potential return on investment. The five stages of delivery are therefore perhaps more focused on the delivery of new technology where the public sector has an active lead or partner role.

PILOT

4.2.6. Trialling new modes, technologies and services in freight is a core part of WP4 recommendations and it will better inform how Transport for the South East will be able to exploit new innovations in the sector, to meet the needs of businesses and communities in the region. The piloting stage for each intervention requires individually developed approaches which are tailored to the desired outcomes of the trials. However, across all pilots, feasibility studies, initial design and business case development will form an essential part of the learning process, ahead of the physical trials themselves.

4.2.7. This work package proposes close coordination of trials at multiple stages of development to provide an insight into how each intervention interfaces with the wider freight and logistics ecosystem, as well as with other interventions and trials. By adopting this area-wide approach, better value can be delivered thanks to the pooling of resources, standardised trialling and monitoring approaches and a clearer strategic view of the role each intervention has across a range of place typologies.

4.2.8. Co-ordinated piloting also allows risk to be more effectively managed by distributing piloting activity across a broader area and testing multiple different use cases of one intervention. Openly sharing learning and predefined stakeholder roles will help to ensure that the burden of risk is shared between multiple parties and that no single organisation is disproportionately impacted.

4.2.9. Oversight for the pilots across the South East will be provided by a piloting co-ordination group and all activities will be supported by the development of best practice guidance for piloting and evaluation of future freight trials.

4.2.10. Transport for the South East will support and encourage more partner authorities to participate in trials of future mobility models across different geographies and use cases. Alongside this, there needs to be greater public sector engagement with private sector partners, to develop relationships and facilitate pilots of new mode, service and infrastructure propositions.

4.2.11. In considering piloting, there could be two approaches applied:

- Innovations that can be trialled within the ‘live’ freight and logistics ecosystem under normal, or near normal, operating conditions; and
- Innovations that require ‘sandbox’ environments where new modes, services or infrastructure need to be trialled in a controlled environment. A term taken from Information Technology testing, sandboxes are sites or areas that provide piloting and trialling within defined environments.

4.2.12. As part of the piloting stage, public sector partners will be encouraged to identify specific strategic and operational challenges that can be addressed by trials in live ecosystem environments using a consistent approach across the region. For less mature interventions, sandbox environments (either digital or physical) will be identified, where testing can be undertaken in a safe and controlled manner, but which replicate, or are, real world situations.

4.2.13. The Solent Future Transport Zone, part of DfT’s £90m investment in Future Transport / Mobility, is the largest such example in the South East and represents a unique opportunity to not only pilot interventions but to accelerate learning for the benefit of all partners. The programme includes trials of sustainable urban logistics, including a dual-purpose DDRT service which moves freight as well as people, drone logistics, freight consolidation at multiple levels and the identification of potential ‘Freight Zones’.

Transport for the South East FUTURE FREIGHT ZONES (FFZs)

The need for a trial of new freight technologies could come about in a number of ways, including through development of individual innovations or the identification of a specific challenge or challenges that need supporting.

A Transport for the South East approach of bundling the piloting of new freight technologies through the development of Future Freight Zones (FFZ) would draw together appropriate innovations to pilot, to meet specific challenges for particular places and use cases. The technologies would be selected based on how each could potentially meet the challenges and needs of particular places or use cases and the extent to which they could be integrated into a single package. In some cases, the technologies may already have been piloted individually but the purpose of the FFZs would be to assess how technologies work together, as well as individually for those that have yet to be piloted.

An integrated plan for an FFZ, at a programme level, would need to be developed with a supporting business case for funding. This would require the drawing together of cross-sectoral partnerships to deliver the FFZ, developing an integrated team to provide expertise and resources covering technology and innovation, policy and commissioning, funding, operations and infrastructure and monitoring and evaluation. The pilots themselves would need to be delivered in a similar way, taking the best from the public, private, third and fourth sectors.

As well as an integrated plan, each technology would need its own proposal for delivery through the FFZ, setting out vision and objectives, hypothesis and learning outcomes, piloting proposal and plan, programme, budget, resource needs and funding, roles and responsibilities, how it would integrate with other piloted technologies and its own. monitoring and evaluation proposals.

EVALUATE & LEARN

4.2.14. The future mobility strategy for the South East outlines a piloting monitoring and evaluation framework which supports the development of trials, as well as aiding in the dissemination of the trials' findings. A detailed monitoring and evaluation plan will be developed for each intervention when trials are more mature, but the strategy will provide a light touch version to be used as guidance and to ensure consistency.

4.2.15. As findings emerge, they can be used to inform the development of future plans and policies, which will ultimately lead to the wider deployment of the future of freight interventions across the South East and beyond. This proactive approach to monitoring and evaluation will help to ensure that the potential benefits and unintended consequences are captured early in the trialling process.

MONITORING AND EVALUATION

As a technology passes through the piloting stage, evaluation will be key to ensure that it provides valuable insights into the technical and commercial development, including how they interact with other technologies. Monitoring should be continuous, including in the development stages, in the lead up to the pilot stage itself and evaluation should be undertaken as the pilot progresses, not simply at the end, so that learning is instantaneous and can help to optimise delivery during the pilot.

Evaluation should not be too onerous at this stage and should be flexible to meet the needs of different pilots and technologies, supporting, rather than hindering, delivery.

Learning should be continuous and disseminated throughout the delivery partnership and beyond, to enable the new understanding to be built into future plans across the South East.

PLAN

4.2.16. In order to successfully conceive and realise the future of freight and logistics, a vision and strategy must be developed to ensure that stakeholders, including those in mobility, energy and digital industries, can integrate across the wide variety of different places in the region. This will help to ensure that the necessary infrastructure, capacity and regulatory environment is in place, allowing interventions outlined in this work package to develop positively. Commissioning interventions will require funding, so the planning stage also includes identifying potential procurement routes and soft market testing.

4.2.17. The development of policy is especially important as it is the overarching lever which guides the development of sustainable logistics to maximise the benefits, whilst mitigating against unintended consequences. Effective policy will also need to be aware of the emergent global trends and technology disruptions which drive change in our economic, spatial and transport priorities.

PLANNING FOR DELIVERY

Where pilots and evaluation have demonstrated strong technical and commercial opportunities for new technologies, either through an FFZ, or elsewhere, their delivery locally will require planning.

Where deployment will be local authority-led or commissioned, new technologies will need to support local policy and new policy may be needed to shape their delivery and to secure funding. New technologies should be integrated into the mobility eco-system and there may need to be alignment with wider policy, demand management, behaviour change, service and infrastructure programmes to optimise the potential benefits.

A public sector business case may be needed to secure funding for delivery and technologies may need to go through procurement and associated processes. However, some technologies, particularly in the largely private sector-led freight industry may not require these public sector processes, unless they need financial support to secure their initial or long term sustainability.

DEPLOY

4.2.18. The deployment stage of the approach to delivery is perhaps one of the most important, as it is where the impact of the intervention will be most visible. When deployed, it will interface with the wider future freight and logistics ecosystem and the real-world benefits, but also challenges, will emerge.

4.2.19. Deployment relates to not just new modes, but also the services through which they are accessed and the necessary facilitating infrastructure. Learnings from the precedent stages will be incorporated as far as possible, to ensure that the approach is fully integrated as it moves through the five stages to delivery. This stage of delivery will include the development of a final design or manufacturing process, a deployment programme and a plan for the day-to-day operational management of the intervention. This may also include managing dependencies such as energy requirements and digital communications.

DEPLOYMENT

Deployment not only relates to the ongoing operation of technologies but also the steps before that, including, where appropriate, final design, manufacturing or construction, testing and initial or phased operation, with eventual wider deployment.

MONITORING & EVALUATION

4.2.20. A high-level Monitoring and Evaluation Framework will ensure a consistent approach across the interventions identified for trialling in the South East. It will detail an assessment of each intervention with respect to the wider environmental, economic, social objectives and outcomes of the freight strategy, as well as technical delivery of interventions.

4.2.21. Core to this stage of delivery is the collection of data and information to provide an evidenced-based assessment of the efficacy of the intervention. This will allow trials to be evaluated and for detailed findings to be disseminated to key stakeholders.

4.2.22. The Monitoring and Evaluation Framework is structured in a modular way and merges contemporary and more established approaches with the following elements:

- Monitoring signals, trends and trajectories;
- Seven key changes;
- Service models;
- Public sector policy;
- Future mobility delivery outside of the strategy;
- Early deployment;
- Intervention monitoring and evaluation;
- Strategy evaluation; and
- Reporting, dissemination and engagement.

MONITORING AND EVALUATION FRAMEWORK

The ongoing monitoring and evaluation of new technologies will allow others to learn from their deployment and build those lessons into their own plans for delivery.

SUPPORTING INTERVENTIONS

4.2.23. Supporting this approach to piloting, the future mobility strategy sets out a number of interventions to drive piloting across the Transport for South East area, which will also be of use to the freight strategy, as detailed in Table 4-1:

Table 4-1 - Supporting interventions

Interventions	Description
Future mobility shared learning hub	The future mobility shared learning hub will be used as a common location for information, learning and best practice relating to future mobility, including future freight and logistics. This will be a virtual platform for collating and disseminating learning with partners and stakeholders across the South East. It will encourage partners (public & private) involved in future mobility and future freight and logistics to share knowledge with other public and private sector partners that are seeking to develop their own future deployments. There are opportunities to use the Local Authority Mobility Platform, which is being developed by TS Catapult, as the basis for this shared learning hub; though this is still in development and is seeking funding for next steps.
Upskilling Local Transport Authorities	The need for upskilling will become more urgent as new freight interventions become a reality and the workforce will need to have the capability to manipulate, analyse and model large amounts of data in real time, as well as understand the implications for new modes on the mobility, freight and logistics ecosystem. It can take many years for staff to become fully competent in their field, so upskilling needs to start immediately to ensure that LTAs are best prepared for disruptive technologies and changes in freight and logistics operational practices.
Local future mobility trials	Supporting and encouraging partner authorities to participate in trials/projects across different geographies to test various future mobility models in order to collate evidence as to their efficacy. Where data or lessons are drawn, this intervention will help to ensure that knowledge sharing is undertaken across all authorities so that all partners benefit. Furthermore, it will seek to learn from best practice/lessons learnt elsewhere, such as the Future Transport Zones outside of the Transport for the South East area. Future freight and logistics will be an integral component of this.
Ties with national research bodies	Develop strong ties with DfT, Innovate UK and other research bodies, so that research, trials and early stage deployments consider the specific needs of the networks and customers in the Transport for the South East area.

Interventions	Description
FTZ engagement	Transport for the South East to continue working with Solent Transport in supporting its Solent Future Transport Zone (FTZ) programme, one of only four FTZs across the country. A common stakeholder engagement and communications plan will be developed to support continuous knowledge sharing with all local authorities in the South East area on the outcomes and learning from the programme. Transport for the South East will then seek to further develop and roll out Future Transport Zones elsewhere, if successful.
Piloting co-ordination group	A piloting co-ordination group should be set up to provide oversight of piloting across the South East, particularly those activities supported by the future mobility strategy and this freight, logistics and gateways strategy. This group would particularly support the co-ordination between local authorities to ensure they share opportunities, funding, best practice and lessons learned.
Piloting best practice guidance	Working with the other sub-national transport bodies on the development of best practice guidance for piloting and evaluation of future mobility and freight and logistics technology interventions
Live ecosystem piloting environments	Across the South East, public sector partners should identify areas of their operations where they can offer 'live ecosystem' piloting environments, focusing on specific strategic or operational challenges they face across different mobility and freight and logistics use cases. This should be coordinated at the pan-South East level, to ensure that there is a consistency of approach and a variation in offer.
Piloting sandbox locations	Partners and stakeholders, across the public, private and academic sectors should work together to identify potential piloting 'sandbox' locations across the area. Such sites or areas, both physical or digital, provide defined environments where trials can be undertaken in a safe and controlled manner, but which replicate, or are, real world situations.
Piloting monitoring and evaluation framework	Developing a framework to encourage active, ongoing monitoring and evaluation of future mobility and freight and logistics measure piloting in the South East. The framework encourages not only key performance metrics but also captures learning, insights and other information which could be useful to help other local authorities develop future business cases. This would be a lean process ensuring that the piloting stages are agile, and monitoring is not overly burdensome.
Identification of piloting use cases	Identification of a range of uses cases across the South East to focus investment and resources in piloting future mobility and freight and logistics interventions.

REPORTING, DISSEMINATION AND ENGAGEMENT

4.2.24. Reporting and dissemination of the findings of the monitoring and evaluation will be key to the strategy continuing to facilitate change. Whilst some dissemination should be periodic, providing overall longer-term findings, it is imperative that learning is also rapidly distributed around the South East, so that practitioners can be reactive to findings and ensure that there is continuous improvement. The future of freight cannot wait for an annual report, so information must be shared continuously.

4.3 CURRENT STAGE OF DELIVERY

4.3.1. The broad range of interventions identified means that each is at a different stage of delivery, both nationally and within the South East. Table 4-2 below presents a summary of the stages of delivery each of the identified new technologies has achieved at both the regional and national level.

Table 4-2 - Current stage of delivery

Intervention	Stage of delivery (SE)	Stage of delivery (national)
Alternative fuels	Plan	Plan
Real-time fleet management	Monitoring and evaluation	Monitoring and evaluation
Booking systems for port access	Monitoring and evaluation	Monitoring and evaluation
New B2B and C2C models	Deploy	Deploy
Automated / autonomous vehicles	Plan	Deploy
Delivery drones	Pilot	Pilot
Delivery droids	Pilot	Deploy
Magway	Pilot	Pilot
E-cargo bikes	Monitoring and evaluation	Monitoring and evaluation
E-walkers	Deploy	Deploy
Freight on public transport	Deploy	Deploy
Load sharing	Deploy	Deploy
Platooning	Plan	Plan
Freight consolidation	Deploy	Deploy
Dynamic kerbspace management	Deploy	Deploy

4.3.2. Naturally, some technologies are at a more advanced stage of delivery nationally than they are in the South East. Engagement with organisations who have led previous trials and evaluation will be essential in avoiding any repeated work and making sure that investment is focused on creating new insights.

4.3.3. Central to Transport for the South East's approach across the broad remit of future mobility and freight and logistics has been the development of 'bundles' of future mobility interventions for different types of place within the Transport for the South East area. As is indicated in **Table 4-2**, a number of the identified freight interventions are already beyond the piloting stage and may not need further piloting before they are deployed more widely across the Transport for the South East area. However, the strength of a bundled approach is to move beyond piloting on individual technologies and to trial potentially complementary groups/bundles of technologies together, to assess both their individual impact and their combined contribution to improving freight and logistics.

4.3.4. The selection of new technologies and their bundles should form a next step to be agreed within the Freight Forum and informed by discussions and consensus with key stakeholders. The resulting preferred technologies could go on to form the basis for a number of 'Future Freight Zones' across the South East.

4.4 APPROACH

4.4.1. Based on the framework provided by the future mobility strategy, the following provides a specification for delivering freight pilots within the South East area:

Table 4-3 - Freight pilot specification

Stage	Description
Use case and place-based bundles	▪ As part of a follow on piece of work, determine the applicability of new freight technologies to the range of uses cases and places in the South East; ▪ Assess the current level of deliverability of trials of new freight technologies for those use cases and places; ▪ Identify bundles of applicable and deliverable new freight technologies for each use case and plan; ▪ Assess bundles against potential to support the achievement of freight strategy objectives; and ▪ Review bundles to identify priorities for Future Freight Zones in the South East.
Develop vision and objectives	▪ Review context of freight and logistics for specific use case or place; ▪ Identify specific challenges the Future Freight Zone is to face; and ▪ Develop vision and objectives for a specific Future Freight Zone.
Scoping	▪ Review specific interventions within bundles to assess applicability to use case/location and challenges; ▪ Review learning from previous pilots and identify lessons learned and how learning can be applied; ▪ Undertake logic mapping to assess the expected benefits of the trial and bundle components; ▪ Identify scope and scale and location of use cases and boundaries of Future Freight Zone; and ▪ Identify initial timescales and programme for pilot.
Identify roles, responsibilities and governance	▪ Identify potential leads, partners and stakeholders in the pilot; ▪ Identify responsibilities of leads, partners and stakeholders; and ▪ Develop governance structure and procedures.
Identify resource needs for pilot	▪ Identify resources needed to deliver pilot.
Identify funding for pilot	▪ Identify funding needs and sources of funding including potential in-kind contributions.

Stage	Description
Develop business case for pilot and submit to funders	▪ Develop business case to secure funding (based on business case requirements of funding partners).
Develop monitoring and evaluation plan	▪ Develop monitoring and evaluation plan and approach to disseminating findings on an ongoing and periodic basis.
Develop pilot	▪ Develop detailed pilot specification and Project Delivery Plan.
Secure resources	▪ Secure resources for pilot through direct operation, procurement or commercial operation.
Gather pre-pilot data	▪ Gather pre-launch data to provide base upon which the success of the pilot will be assessed.
Launch and operate pilot	▪ Launch the pilot (including in phases, where appropriate) and operate on a steady-state basis to enable evaluation.
Ongoing monitoring	▪ Ongoing data and information collection to enable pilot to be evaluated.
Ongoing evaluation	▪ Through use of ongoing monitoring outputs, undertake ongoing monitoring and disseminate findings; and ▪ Where appropriate, make adjustments to the pilot to improve performance.
End of pilot monitoring	▪ Undertake monitoring at the end of the pilot period to support final evaluation.
Evaluation Report	▪ Develop and disseminate final pilot findings.
Forward Plan	▪ Where appropriate, take the findings of the pilot into forward plans.

4.5 ROLES AND RESPONSIBILITIES

4.5.1. There are many stakeholder organisations involved in, or with interests in, freight and logistics. Each has a part to play in the facilitation of trials and in embedding the lessons learnt to create a new normal in the industry.

4.5.2. Transport for the South East will have a key role to play in coordinating the inputs and involvement of many different organisations, some of which are traditionally very separate and not accustomed to working together. Transport for the South East is uniquely placed to perform this role, as it can support cross-sectoral involvement, with a maintained focus on the region's key priorities and the interests of the resident people and businesses.

4.5.3. Through the development of this strategy, a **Freight Forum** has been convened. The number of topic-focused forums should be limited to ensure that they do not become burdensome with those focusing on decarbonisation being higher priority.

4.5.4. The forums will be:

- Mechanisms for developing close and collaborative relationships across public and private sector;
- Mechanisms through which to secure funding;
- Mechanisms for Transport for the South East to embed and promote a people, place, activity outcomes focus;
- Mechanisms through which to co-ordinate monitoring and evaluation methodologies;
- Platforms for knowledge sharing;
- Platforms for encouraging Business as Usual;
- Platforms for encouraging innovation & enabling the conditions for success; and
- Actively working to remove industry blockers.

4.5.5. The roles of organisations in delivering modes, service models and infrastructure will also vary over the course of project delivery. The range of organisations in pilots may be limited, but at full scale deployment at bundle level, where multiple interventions are delivered concurrently, the involvement of multiple organisations is likely.

4.5.6. Table 4-4 (overleaf) presents for each of the organisations or types of organisations, the asks and actions the strategy has of them, and their interdependencies.

Table 4-4 - Roles in delivery

Organisation	Asks and Actions	Interdependencies
Central Government	▪ Embed freight into policies and programmes; ▪ Provide funding to support freight programmes and supporting infrastructure (including digital and electricity networks); ▪ Investigate potential for tax relief for freight delivery; ▪ Develop and update national standards to support freight delivery e.g. data sharing, highway design, TROs and EV charging/hydrogen infrastructure; ▪ Evolve monitoring, appraisal and evaluation to include freight; ▪ Standardise freight data terminology and collection methodologies; ▪ Support cross-sectoral engagement and sharing of information and best practice; and ▪ Support public sector service digitisation to make access more efficient for operators.	▪ Funding and staff resources; ▪ Freight and supporting skills and knowledge development and enhancement; ▪ Project and programme management; and ▪ Connections to freight and logistics stakeholders including mode, service and infrastructure operators.
Local authorities	▪ Identify dedicated local leads for freight within authorities; ▪ Support the development of more comprehensive freight policies and strategies; ▪ Lead the drive for local electricity grid upgrades and integrate EVs into local policies; ▪ Increase knowledge and skills in freight and logistics and supporting subjects (e.g. piloting, monitoring & evaluation) of officers and members; ▪ Play an active part in trialling, piloting and deploying freight interventions including working with Transport for the South East to develop live and sandbox piloting environments; ▪ Work with other local authorities to ensure consistency and efficiency in delivery; ▪ Embed freight into transport, economic and spatial policies and programme including electrification and digital communications; ▪ Embed freight in behavioural change programmes (e.g. consolidated deliveries); ▪ Support the deployment of freight in new developments (logistics centred developments); ▪ Share data and information with other local authorities and stakeholders; ▪ Support the identification of live and sandbox locations and local use cases piloting; ▪ Drive the further digitisation of public sector services; and ▪ Work with partners to deliver improved urban and rural digital communications supported by local policies.	▪ Funding and staff resourcing; ▪ Freight and supporting skills and knowledge; ▪ Project and programme management; and ▪ Connections to freight and logistics stakeholders including mode, service and infrastructure operators.
Local Enterprise Partnerships	▪ Embed freight into policies and programmes; ▪ Identify opportunities to integrate more sustainable freight practices; ▪ Open funding channels to freight interventions; ▪ Support cross-sectoral engagement and sharing of information and best practice; and ▪ Engage with businesses to better understand freight needs and the nature of freight movements.	▪ Funding and staff resourcing; ▪ Freight and supporting skills and knowledge; ▪ Project and programme management; and ▪ Connections to freight stakeholders including mode, service and infrastructure operators.
Major Public Sector Organisations	▪ Embed freight into policies and programmes; ▪ Embed freight into day-to-day operations including staff, user and freight transport (e.g. better consolidation of deliveries, encourage use of delivery lockers); and ▪ Embed freight into new developments.	▪ Funding and staff resourcing; ▪ Freight and supporting skills and knowledge; ▪ Project and programme management; and ▪ Connections to freight stakeholders including mode, service and infrastructure operators.
Major transport infrastructure providers	▪ Embed freight into policies and programmes; ▪ Deliver freight interventions within their networks and support trials where necessary; and ▪ Work with stakeholders to fund freight interventions.	▪ Funding and staff resourcing; ▪ Freight and supporting skills and knowledge; ▪ Project and programme management; and ▪ Connections to freight and logistics stakeholders including mode, service and infrastructure operators.

Organisation	Asks and Actions	Interdependencies
Major logistics operators	▪ Work closely with stakeholders to test, deploy, monitor and evaluate freight interventions; ▪ Embed more sustainable logistics interventions into existing operations to support real-world trials; ▪ Embrace an open and shared approach to data to produce better insights; and ▪ Contribute knowledge of operational best practice.	▪ Funding and staff resourcing; ▪ Freight and supporting skills and knowledge; ▪ Project and programme management; and ▪ Connections to freight and logistics stakeholders including mode, service and infrastructure operators.
Major online retailers	▪ Work closely with stakeholders to test, deploy, monitor and evaluate freight interventions (e.g. incentives for greener delivery option); ▪ Embed more sustainable logistics interventions into existing operations to support real-world trials; ▪ Embrace an open and shared approach to data to produce better insights; and ▪ Contribute knowledge of operational best practice.	▪ Funding and staff resourcing; ▪ Freight and supporting skills and knowledge; ▪ Project and programme management; and ▪ Connections to freight and logistics stakeholders including mode, service and infrastructure operators.
Research organisations, academia, universities and colleges	▪ Work with other stakeholders to develop, test, deploy, monitor and evaluate freight interventions; and ▪ Embed aspects of freight into teaching to increase skills of workforce entering related industries.	▪ Funding and staff resourcing; ▪ Freight and supporting skills and knowledge; ▪ Project and programme management; and ▪ Connections to freight and logistics stakeholders including mode, service and infrastructure operators.
Industry and trade organisations	▪ Embed freight and logistics into policies and programmes; ▪ Lead the further embedment of freight into industries and trades; and ▪ Lead the development of knowledge and skills in freight within industries and trades.	▪ Funding and staff resourcing; ▪ Freight and supporting skills and knowledge; and ▪ Project and programme management.
Utility companies	▪ Continue to lead the deployment of utilities to support the development of freight interventions across all areas of the South East; ▪ Work with local authorities to develop policies and programmes for the development of supporting utility networks.	▪ Funding and staff resourcing; ▪ Freight and supporting skills and knowledge; ▪ Project and programme management; and ▪ Connections to freight and logistics stakeholders including mode, service and infrastructure operators.
Major landowners, developers and holders of portfolios of economic sites	▪ Embed freight into policies and programmes; and ▪ Embed freight into new developments.	▪ Funding and staff resourcing; ▪ Freight and supporting skills and knowledge; ▪ Project and programme management; and ▪ Connections to freight and logistics stakeholders including mode, service and infrastructure operators.
Vehicle and technology manufacturers	▪ Work with other stakeholders to develop, test, deploy, monitor and evaluate freight interventions; ▪ Provide funding for the development of technical trials.	▪ Funding and business models; and ▪ Development of freight interventions appropriate to specific Transport for the South East locations and conditions.
Specialist interest groups	▪ Embed freight into policies and programmes; ▪ Lead the embedding of freight into specialist interests; and ▪ Lead the development of knowledge and skills in freight within specialist interests.	▪ Funding and staff resourcing; and ▪ freight and supporting skills and knowledge.
Other adjacent sectors	▪ Embed freight into policies and programmes; and ▪ Work with other stakeholders to develop, test, deploy, monitor and evaluate freight interventions.	▪ Funding and staff resourcing; and ▪ freight and supporting skills and knowledge.

4.6 ENGAGEMENT

4.6.1. Ongoing engagement is key to the successful delivery of this work and the best results will be delivered through collaborative working with stakeholders, across multiple sectors and industries. Engagement will be predominantly led through the Freight Forum described in the previous section, and they will be a conduit for making freight a natural part of all transport conversations. This will ensure that it becomes an integral part of the decarbonisation agenda, rather than something considered separately and at a later stage, if at all.

4.6.2. The supporting measures included as part of the future mobility strategy will also be key to the delivery of future freight interventions. These include:

- Shared learning hub;
- Ties with national research bodies;
- Future Transport Zone engagement;
- Piloting co-ordination group;
- Piloting best practice guidance;
- Live piloting environments and sandbox locations;
- Piloting monitoring and evaluation framework; and
- Identification of piloting use cases.

4.7 POTENTIAL SOURCES OF FUNDING

4.7.1. There is a wide range of funding sources available to develop the interventions set out in this work. However, many of the interventions are not traditional schemes, in that the outcomes are not yet known, and the business case will therefore be inherently different. Furthermore, some of the less commercially and technically mature interventions may not provide direct economic benefits, but they will still be very valuable in what they can teach us and in shaping the future of freight.

4.7.2. Government strategy is a key driver of funding and as national priorities increasingly shift towards decarbonisation, it is likely that more and more funding opportunities will become available. These funding streams are likely to be tailored or channelled around individual modes, such as the Waterborne Freight Grant Scheme or the Plug In Grant for a proportion of the total cost of specific road freight vehicles.

4.7.3. Funding is also becoming more diversified and devolution is enabling sub-national transport bodies to target funding where it can be most beneficial. This presents an opportunity for Transport for the South East to take a leading role in pushing innovation in the region and make real changes to the freight and logistics ecosystem to make it greener. For example, this could require working with partners on the Solent FTZ on shaping funding bids and seeking match funding where possible with the rail industry through its Customers & Communities Investment Fund (CCIF) for exploring the role of freight on public transport across parts of the region.

4.7.4. Indeed, alongside public sector funding, there are significant opportunities to partner with the private sector and benefit from their operational expertise. Market-driven investment is essential in mainstreaming interventions to become part of a ‘new normal’ and it is ultimately the force which will spread the benefits of an intervention across the region. As freight and logistics is mostly led by the private sector, close collaboration between stakeholders is needed to ensure that the industry is moving in a collective and desirable direction.

4.7.5. Most importantly, funding opportunities need to be coordinated to ensure that the maximum benefit is derived from the trials. An integrated approach, ideally in the form of 'Future Freight Zones', will enable greater collaboration and a more structured approach to monitoring and evaluating the impacts across multiple domains. Doing so will support the development of a much more robust business case with the beneficiaries, roles and responsibilities more clearly identified.

4.8 INTERDEPENDENCIES, RISKS AND OPPORTUNITIES

4.8.1. In addition to the intra-trial interdependencies, the interventions will be subject to external pressures and trends of change. The future mobility strategy describes these in more detail and has strong links with the Transport for the South East transport strategy, which views these issues more broadly through the entire spectrum of the present mobility ecosystem,

4.8.2. The freight strategy closely aligns to these documents and shares many of the interdependencies.

4.8.3. **Table 4-5** overleaf provides a more detailed commentary of their relevance to freight.

Table 4-5 - Freight strategy interdependencies

Interdependency	Detail
Climate change / crisis and our environment	This work has the priority of decarbonisation at its core and includes a wide range of measures supporting the transition to zero emission delivery vehicles and increasing efficiency in logistics networks. It is complemented by Transport for the South East's Future Mobility Strategy and transport strategy to deliver interventions that directly respond to the climate change crisis.
Energy and decarbonisation	Electrification of both established and new modes (battery electric and hydrogen fuel cell), across modes, will create significant demand for energy generation and for this to be zero carbon. New infrastructure is required to support the supply of both electricity and hydrogen, particularly at depots and major international gateways. Within local areas, grid capacity may limit the ability of developers, organisations, fleet operators and consumers to transition to zero carbon propulsion. Networks also require adaption to enable smart generation, supply and storage to optimise and make efficient use of energy and related networks.
Space/Land use	With total e-commerce sales having increased dramatically in the last 5 years, the demand for warehousing space is also expected to continue increasing and putting pressure on land use policy. New logistics services require space, and in the South East this is becoming an increasingly scarce and therefore costly resource. This strategy will need to consider of how freight will change demand for and use of space and this will be key to merging new and established modes and services alongside the infrastructure that supports them.
Long-term impacts COVID-19	The impact of the lockdown and a move to a 'new normal' presents short, medium and potentially long-term challenges to the economy. New behaviours that emerged during the pandemic may become more commonplace, such as the trend for living, working and shopping more locally, resulting in a shift in focus away from urban centres and towards more disparate logistics requirements. Furthermore, the rapid growth in online retail may continue, as businesses have adapted to grow their delivery networks and as some people remain cautious over returning to enclosed spaces.
Brexit implications	Additional regulatory requirements and documentation place new demands on logistics, such as the need for additional lorry parking near ports. Uncertainty over trading internationally may constrain and reduce investment and the long-term economic impact of the final trade agreements is unknown. Also needing consideration is the emerging impact of Brexit on the availability of employees for freight and logistics industry including drivers and warehouse operatives. This work has been developed through this period of uncertainty and needs to be flexible in approaches to any challenges that appear.

Interdependency	Detail
Shifting Mobility / Transport Modes	The future of freight will blend new with established modes, but this could cause significant disruption and uncertainty in those existing markets. The Transport for the South East transport strategy is mostly concerned with existing modes and could be influenced by the emergence of new modes, placing new demands on the existing mobility ecosystem. However, this work outlines an approach to monitoring and responding to these changes proactively to identify and plan for them as early as possible.
Digital Communications	Strong digital networks will be necessary to support freight interventions, and, increasingly, the evolving established modes, logistics networks and services. The development of digital connectivity through superfast broadband and 5G promises to help transform mobility and offer new capabilities in the freight and logistics sector. However, spatial variability of communications means that, at present, some rural areas lag behind core urban areas, limiting the reach of some interventions.
Changing behaviours	Changing attitudes such as a greater environmental awareness are impacting on consumer behaviour. Many companies are capitalising on this trend and are visibly demonstrating their commitments to sustainability in their branding and operations. However, this change is not yet complete as many operators still have a long way to go until they are operating with net zero emissions, so it will continue to be an important interdependency to watch.
Integrating Spatial Planning:	As with many changes in transport in the past, such as the rise of the private car and containerisation of freight, new modes can present significant challenges to established land use patterns. However, our freight interventions also present opportunities to redress previous negative impacts of transport by considering logistics in new developments to enable it to become an integrated part of the design, alongside the movement of people. In doing so, previous car-centric design can be adapted to serve user needs for deliveries through more sustainable means.
Driving Economic development and employment	A key driver for Transport for the South East's transport strategies is to support planned economic growth within the South East. This focuses on delivering sustainable development and limiting the negative impacts of resulting demand whilst also facilitating the necessary movement of goods and people. An efficient logistics sector is a major catalyst for economic growth and enables businesses to thrive, unconstrained by delays in importing and exporting goods.
Human capital education and skills resilience	Although automation may have a significant impact on how humans operate vehicles in the medium and longer terms, they will still play a key role in the planning, management, operation, maintenance and improvement of logistics networks. Increasingly, more aspects of port and warehouse operations are becoming automated and the shape and size of employment in freight and logistics is likely to evolve and the workforce will need to adapt to the news skills needed.

Interdependency	Detail
Health and wellbeing agenda	The freight industry needs to work towards reducing its impacts on the health of communities through improving air quality, enabling more active lifestyles, reducing noise and limiting the impacts of infrastructure on communities. The unforeseen and unintended consequences brought about by changes to the mobility, freight and logistics ecosystem also need to be considered in delivering the strategies, such as the potential for new modes such as drones to create new safety, privacy and noise pollution concerns.
Changing nature of retail and services	Changes to the retail and services markets are continuing, both contributed to by some aspects of mobility (e.g. accessibility of town centres) and impacting on mobility (e.g. the rise of online retail related deliveries). Strategies need to reflect changes in these markets, harnessing positive changes (such as increased access to services remotely without the need to receive physical products) and helping to mitigate negative impacts (such as the decline of retail in the 'High Street'). Furthermore, the retail sector is moving to become more experiential, with customers opting to have their purchases delivered to their homes having viewed the product, rather than transporting it home using their own means.
Importance of international gateways	As new UK markets emerge and decline, the geography of trade will change and place new requirements on our international gateways. The South East both generates and attracts international movements but is also a gateway to the UK, Europe and the global economy, through which people and goods pass. The Transport for the South East transport strategy faces the challenges in international transport and the Transport for the South East future mobility strategy has a role in supporting the meeting of those challenges. However, the freight strategy needs to be cognisant of the long-term impacts of COVID-19 and Brexit on international travel, which are unclear, but they could substantially change the demand and how people and goods travel.
Devolution of decision-making	Both established and future freight interventions could be delivered under devolved decision-making and funding arrangements, following any further development of the Sub-national Transport Bodies and City Regions. However, a significant proportion of delivery will be undertaken by other tiers of government, in particular local authorities., in close partnership with the private sector in many cases.
Securing funding and investment	There is a wide range of funding sources available to deliver the strategies, especially with a renewed focus on starting a 'green industrial revolution'. However, building the case for funding will be vital, given that the evidence to support such cases is limited for future freight interventions. Consequently, this strategy aims to support the trialling, testing, monitoring and evaluation of new modes, service models and infrastructure to support the development of business cases for investment. Government policy is a key driver of funding and national priorities may change over time affecting where strategies need to focus to secure funding.

Interdependency	Detail
Influencing regulation and legislation	Changes have already been made to the regulatory and legal framework to support the development of emergent technologies, including those related to automated vehicles operating at speeds of up to 37mph, for example. In addition, rapid changes have been made to legislation in response to issues related to the COVID-19 pandemic, such as relaxing rules around driver hours to tackle the shortage of HGV drivers.
Capitalising upon partners and stakeholders' skills and enthusiasm	Transport for the South East will need to work with partners to deliver both the future mobility and freight strategies. These partners range across the public sector, private sector, academia and the arts, focusing on freight and a wider range of dependent and supporting sectors. Transport in the UK relies in many instances on an open marketplace, especially in freight, and will continue to require market-driven investment alongside public sector funding to deliver interventions and to make the mainstream over time.
Data	The collection, analysis and sharing of data is key to realising the future of freight and this strategy aims to support partners in setting up appropriate structures to facilitate the open distribution of the data needed to deliver new solutions and enhance those already in operation. DfT undoubtedly have a key role to play in standardising terminology and data collection methodologies. By standardising the approach to trialling, data will be gathered with more consistency and therefore comparability, enabling insights to be gathered and disseminated much more easily.

5 CONCLUSIONS

5.1 OVERVIEW

5.1.1. This report has identified key technological developments within the freight sector and their potential for implementation across the Transport for the South East area. Throughout, there has been a focus on the potential of these interventions to contribute the operational efficiency of the freight networks across the region. Crucially, however, the contributions the interventions can make to decarbonising the industry have also been assessed, with each taking on different aspects of freight and logistics across a broad range of place types and applications.

5.1.2. Some interventions relate to new modes which are promising to move freight more efficiently by providing zero-emission alternatives to traditional van and HGV movements. This is especially true for last-mile modes such as drones, droids and e-cargo bikes which can penetrate the densest parts of urban areas where the negative impacts of logistics are often felt most acutely. Other innovations include new business and service models which change the way that freight networks are managed, optimised and accessed. Increasingly, customers are playing a greater role in the movement of freight too, with peer-to-peer platforms emerging that exclude traditional logistics operators and capitalise on spare capacity on passenger journeys.

5.1.3. In the accompanying dashboards included in Appendix A, there are examples of best practice in the industry, as well as some of the notable setbacks the industry has faced in the development of the technology. Finally, each of the interventions are linked back to the freight strategy's objectives by highlighting the contributions they can make to the objectives across the three key themes of Economy, Environment and Society, with a specific focus on decarbonisation.

5.2 A STRUCTURED APPROACH TO PILOTING

5.2.1. This report has been designed to align with the recently published Transport for the South East future mobility strategy and it sets out an integrated approach to trialling new modes and services. Due to the nature of emergent technologies, the interventions listed in this report are at varying stages of technological and commercial maturity. Furthermore, whilst some may have been piloted elsewhere, their applicability to the South East and its unique mobility ecosystem may not yet have been tested.

5.2.2. Given the points above and the broad range of technologies, services and business models that constitute freight networks, it is not enough to trial new interventions in isolation. This strategy draws upon the specification developed in the Transport for the South East future mobility strategy which details how several interventions should be piloted in parallel in similar place-based typologies to produce aggregate insights and a more holistic view of how each piece of the freight network fits together.

5.3 THE FUTURE OF FREIGHT

5.3.1. The field of freight and logistics is constantly evolving, and the rate of technological change is faster than ever before. Whilst it is normal to refer to optimisation for operational efficiencies, increasingly there are pressures on the industry to decarbonise and energy efficiency is becoming a top priority. Consequently, it is necessary for the strategy to be responsive to new Signals, Trends and Trajectories in freight, and for it to be continually reviewed.

5.3.2. This will ensure that the strategy is addressing the most up-to-date developments across the sector to be reactive to new forces that shape the mobility, freight and logistics ecosystem in ways not seen previously. Indeed, the COVID-19 pandemic has demonstrated that even seemingly fixed trajectories can take a rapid change of direction in response to shock events.

5.3.3. Similarly, it is becoming more important than ever to act more decisively to decarbonise the industry, which is creating new challenges, but also opportunities to simultaneously reduce the impact that freight and logistics has on the region's communities and ecology.

5.3.4. The approach set out in this working paper helps to define the role of new technologies, services and business models in creating a net zero carbon future for the freight sector. However, implementing these solutions alone will not achieve the desired outcomes. In addition to the listed interventions and continuous monitoring of trends, the 'Vision and Validate' approach will need to be adhered to, in which policy is centred around desired outcomes for people and places, rather than the most probable outcomes based on current trajectories. This means designing solutions around real issues, rather than just trialling technologies because they appear new or exciting.

5.4 UPDATING THE STRATEGY

5.4.1. The rate of change in the industry, as well as the uncertainty created by the COVID-19 pandemic, mean that it is perhaps not appropriate to provide a fixed timescale for the strategy and this document should be considered as an approach, rather than a pre-defined vision of the future. A key task of the monitoring and evaluation framework will therefore be to assess when is the right time to undertake a partial or full review of this work.

5.4.2. Transport for the South East cannot deliver the future of freight alone. Change requires the buy-in and support of all organisations with a stake in freight; those who plan it, deliver it and receive it. If the South East is to achieve its aim of having a globally leading sustainable mobility, freight and logistics ecosystem, actions need to be accelerated with interventions adopted and delivered through partnership, across the whole mobility, freight and logistics ecosystem.

5.5 TECHNOLOGY AND DECARBONISATION

5.5.1. This report has presented the role that technology can play in decarbonising the freight and logistics sector. However, it should be acknowledged that no single measure will offer a complete solution and that many of the measures share a number of interdependencies ensuring their success. For example, for many of the last mile modes to be practicable, an extra stage of consolidation is required to facilitate the trans-shipment of freight from a van or lorry to a zero emission mode for the last stage of delivery, across an urban area.

5.5.2. As such, it will be necessary to trial multiple interventions in parallel, to enable us to understand not just how they perform individually but how they perform as part of the wider mobility ecosystem, including how they interface with passenger transport. This report has also suggested the implementation of Future Freight Zones, where an integrated programme of interventions can be trialled in a structured way, building on the high level piloting specification outlined in **Section 4.**

Appendix A

DASHBOARDS

APPENDIX A - DASHBOARDS

I. ALTERNATIVE FUELS

Alternative fuels	**Modes Impacted In UK:**		**Freight Sector**	**All sectors**	**Journey Range**	**All ranges**	**Technical Maturity**	**Initial real-world operation**	**UK Commercial Maturity:**	**Operating commercially**
Definition: **[Trajectory]**	The use of alternative fuels and drivetrains to traditional diesel and petrol internal combustion engines is helping to reduce vehicle emissions. A range of alternatives are in development including battery electric vehicles (BEVs) and Hydrogen vehicles, as well as biofuels. Alternative fuels are essential in the decarbonisation of freight transport and in reducing the public health impact of harmful exhaust emissions. However, for alternative fuels to become mainstream, there is a significant infrastructure needed to enable seamless commercial operation.						**Regulatory maturity**		**Permitted within certain constraints**	
Sub-models	*Battery electric vehicles, Hydrogen fuel cell technology, biofuels*						**Geographical Applicability:**			
Best Practice	**Analysis of existing models and use cases**									
TESLA	Tesla **Tesla Semi** [Battery electric truck]	The Tesla Semi is an all-electric battery-powered Class 8 semi-truck in development by Tesla, Inc. Two concept vehicles were unveiled in November 2017, and production in 2021 is planned. ... Tesla CEO Elon Musk said that the Semi would come standard with Tesla Autopilot that allows semi-autonomous driving on highways. Electric energy costs are half those of diesel. With fewer systems to maintain, the Tesla Semi provides $200,000+ in fuel savings and a two-year payback period. The long-range version can cover 500 miles on a single charge when fully laden,									
NIKOLA MOTOR COMPANY	Nikola **Nikola Two** [Fuel cell electric vehicle]	Hydrogen-powered vehicles use fuel cells to convert Hydrogen and Oxygen into electricity and water. The electricity drives electric motors to propel the vehicle. The major benefit of Hydrogen over electrification is its flexibility. A Hydrogen truck can be refuelled in approximately the same time as a diesel truck and the operating range and operating patterns are similar meaning that Hydrogen-powered trucks could fit into the existing logistics system without too much change. However, Hydrogen is much more energy intensive than electricity and consequently is inherently more expensive for the economy, the environment and probably for the vehicle operator.									
Project Cavendish	**Project Cavendish** [Hydrogen Hub, South East]	Project Cavendish is a plan to construct a hydrogen hub in the South East which by 2026 will produce 700MW of blue hydrogen and capture 1.2 million tonnes of CO2 per year. There are further plans to increase production capacity to 1.75GW by 2030. The site will be located on Kent's Isle of Grain, an established industrial hub with existing energy infrastructure that can be exploited to aid in producing blue hydrogen from reformed natural gas. CO2 emissions will be sequestered in an offshore facility. Its location will allow it to supply future demand in London and the South East and to stimulate the growth of a hydrogen economy in the region in support of the government's decarbonisation targets.									
SCANIA	Scania **Bioethanol trucks** [Biofuel vehicle]	Biogas is the most commercially viable way to reduce CO2 emissions for transport. It provides cleaner, greener and quieter operation with significantly lower costs than those associated with hybrid, electric or hydrogen options. It's a completely natural, sustainable and renewable fuel source, and it's available now. Biogas is produced by the natural breakdown of food and sewage waste. It uses a process called anaerobic digestion to split waste material into gas (biofuel) and solids (bio fertilizer).									
Qualcomm halo	Qualcomm **Halo** [Inductive roads]	Qualcomm has designed, built, and tested a dynamic electric vehicle charging system capable of charging two EVs dynamically at in excess of, 100 km/h with 20 kW of energy. The system allows an electric vehicle to wirelessly charge whilst travelling down an adapted road. The system has also been trialled in a Formula E racing environment to enable safety cars to charge wirelessly an remain fully charged at all times in case they need to be deployed in an emergency.									
Notable setbacks	General **Investment in infrastructure**	Often economies of scale are accompanied by a "chicken-and-egg" problem, wherein multiple actors must simultaneously invest and ramp up production in order to commercialise a new technology. This may be most relevant in technologies that require a new infrastructure, such as hydrogen-fuelled vehicles, which may or may not use renewable energy depending on the hydrogen generation source. Such possibilities require interindustry cooperation and thus may greatly delay investments.									

Contribution to decarbonisation	Alternative fuels and drivetrains will be essential in decarbonising freight. The volume of goods being moved in the UK is growing and demand is set to continue increasing. If left unaddressed, this growth in demand will continue to be satisfied by diesel fuelled vehicles, locking in years of continued carbon emission. However, use of hydrogen and battery electric vehicles will only decarbonise freight if the means of energy production are also low in carbon. Consequently, the success of alternative fuels and drivetrains is predicated on the energy sector being able to decarbonise in parallel through continued investment in renewables, for example.
Opportunities	Pairing with renewable energy generation to create net zero carbon logistics, creating refuelling/recharging hubs around sites such as ports and warehousing sites which generate a lot of HGV trips
Barriers	Conversion of fleets currently limited by production capacity for BEVs and H2, Infrastructure not yet there for heavy duty use cases, BEVs may not fit into existing service patterns
Wider links	Booking destination chargers/refuelling hubs using dynamic kerbspace management or VBS at ports

Applicability to Policy Objectives

Economy		Environment		Society	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Min	**Air quality** Reduce the impact of the sector through air quality improvements	Max	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Min
Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Max	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Max	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Med
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Min		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Min

Key resources:	DHL Sustainable Fuels for Logistics: https://www.dhl.com/content/dam/dhl/global/dhl-global-forwarding/documents/pdf/glo-dgf-sustainable-fuels-for-logistics.pdf

II. REAL-TIME FLEET MANAGEMENT

Real-time fleet management	Modes Impacted In UK:	All freight modes	Freight Sector	All sectors	Journey Range	All ranges	Technical Maturity	Mature technical operation	UK Commercial Maturity:	Mature commercial operation
Definition: [Trajectory]	Fleet management tools can provide real-time visibility into fleet operations while increasing driver satisfaction and decreasing fuel usage through predictive analytics and accurate reporting. It also helps fleet managers ensure that their operations are adhering to the complex regulations governing the industry. Fleet management can also improve operational efficiency by assigning and dispatching routes to drivers in real-time to ensure accurate pickups, deliveries, and returns. Solutions include hazard alert services, delivery tracking, and dynamic routing tools						**Regulatory Maturity**		**Permitted within certain constraints**	
Sub-models	*Route planning and optimisation, Vehicle assignment algorithms*						**Geographical Applicability:**			

Best Practice	Analysis of existing models and use cases	
gnewt cargo OptimoRoute ZEDIFY ZERO EMISSION DELIVERIES	GeoTab **Gnewt** [London, UK]	has the UK's largest fully electric commercial vehicle fleet. Delivering zero-emission final mile logistics for retailers and third-party logistics companies, Gnewt's fleet of double payload modified vans has transformed green deliveries in London – growing from just a handful of vans into the UK's largest all-electric fleet. Gnewt needed to optimise its operations in order to compete with ICE delivery companies which were often cheaper. To add to this, there are charging limitations with only a finite amount of power coming into its charging depot. Only 35 vehicles a day could be fully charged at first. To combat these constraints, drive greater scalability, and provide a platform for future innovation, Gnewt needed a telematics solution that could transform how it views and models its fleet's charging operations – one that could directly feed in vital intelligence on vehicle state of charge, as well as which vehicle is being charged, and when.
	OptimoRoute [Software]	OptimoRoute enables users to optimise for the best routes & schedules while respecting all order and task criteria: priority, time windows, day of week, date range, reverse logistics orders, variable job durations vehicle matching (e.g. loading ramp/refrigeration). List minute orders can be integrated into route plans and automatically recalculated to reflect manual changes. It also integrates with delivery systems to provide proof of delivery, capturing digital signatures and sending messages to customers informing them when the driver is scheduled to arrive.
	E-cargo bikes **Zedify** [UK, Nationwide]	Zedify built their own robust, efficient technology platform that addresses the specific demands of providing predominantly cargo bike-based city logistics. Routes are optimised daily meaning deliveries are made as quickly and efficiently as possible. Barcode scanning enables consistency with other systems in the supply chain. Digital proof of delivery capture provides end-to-end tracking and client login means deliveries can be booked and tracked and reports accessed directly.
Notable Setbacks	**General**	Route planning and optimisation is currently executed in isolation by individual fleet operators. There is a risk that if multiple fleet operators optimise their routing strategies in response to the same stimuli (e.g. diverting freight traffic onto a lower capacity road to avoid congestion), this could create new problems elsewhere. To counter this, more data sharing between major hauliers should be encouraged. Simulations have shown that if we were all willing to take a wider variety of coordinated routes that may not be optimised on an individual level, it would yield an overall reduction in congestion.
Contribution to decarbonisation	Fleet optimisation helps to ensure that vehicles are utilised to the greatest extent possible, in theory reducing the number of vehicles needed on the road, and the total vehicle kilometres travelled. Route optimisation reduces the stem mileage travelled by fleet vehicles and it can also inform where best to strategically place consolidation and distribution centres. Together, these measures reduce the amount of fuel consumed by an operator's fleet and therefore the amount of harmful emissions.	
Opportunities	Vehicle emissions savings due to route optimisation, reducing the amount of stem mileage and empty running. Better co-ordination of assets resulting in reduced waiting times and more certainty in delivery windows	
Barriers	No co-ordination between operators, only done in isolation	
Wider links	Dynamic kerbspace management – booking a virtual loading bay or destination charger to coincide with delivery patterns and vehicle state	

Applicability to Policy Objectives					
Economy		**Environment**		**Society**	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Max	**Air quality** Reduce the impact of the sector through air quality improvements	Min	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Min
Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Min	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Med	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Min
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Min		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Min
Key resources:					

III. BOOKING SYSTEMS FOR PORT/SITE ACCESS

Booking systems for port/site access		**Modes Impacted In UK:**		**Freight Sector**	**Container Haulage**	**Journey Range**	**All ranges**	**Technical Maturity**	**Mature technical operation**	**UK Commercial Maturity:**	**Mature commercial operation**
Definition: [Trajectory]	The main cause of truck congestion around ports and key sites is the fluctuating arrival pattern of trucks. This results in a situation where demand significantly exceeds supply or vice versa. Truck appointment systems (TAS) allow ports to reduce peaks in truck arrivals. Thereby, the operation costs for terminals and construction sites and the waiting times for trucking companies are reduced							**Regulatory Maturity**		**Permitted within certain constraints**	
Sub-models	*VBS at ports, construction sites, other major trip attractors*							**Geographical Applicability:**			
Best Practice	**Analysis of existing models and use cases**										
1-Stop **Vehicle Booking System (VBS)** [Australasia / SE Asia]	VBS was developed to drive efficiencies by addressing the common issues shared by port communities around the world – the lack of transparent information flow, under-utilisation of equipment and inefficient practices. VBS allows terminal operators to match terminal resources with landside demand. Terminals can configure timeslots, work-day calendars and business rules, and create and maintain customer details. For example, when the quayside is busy, landside resources can be adjusted to support best use of equipment. Equally, when quayside activity is lower, landside operations can be ramped up to support clearing for the next vessel arrival.										
Terminal Appointment Booking System (TABS) [Manila, Philippines]	Manila's two main terminals have launched a vehicle booking system that is expected to improve container flows into and out of the port as the Philippines' peak shipping season approaches. The Terminal Appointment Booking System, or TABS, was a response to the truck ban and road policies that were introduced by the local government in 2014 to combat the traffic congestion in Manila but only served to bring the port to a complete standstill with vessel delays often measured in weeks. TABS will also allow the terminals to better manage their port capacity and ensure the resources are in place to handle more predictable volumes and scheduling.										
DP World **Southampton** [United Kingdom]	VBS Premium, implemented in 2013 has been a tremendous success for managing terminal capacity. Firstly, all truck lines have been eliminated with hauliers saving time with turnarounds now at 30mins, one of the best in the UK . As a result, exchange areas are always now reachable because there are not hundreds of trucks blocking common areas. Additionally, traffic jams leading in and out of the port have been reduced. The process of logging into the VBS also requires drivers to undertake a Driver Awareness Assessment; thereby lifting standards of use and mitigating risk associated with egressing and accessing the terminal.										
Notable Setbacks	Hutchison **Port of Felixstowe** [UK]	The UK's largest container port, Port of Felixstowe, is making some significant changes to its troubled vehicle booking system (VBS) following criticism from the British International Freight Association to try to prevent container collection slots for box hauliers and freight forwarders being wasted. The failure of the system has come about as a result of a poorly migration to the new systems and a spike in demand for the movement of containers. A statement from BIFA read "BIFA members have suffered from two years of poor service from the port, and we feel that there is a need for independent intervention by government to address the many issues faced by the port's users."									
Contribution to decarbonisation	Bottlenecks, producing truck congestion inside and outside port terminals and construction sites, can lead to serious local environmental problems such as noise and harmful emissions, but also to major inefficiencies in various operations. By managing and mandating the arrival times of vehicles accessing these sites, congestion can be alleviated, and vehicles will spend less time on the road and less time idling, reducing overall emissions.										
Opportunities	Integration with real-time fleet management systems to enable flexible scheduling dependent on slot availability to reduce waiting time. Active routing of drayage trucks through the port based on internal traffic.										
Barriers	Most actors of the port community are small-sized, and struggle to fund the investment for developing or modifying their systems for connecting to the booking system and, thus, for sharing and receiving information										
Wider links	Real-time fleet management systems										
Applicability to Policy Objectives											

Economy		Environment		Society	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Max	**Air quality** Reduce the impact of the sector through air quality improvements	Med	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Min
Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Min	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Med	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Max
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Max		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Med
Key resources:	Port of the future challenges, enablers and barriers: https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5bf625369&appId=PPGMS				

IV. NEW BUSINESS MODELS

New business models	Modes Impacted In UK:	All Modes	Freight Sector	Services	Journey Range	All Ranges	Technical Maturity	Initial real-world operation	UK Commercial Maturity:	Commercial Launch
Definition: [Trend]	New and innovative ways of accessing logistics services are changing the mobility landscape. In recent years, there has been a notable shift away from high street shopping and towards online retail. This is a trend that has been accelerated by the Covid-19 pandemic, but online services are also opening the door to new business models, brokerage models and peer-to-peer services.						**Regulatory Maturity**		**Permitted within certain constraints**	
Sub-models	*See below*						**Geographical Applicability:**			

Best Practice	**Analysis of existing models and use cases**	
Dropit Uber Grabr	**Dropit** [US, UK, Belgium]	Dropit enables customers to have a more enjoyable retail experience by allowing customers to drop off their shopping at designated locations to be delivered to their door. By purchasing a Dropit pass, users can drop off unlimited bags at a number of locations as they shop, which are then collected and made available for collection. Alternatively, they can be forwarded to your home, hotel or workplace. Partner stores expect you to have made a purchase in order to be able to drop off items, but they will accept items from other stores alongside. Kerbside drop-off is another delivery option made available, enabling users to load their car with a day's shopping before driving back home, without having needed to carry it around all day.
	Uber **Uber Freight** [North America and Europe]	Uber freight is a freight brokerage service which works through a smartphone application and allows independent hauliers and van drivers to connect with shippers and freight forwarders. It is particularly useful to SMEs with no visibility of the supply base. The shippers will advertise loads for sale, and the hauliers will accept the loads depending on stand and end location, size/weight and price. The service is highly flexible and allows shippers and truck drivers to match needs and services, to ultimately deliver the freight where it needs to go on a one-time basis. Once the freight is picked up, shippers can monitor their shipments online in real time. And on delivery, Uber Freight provides a proof of delivery photo along with a photo of the signed bill of lading.
	Grabr [Worldwide]	Grabr enables customers to purchase any item from around the world by utilising a network of travellers and buyers. Buyers create an order on the online platform which is then advertised with details of cost and where it can be bought. Once published, the order is shared with a group of willing travellers, one of whom will make an offer to deliver the requested item for an agreed fee, including pre-calculated taxes and fees. Finally, a time and a place for delivery/pick-up is agreed and the order is completed. All payments are protected and secured by Grabr to provide peace-of-mind to users
Notable Setbacks	**Doddle** [UK}	Doddle operated a click and collect service with physical stores, as opposed to similar services offered by parcel lockers. Doddle has failed to pull customers through its doors; and because of its high-rent prime locations, it's closing all but six standalone stores in favour of third-party tie-ups, such as those it already has with Morrisons and Cancer Research UK. Furthermore, delivery providers have broadened their delivery options, offering to 'leave in a safe place' or 'leave with a neighbour', giving consumers more confidence to receive deliveries when they're not home, and the rise in flexible working means consumers are actually at home to receive deliveries an lot more than they used to be, negating the need for a click and collect service.
Contribution to decarbonisation	New business models are transforming the way freight is being used by making better use of spare capacity in the network. This includes both passenger and freight trips and by providing better visibility of consignments on the network, resources can be more efficiently allocated. Similarly, by aligning freight and passenger movements unnecessary car trips to and from the shops can be replaced by aggregated deliveries using a single van to serve multiple customers, thereby reduce vehicle kilometres travelled and subsequently carbon dioxide emissions.	
Opportunities	Hyper-local supply chains and customer-to-customer delivery facilitated by online platforms, maximising local resource whilst minimising total distance travelled	
Barriers	Assurances for shippers not the same as with a trusted operator, reliant on community buy-in	
Wider links	Fleet-management systems	

Applicability to Policy Objectives					
Economy		**Environment**		**Society**	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Med	**Air quality** Reduce the impact of the sector through air quality improvements	Med	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Low
Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Low	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Med	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Med
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Low		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Max
Key resources:	Future of Freight Management: https://nic.org.uk/app/uploads/Future-of-Freight_Managing-Congestion-Intervention-Dashboards-Appendix_WSP.pdf				

V. AUTONOMOUS VEHICLES

Autonomous Vehicles	Modes Impacted In UK:		Freight Sector	All sectors	Journey Range	All ranges	Technical Maturity	Piloting	UK Commercial Maturity:	Commercial testing / piloting
Definition: [Trend]	Much of the cost of delivery is the costs of drivers' salaries, and often deliveries are slowed due to mandatory rest periods whilst driving. Furthermore, 95% of accidents are attributed to human error, so with increasing automation it is hoped that road safety will improve for all users. CAVs are considered by many to be key to the future of parcel delivery, due in part to the cost savings that can be achieved by removing the need to pay a driver's salary. There are many pilots underway to test different sizes and types of CAVs which vary from small units that travel to residential areas for last mile delivery, to long distance applications using platoons of HGVs on trunk roads.						**Regulatory Maturity**		**Not currently legislated for**	
Sub-models	*Automation of long-distance trunking, residential deliveries using small AV with lockable compartments, operational*						**Geographical Applicability:**			
Best Practice	**Analysis of existing models and use cases**									
ARRIVAL	ARRIVAL **ROBOPILOT** [Bristol, UK]	In the ROBOPILOT project, a small all-electric van will be fully automated for local deliveries and tested safely in the north Bristol Innovation Corridor. Also involving work on safety and security (including cyber security), the objective is to deliver parcels on a fully autonomous 10-mile journey in all kinds of weather, and on various types of roads. The project seeks to understand what real-world use cases could adopt highly automated commercial vehicles, helping to overcome existing problems, issues or challenges in the transport system.								
nuro	Nuro **Nuro R2** [USA]	Nuro have designed a vehicle specifically to move goods between and among businesses, neighbourhoods, and homes. The fully autonomous vehicle is unmanned and about half the width of a passenger car. It's built with ultra-light materials and designed for neighbourhoods. These combined design elements will make it one of the safest vehicles on the road. Furthermore, this vehicle is the first company to receive a driverless exemption from the federal government in the USA.								
OXBOTICA	Oxbotica **CargoPod** [Greenwich UK]	The trial service is part of the GATEway (Greenwich Automated Transport Environment) program and will operate in the Woolwich area of Greenwich. Once customers place an order at Ocado, the CargoPod collects it and sets out on a number of set routes around the neighbourhood. Each order has its own GPS coordinates, and once the van has reached its programmed destination, customers can collect their order from one of the eight compartments. The van can hold up to 128kg (282 pounds) of groceries at a time.								
Notable Setbacks	**Uber** [USA]	Uber decided in 2020 to sell off its driverless car division to technology start-up Aurora. The move came as part of a drive to push for profitability. The company has maintained a 26% stake in the self-driving subsidiary and continues to maintain an interest, but the programme hit seer setbacks when one of Uber's driverless vehicles hit a woman in Tempe, Arizona in 2018. Although a supervisory driver should have been attentive to intervene, the supervisor was watching a streaming service at the time of the incident.								
Contribution to decarbonisation	By 2050, connected autonomous vehicles could reduce fuel consumption by as much as 44 percent for passenger vehicles and 18 percent for trucks, according to a new study released by the Energy Information Administration. This is due in part to softer acceleration and deceleration gradients and the enabling of vehicle platooning, resulting in less fuel consumption.									
Opportunities	Big savings on the cost of delivery thanks to the removal of a human driver, Vehicle could operate continuously without the need for driver breaks. Likely safety benefits due to automated systems not getting tired or distracted etc. Autonomy also allows vehicle platooning to reduce fuel costs.									
Barriers	Trialling is possible as long as the vehicle adheres to the 1988 Road Traffic Act – still requires human oversight. New regulations allow 'hands off, eyes on up to 60kmph, perhaps enabling urban applications but this is not full self-driving and still requires a human in the loop.									
Wider links	Vehicle platooning, Dynamic kerbspace management, automatically booking delivery windows at convenient drop-off locations									

Applicability to Policy Objectives					
Economy		**Environment**		**Society**	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Max	**Air quality** Reduce the impact of the sector through air quality improvements	Min	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Max
Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Med	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Med	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Min
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Min		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Min
Key resources:	Introducing autonomous vehicles in logistics: a review from a broad perspective https://core.ac.uk/download/pdf/45289932.pdf				

VI. DRONE DELIVERY

Drone Delivery	Modes Impacted In UK:		Freight Sector	Last Mile Logistics	Journey Range	Short and Medium Range	Technical Maturity	Initial real-world operation	UK Commercial Maturity:	Commercial Testing / piloting
Definition: [Signal]	Urban areas are becoming increasingly congested which is limiting the speed at which time-critical deliveries can be made. Furthermore, barriers such as bodies of water, terrain impassable by road, and railway lines can result in highly circuitous or lengthily trips being made to access geographically close locations. Drones are unique in that they can fly directly to delivery destinations unaffected by congestion and bypassing obstacles, drastically reducing journey times.						**Regulatory Maturity**		**Not currently legislated for**	
Sub-models	*Fixed wing (long distance), Multicopter (short range), tilt wing (intermediate), unmanned helicopter (heavy duty use case)*						**Geographical Applicability:**			

Best Practice	Analysis of existing models and use cases	
Solent Transport	Solent FTZ **Medical deliveries** [The Solent, UK]	The Solent Future Transport Zone is leading a series of trials exploring the use of a drone in delivering pathological samples between hospitals on the Isle of Wight, in Portsmouth and in Southampton. Key to this trial is the development of an air traffic management system which integrates and deconflicts the movement of drone traffic with traditional manned air traffic. The project will trial multiple different types of aircraft to evaluate their ability to reduce the costs and increase the speed and efficiency of delivering medical consignments between NHS locations. The trial is significant because it is the first example of an unmanned civilian aircraft being permitted to fly beyond visual range, a key milestone in the wider deployment of the technology.
Royal Mail	Royal Mail **Parcel Delivery** [Isles of Scilly}	Royal Mail has become the first UK parcel delivery carrier to deliver mail via unmanned drone to the Isles of Scilly more than 70 miles out to sea. It forms part of a major new out-of-sight autonomous flight trial which will see drones carry PPE and COVID testing kits from the mainland to remote communities on the islands. While this current trial will focus on crucial medical deliveries, other parcels from various retailer weighing up to 100kg will also be delivered. If successful, Royal Mail says it will consider expanding the technology across its wider delivery network helping to deliver parcels to remote and hard to reach areas across the UK.
Skyports	Skyports **Medical deliveries** [Scottish Highlands]	Skyports is conducting hospital-to-hospital medical drone deliveries to assist the NHS in the battle against COVID-19. Over the course of the project, Skyports is flying essential medical cargo 17kms Beyond Visual Line of Sight (BVLOS) between two hospitals in the Scottish Highlands. The project is a joint to prove the feasibility of delivering urgent medical cargo, such as COVID-19 test kits and Personal Protective Equipment (PPE), between remote medical facilities. This is the first phase of a long-term project to integrate delivery drones into NHS supply chains, ensuring that rural communities have fast and frequent access to healthcare logistics.
Notable Setbacks	Swiss Post **Medical deliveries** [Switzerland]	Swiss Post and drone manufacturer Matternet have been collaborating on a drone delivery service in three different cities in Switzerland, with drones ferrying lab samples between hospitals far faster and more efficiently than is possible with conventional ground transportation. The service had made about 3,000 successful flights as of January 2018, but two crashes in 2019 suspended the service indefinitely after a malfunction caused a drone to deploy its emergency parachute, causing it to crash 50yd from a group of children. Weighing 10kg, the drone could have caused serious injury
Contribution to decarbonisation	Drones provide the option to resize delivery vehicles in accordance with the load they are carrying. If a small number of packages need to be transported over a distance to a rural area, it is far more economical in environmental and commercial terms to make the deliveries using small drones, rather than sending a much heavier and therefore inefficient van out of its way to make the same deliveries. Furthermore, as they are unaffected by congestion and physical barriers, drones are able to take more direct routes to their destinations, resulting in further efficiency gains.	
Opportunities	Connecting remote and rural communities and providing new services thanks to reduce delivery time and cost, same day delivery of products purchased online	
Barriers	Significant regulatory barriers. For now, most UAVs operate outside controlled or restricted airspace, and this minimizes interference with other airspace users. But if UAV operations are to become widespread in logistics and other industries, integration will be essential.	
Wider links	Urban Aerial mobility, Droids (terrestrial)	

Applicability to Policy Objectives					
Economy		**Environment**		**Society**	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Max	**Air quality** Reduce the impact of the sector through air quality improvements	Med	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Med
Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Med	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Med	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Min
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Med		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Min
Key resources:	Unmanned aerial vehicle in logistics: https://www.dhl.com/content/dam/downloads/g0/about_us/logistics_insights/DHL_TrendReport_UAV.pdf				

VII. DELIVERY DROIDS

Delivery Droids	Modes Impacted In UK:		Freight Sector	Last Mile Logistics	Journey Range	Short Range	Technical Maturity	Initial real-world operation	UK Commercial Maturity:	Commercial Testing / piloting
Definition: [Signal]	Delivery droids are small autonomous delivery vehicles which can travel on pavements or through pedestrianised areas to complete local last-mile deliveries to customers at low cost compared to delivery by human drivers. Their cargo is transported in a locker that can be accessed only be the recipient of the delivery. Droids offer a zero emission last mile solution and can be employed across an area to replace van trips. Unlike vans, they can also operate in pedestrianised areas inaccessible to other modes such as e-cargo bikes.						**Regulatory Maturity**		**Permitted within certain constraints**	
Sub-models	*Home delivery, campus delivery*						**Geographical Applicability:**			
Best Practice	**Analysis of existing models and use cases**									
STARSHIP	Starship **Food delivery** [Milton Keynes]	Starship Technologies, an autonomous delivery start-up created in 2014 by two Skype co-founders, has been in public testing mode in 20 countries around the world since 2015. The company has recently completed its 1,000,000th delivery. Ongoing research and development into the technology ensures that the devices can safely and efficiently navigate around pets, pedestrians and anything else in their path. Thus far its deliveries have been mostly of food and parcels through corporate partnerships such as Just Eat, Domino's Pizza, Hermes and Postmates in the US, though it launched a trial "plug and play" service for small businesses in Milton Keynes in 2018								
FedEx	FedEx **Roxo** [USA]	The SameDay Bot 'Roxo' is battery-powered, has a top speed of 10 mph, and is autonomous, meaning it can steer itself around pedestrians and traffic using a combination of LIDAR sensors like those found in self-driving cars and regular cameras. The robot has specially designed controllers to enable it to scale kerbs, rough terrain and safely navigate the pedestrian environment. The bot is still a prototype, but the version that is currently being tested is the third generation and is undergoing extensive testing through 2021.								
robby	Robby Technologies **Snackbot** [California, USA]	Initial real-world trials of the Robby delivery robot are underway in San Francisco delivering food across a local area. The city has heavily restricted use of delivery robots to specific defined corridors, and humans still need to accompany the systems as they undergo real-world trials. Robby 2 has a suite of infrared cameras, allowing it to navigate at night. The new design is water and weather resistant and the droid can travel for more than 20 miles on a charge.								
Notable Setbacks	**Freight Traffic Control 2050**	There are some doubts within the industry around the potential for droids to reduce congestion in urban areas due to the many technological, legal and safety issues involved, and the subsequent timeframes for implementation. Previous trials have shown that whilst using the pavements as per their design, they are unable to press buttons to crossroads or climb stairs. There are also suggestions that congestion needs to be tackled holistically, through reducing trips, not through shifting the problems off the roads and onto the pavement. However, droids are a small part of a much larger set of interventions and trials will be useful in exposing their commercial niche in the logistics network.								
Contribution to decarbonisation	Similarly, to drones, droids provide the option to resize delivery vehicles in accordance with the load they are carrying, reducing the need for vans to drive around making deliveries with a suboptimal load utilisation. Making use of the pedestrian footway network, droids may also be able to take more direct routes to destinations in dense urban areas, where the equivalent van would be forced to take a far more circuitous route. Furthermore, droids are battery operated, meaning that they produce no emissions at street level and can be powered using renewable energy sources.									
Opportunities	Deliveries within the hour as droids can be dispatched as and when required carrying a single delivery									
Barriers	Risk of vandalism and theft, regulatory barriers to operating autonomously without supervision, unable to access some pedestrian areas due to pedestrian operated crossings, steps etc									
Wider links	Logistics-centred developments, other last mile modes									

Applicability to Policy Objectives					
Economy		**Environment**		**Society**	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Max	**Air quality** Reduce the impact of the sector through air quality improvements	Med	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Max
Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Low	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Med	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Max
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Low		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Med
Key resources:	A Two-Tier Urban Delivery Network with Robot-based Deliveries https://www.fww.ovgu.de/fww_media/femm/femm_2020/2020_01-p-11148.pdf				

VIII. MAGWAY

Magway	Modes Impacted In UK:		Freight Sector	Last Mile Logistics	Journey Range	Short Range	Technical Maturity	Concept	UK Commercial Maturity:	Not operating commercially in the UK
Definition: [Signal]	The Magway system aims to provide a safer, faster, more reliable and more sustainable way of delivering parcels. Magway runs inside plastic small diameter pipes like those utilised by large gas and electricity providers. This eases the installation process as existing techniques and technologies of tunnel boring and pipe installation can be used. Moving around pipe systems that can run below ground, underground or even suspended, Magway's carriages travel just milliseconds apart from each other at speeds of up to 50kph. Automated loading and unloading processes controlled by advanced computer programming maintain a steady flow of carriages through the system.						**Regulatory Maturity**		Not currently legislated for	
Sub-models	*Hyperloop, pneumatic tube transport*						**Geographical Applicability:**			
Best Practice	**Analysis of existing models and use cases**									
Heathrow Making every journey better	Magway **Heathrow Airport** [United Kingdom]	Wembley-based Magway was co-founded in 2017 by Phil Davies and Rupert Cruise, an engineer who has worked on Elon Musk's Hyperloop project. It has so far raised £1.5m to start work on a series of tunnels that could carry items in pods along underground tracks powered by a magnetic motor. The tunnels are expected to be no bigger than 1m wide, like pipes used for the transfer of water and gas and will feature pods that travel at 30mph. They could form part of a wider sprawling network that connects consumers to distribution centres or shops. Magway is hoping to trial the technology at an airport, where it envisions carrying duty free goods to terminals, as well as baggage, allowing parcels to bypass lengthy delays moving through the airport perimeter. The company is currently in talks with Heathrow Airport to deploy its magnetic tracks and is seeking funding from an airport for the pilot. An additional route that stretches from the capital to Milton Keynes is expected to have the capacity to transport more than 600m parcels each year.									
Notable Setbacks		[Still at concept stage]								
Contribution to decarbonisation	Magway provides a means of circumventing congestion by moving freight through dedicated 1m diameter tunnels on electrically propelled carriages. By replacing up to 3,000 lorryloads per day, a huge number of trips are taken off the network, reducing vehicle emissions in the process and helping to decarbonise the industry.									
Opportunities	Faster, smarter, safer and cheaper than existing solutions. Enables, timing of deliveries down to the last second for just-in-time deliveries and remote warehousing.									
Barriers	Costly to implement at scale, may be limited to just few destinations for a whilst the network grows. May only be suited to origins and destinations with substantial flows between them.									
Wider links	Hyperloop, pipeline logistics									

Applicability to Policy Objectives

Economy		Environment		Society	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Max	**Air quality** Reduce the impact of the sector through air quality improvements	Max	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Max

Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Med	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Max	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Max
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Med		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Med
Key resources:	Magway: https://www.magway.com/				

IX. E-CARGO BIKES

E-Cargo Bikes	Modes Impacted In UK:		Freight Sector	Last Mile Logistics	Journey Range	Short Range	Technical Maturity	Initial real-world operation	UK Commercial Maturity:	Operating commercially
Definition: [Trajectory]	Electric cargo bikes are a highly versatile form of first and last mile freight transportation that can replace deliveries in urban areas traditionally made by light goods vehicles (LGVs), whilst using a fraction of the road space. Being electrically assisted, they enable the rider to efficiently transport cargo with zero emissions at street level, with some variants able to carry loads of 250kgs+. Additionally, where infrastructure allows, they can use the cycling network to efficiently move around a city and their smaller size allows them to be parked more conveniently near to their destination and to have access to pedestrianised areas.						**Regulatory Maturity**		**Permitted within certain constraints**	
Sub-models	*Shared-use, Last mile delivery, Use by tradespeople, B2C deliveries, reverse logistics and waste collection, campus logistics*						**Geographical Applicability:**			

Best Practice	**Analysis of existing models and use cases**	
ZEDIFY ZERO EMISSION DELIVERIES	Outspoken Cycles **Zedify** [UK]	Zedify use a fleet of zero emission cargo bicycles and tricycles, supplemented by electric vans, that operate out of small urban logistics hubs to fulfil deliveries and collections in urban areas. At the hubs, items are sorted into local, digitally-tracked delivery rounds and sent to their final addresses by specially adapted cargo bikes carrying up to 250kg – or electric vans for longer distances, if needed. Clients include online retailers, logistics carriers, as well as local businesses for 'across town' same day deliveries. They currently operate in 9 UK cities, including Cambridge, London, Brighton, Southampton Portsmouth, Glasgow and most recently in Bristol
DHL	DHL **City Hub** [Utrecht, Netherlands]	DHL Express is piloting a new City Hub concept that will enable increased use of cargo bicycles for inner-city deliveries. The City Hub is a customised trailer which can carry up to four containers for the DHL Cubicycle, a customised cargo bicycle which can carry a container with a load of up to 125 kg (one cubic meter in volume). A DHL van delivers the trailer into the city centre, where the containers can be quickly loaded on to two Cubicyles for last-mile inner-city delivery. It can then be reloaded for outbound shipments. DHL Express has already replaced up to 60% of inner-city vehicle routes in some European countries with cargo bicycles and they plan to roll out the approach more widely over the next 3-5 years.
HEREFORD PEDICABS & CARGO	Hereford Pedicabs **Pedicargo** [Hereford]	Hereford PediCargo collect business waste for recycling on a weekly or ad hoc basis. They use cargo trikes and deployable trailer bins to gather the city's paper, cardboard and plastic and then shred, compact and send it for recycling. The service is then invoiced at the end of the month to collect cash from the clients. Having diversified from a pedicab service after identifying a lack of trade waste recycling facilities in Hereford, they now provide an easy way to recycle waste, much of which would ordinarily go to landfill despite 80% of the waste being recyclable. Having rapidly grown, they now operate a fleet of e-cargo bikes and prevent over 10,000kg of recyclable waste from going to landfill every week.
Notable Setbacks	General Challenges	Previous work has identified that e-cargo bike operators face several challenges which affect their ability to compete with traditional van traffic. Firstly, in logistics, e-cargo bike operators are subject to strong downward price pressures and the margins in logistics are quite slim, making expedient or risky investments very difficult. Furthermore, as a relatively new mode, there is a limited market for e-cargo bikes and many models haven't gone through the same rigorous testing processes as ordinary bikes. This leads to issues with reliability and increases costs, especially given that some larger models can cost in excess of £10,000. Whilst e-cargo bikes are highly versatile, clearly much larger modes are out of scope. This can result in partners needing to manage two separate operators, which often proves too costly or time-consuming.
Contribution to decarbonisation	The UK's current fleet of conventionally-fuelled goods vehicles is estimated to be in excess of 400,000 HGVs and over 4,600,000 vans and this reliance is exacerbating congestion, greenhouse gas emissions and noise pollution. E-cargo bikes offer the potential to remove some of these vehicles, particularly vans, from urban areas, with benefits of improved air quality and more sustainable movement of freight as a result.	
Opportunities	Links to micro-consolidation centres and mobility hubs, logistics centred development	
Barriers	Limited to a small geography, cannot carry some larger loads, not suited to all locations, dependent to a degree on urban form	
Wider links	Micro-consolidation, urban depots, other last mile modes	

Applicability to Policy Objectives					
Economy		**Environment**		**Society**	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Max	**Air quality** Reduce the impact of the sector through air quality improvements	Max	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Max
Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Med	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Max	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Max
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Low		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Med
Key resources:	E-Cargo bike case studies: https://www.youtube.com/watch?v=FqRUnjU2XbY Government call for evidence: https://e-cargobikes.com/uploads/news/last-mile-call-for-evidence.pdf				

X. E-WALKERS

E-walkers	Modes Impacted In UK:		Freight Sector	Last-mile	Journey Range	Short Range	Technical Maturity	Initial real-world operation	UK Commercial Maturity:	Commercial Launch

Definition: [Trend]	E-walkers are electrically assisted cargo trailers designed to be pulled by a person through pedestrianised areas. The electrical assistance allows the operator to easily move large quantities of cargo and the dimensions of the vehicle allow it to pass through doors to access places such as shopping centres. E-walkers have the potential to service busy congested environments where space is restricted, and it wouldn't be appropriate to use other modes such as an e-cargo bike.		**Regulatory Maturity**	**Legal status unclear**
Sub-models	*E-trolley, Foot porterage, post cart (unassisted)*		**Geographical Applicability:**	

Best Practice	**Analysis of existing models and use cases**	
FH FERNHAY	Fernhay **eWalker** [Dublin]	Funded by Dublin City Council, Enterprise Ireland and Belfast City Council, Fernhay's unique solution was developed as part of a Small Business Innovation Research (SBIR) challenge that sought new approaches to optimising deliveries. Participating in the challenge enabled Fernhay, to develop the new zero emissions delivery solutions for global logistics carrier, UPS, to trial. The eWalker was used where there is the highest parcel drop densities and will increasingly show its merits as cities move to more pedestrianised zones. The eWalker is agile in tight spaces, can go through a standard door, and fellow pedestrians can see over and around it. This enables the vehicle to move unobtrusively right to the customer door whilst limiting the impact on the surrounding urban realm.
Deutsche Post	Deutsche Post **Trolley 7 +1** [Germany]	The eTrolley 7 + 1 was devolved in close partnership between Kyburz and Deutsche Post to provide powerful means of making deliveries on foot. The trolley can carry loads of up to 120kg over 20km whilst requiring very little physical input from its operator. The powered unit at the base of the vehicle can be easily adapted to fit a wide variety of configurations to suit different delivery needs. The motor will provide electrical assistance up to speeds of 6kmh and the cargo hold is lockable to provide security whilst making deliveries. The eTrolleys have been widely deployed by Deutsche Post and across more widely with more than 500 in operation in Germany, Norway, Finland, Austria, Luxembourg and Australia.
Notable Setbacks		[Still in early trial phases]
Contribution to decarbonisation	E-walkers offer another last mile solution to logistics operators, enabling them to make zero emission deliveries across dense urban areas and negating the need to use a van. E-walkers can also access premises directly, removing the need to drive around to find a suitable location for loading. Together, these factors reduce van mileage and therefore carbon emissions.	
Opportunities	Servicing pedestrian areas, servicing indoor areas	
Barriers	Requires very high delivery drop densities, wouldn't be able to access all areas such as those with stepped access	
Wider links	E-cargo bikes	

Applicability to Policy Objectives

Economy		Environment		Society	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Med	**Air quality** Reduce the impact of the sector through air quality improvements	Max	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Max

Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Low	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Max	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Max
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Low		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Max
Key resources:	Fernhay e-walker https://fernhay.com/our-products/eWalker				

XI. FREIGHT ON PUBLIC TRANSPORT

Freight on Public Transport	Modes Impacted In UK:		Freight Sector	Haulage	Journey Range	All Ranges	Technical Maturity	Mature Technical operation	UK Commercial Maturity:	Mature Commercial Operation
Definition: [Trajectory]	Train stations act as major transport interchanges and offer unparalleled direct access to city centres and low journey times compared to travel by road. This is a benefit to logistics as it is to passengers and could allow e cargo bikes to collect parcels offloaded from trains for onward delivery. Similarly, many buses are running below capacity and supplementing the movement of people with freight would add another much-needed revenue stream and it would in turn improve the experience for passengers. The routing algorithms that underpin DDRT could also factor in both people and freight to create the most efficient routes that do not compromise on customer experience or journey times.						**Regulatory Maturity**		**Permitted within certain constraints**	
Sub-models	*Freight on passenger trains, Freight on buses, DDRT and Coaches*						**Geographical Applicability:**			
Best Practice	**Analysis of existing models and use cases**									
GBRf	GB Railfreight **Freight trial** [UK]	UK rail freight operator GB Railfreight has taken a leaf out of the air cargo industry playbook and converted a commuter train to carry express freight to London. The company completed a trial shipment of NHS supplies on a passenger train on the West Midlands to London route in 2020, and said that with minor interior modifications, it could be loaded in both dedicated freight terminals or platform-side in any town or city that has a station and appropriate road access. The train was loaded with cages that can each carry 200kg of packages and parcels, The test was to ensure that the cages could be loaded/unloaded from the trains existing door arrangement, with minimal modifications, and to see how many of the parcel cages could be conveyed within each vehicle with seating removed or a modified seating arrangement."								
PostBus	HobbyDB **PostBus** [Switzerland]	PostBus Switzerland is a subsidiary company of the Swiss Post, which provides regional and rural bus services throughout Switzerland, and in France and Liechtenstein. Whilst post and passengers are mostly separate in Switzerland, the PostBus still exists to connect to post offices in peripheral regions. The federal law and the Swiss Constitution stipulate that every village with a population greater than 40 is entitled to regular bus services. The frequency of these services is in direct proportion to the population density, however, for the most remote communities, combining postal and passenger movements makes commercial sense.								
greyhound Australia	Greyhound **Greyhound Freight** [Australia]	Using the Greyhound Coach network, and available space on coaches, the Greyhound Freight division delivers over 220,000 freight items each year from major capital cities and country towns to the most remote places in Australia. Greyhound Freight offers competitive rates, and as parcels travel on regular scheduled services, and there is no need to wait for a full freight load to depart. As soon as freight has been received in their depot, it departs on the next available coach service.								
Notable Setbacks	Royal Mail **Postbus** [UK, Historic]	Royal Mail postbuses used to be a common sight in some rural areas across the United Kingdom, most notably across the Yorkshire Dales and South West Scotland, but as the needs of passengers and freight diverged, so did the respective services. The postbus was originally created to replace rapidly declining local bus and rail services across remote locations where they sometimes served as the only form of public transportation, running once or twice a day. Even as recently as 2006 there were more than 200 services running, however, as of August 2007, there were no more postbus services.								
Contribution to decarbonisation	Many public transportation services run with spare capacity during off-peak periods. This capacity could be used to support the movement of freight between urban centres, and in the process remove HGV and van trips from the network, which reduces vehicle emissions. Furthermore, direct access to urban centres provides the opportunity to transfer freight to zero emission last miles modes for delivery across the urban centre.									
Opportunities	Creating consolidation hubs at rail/bus/coach stations to create a modal interchange for goods for onward delivery by last mile modes									
Barriers	Regulatory barriers to moving freight alongside passengers, security concerns									
Wider links	DDRT, urban depots									

Applicability to Policy Objectives					
Economy		**Environment**		**Society**	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Max	**Air quality** Reduce the impact of the sector through air quality improvements	Max	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Max
Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Low	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Max	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Low
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Med		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Low
Key resources:	Moving freight on public transit: Best practices, challenges, and opportunities: https://www.tandfonline.com/doi/abs/10.1080/15568318.2016.1197349?journalCode=ujst20				

XII. PLATOONING

Platooning	Modes Impacted In UK:		Freight Sector	Haulage	Journey Range	Long range	Technical Maturity	Piloting	UK Commercial Maturity:	Commercial testing / piloting
Definition: [Trend]	In truck platooning highly advanced V2V and sensor technology will allow two or more wirelessly connected trucks to drive at a short distance apart. Using the driving information from the first truck in the platoon, the following vehicles can automatically accelerate, brake and steer. While platooning, when the lead vehicle brakes, the following vehicles automatically brake with no noticeable reaction time significantly increasing road safety. This enables the gap between truck combinations to be reduced as much as possible, which due to slipstreaming can save 10% in fuel and an equivalent reduction in CO2 emissions.						**Regulatory Maturity**		**Not currently legilsated for**	
Sub-models	*HGV only, mixed traffic platooning*						**Geographical Applicability:**			

Best Practice	Analysis of existing models and use cases	
TRL THE FUTURE OF TRANSPORT ENSEMBLE Peloton	TRL **DAF Vehicle Platooning** [UK]	TRL successfully delivered a feasibility study for a UK road trial of autonomous platooning heavy vehicles. Their report predicts significant and practical benefits to road safety, capacity, congestion, CO2 efficiency and fuel economy and defines the aspects that require further information. Their independent assessment provided the Department of Transport with a clear picture of how an autonomous platooning trial could operate for heavy vehicles, along with producing a number of technology roadmaps.
	TNO **ENSEMBLE** [Europe]	The ENSEMBLE Project aimed to demonstrate technical trials of platooning technology including ensuring interoperability between different manufacturers, safety and designed-in failsafes that manage the interactions between vehicles in the platoon and other road users. Practical tests on closed testing grounds and in real life serve to an experience of 'learning by doing', to assess the impact on traffic and infrastructure and to promote multi-brand platooning. Furthermore, the project will design an interface to cloud-based services so that the platooning concept can be seamlessly integrated into the logistic value chain.
	Peloton **PlatoonPro** [California, USA]	The Peloton System has proven savings of more than 7% when platooning using industry standard tests: 4.5% for the lead truck, and 10% for the following truck. Platooning only occurs when it's safe, where it's safe, and how it's safe. Peloton's cloud-based Network Operations Cloud (NOC) approves each platoon. It adjusts platooning parameters to be safe for conditions. Each driver is empowered with over-the-horizon alerts at all times. The NOC maximizes platooning opportunities by notifying drivers of potential pairings based on their location and anticipated route. The NOC can find platooning partners for drivers en route or platooning can be planned ahead of time.
Notable Setbacks	**Mercedes-Benz**	Mercedes-Benz Trucks has concluded that there is no business case for truck platooning, saying that the technology failed to deliver appreciable fuel savings in its on-the-road tests. Although the manufacturer will remain committed to ongoing platooning projects with partners, such as Ensemble in Europe, it now plans to refocus its resources on developing autonomous, self-driving technologies in its trucks.
Contribution to decarbonisation	Vehicle platooning enables significant fuel savings by exploiting the aerodynamic efficiency gains achieved when vehicles drive in one another's slipstream. Tests to date have indicated that efficiency gains of between 5% and 10% can be achieved, which if applied at scale, could make significant contributions to decarbonising the industry. There are, however, questions about how scalable this solution is within the context of the UK's roads and how effective this measure would be in practice.	
Opportunities	Ties in with increasing levels of vehicle automation	
Barriers	Congestion and relatively frequent motorway junctions in the UK may be a barrier to implementation. Regulatory barriers - need to understand the liabilities of the lead and following vehicles when platooning. Successful application would require a critical mass of platoon-capable vehicles on the SRN to provide the opportunities to link with other vehicles.	
Wider links	Vehicle automation	

Applicability to Policy Objectives

Economy		Environment		Society	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Max	**Air quality** Reduce the impact of the sector through air quality improvements	Min	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Max
Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Med	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Med	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Min
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Min		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Min
Key resources:	Heavy vehicle platoons on UK roads feasibility study: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/637361/truck-platooning-uk-feasibility-study.pdf Decarbonising road freight: Is truck automation and platooning an opportunity? https://link.springer.com/article/10.1007/s10098-020-02020-9				

XIII. CONSOLIDATION

Consolidation	Modes Impacted In UK:	All	Freight Sector	Services	Journey Range	Short Range	Technical Maturity	Initial real-world operation	UK Commercial Maturity:	Commercial Launch
Definition: [Trajectory]	Freight consolidation exploits the economies of aggregation by combining multiple shipments destined for a geographic region into a single load where upon arrival, the shipment is broken into smaller consignments for onward delivery across the locality. Consolidation can happen at all scales, manifesting differently at various points in the logistical chain. Increasingly, these facilities are becoming mandatory to encourage their use and to channel freight through them, particularly as part of new residential and retail developments.						**Regulatory Maturity**		**Permitted within certain constraints**	
Sub-models	*Freight consolidation centres, micro consolidation centres,*						**Geographical Applicability:**			
Best Practice	**Analysis of existing models and use cases**									
ZEDIFY ZERO EMISSION DELIVERIES	Zedify **Zero emission hub** [Bristol}	Zedify received a £100,000 grant to set up a zero-emission delivery hub in Bristol to enable their fleet of electric cargo bikes to make sustainable last mile deliveries across the city centre. It is hoped that within 10 years, 95% of deliveries can be made by electric vehicles. The zero-emission hub is located on the edge of Bristol where it intercepts deliveries bound for the city centre. Here, freight is processed and then remoded on to electric cargo bike, or other sustainable last mile mode of delivery, to make the part of its journey to the recipient of the delivery. This discourages vans and HGVs from needing to access the congested centre of Bristol, and therefore creates savings in CO2 emissions and improves air quality in the locality. There is also a commercial incentive to use consolidation centres where accessing urban centres using multiple ICE vehicles becomes prohibitively expensive due to ULEZ charges, or an increasingly impermeable urban road network. Zedify Bristol's new depot is part of a national urban network, with nine other micro consolidation hubs across the country.								

travelwest comouk supporting shared transport	Travelwest **Bristol Bath Freight Consolidation Centre**	Bristol Freight Consolidation Centre was initially set up as a pilot scheme in 2004 with European funding to help alleviate issues associated with freight in Broadmead, Bristol. At its peak, a 70% to 80% reduction in the number of onward trips was seen by the freight consolidation scheme subsidised by Bristol City Council to serve the central area between 2004 and 2018. This meant that for every 10 vehicles that made a delivery to the consolidation centre, just 2 or 3 onward journeys to the central area were made. The return trip provided the opportunity to return packaging materials for recycling.
	CoMoUK **Mobility Hubs Guidance**	'Local Mobility Hubs' will provide an array of mobility, commercial and community services to a surrounding area and will allow people to lead low-car lifestyles by co-locating the movement of people with the services that they might commonly need on their daily journeys. One such service that could be provided is a micro-consolidation hub where freight can arrive for distribution across a local area. Furthermore, the coincidence of the movement of goods and people also offers an opportunity for travellers to access 'click-and-collect' services and make use of parcel lockers.
Notable Setbacks	Elcidis UCC **Urban consolidation Centre** [La Rochelle]	La Rochelle Urban Community has been implementing a last mile urban freight delivery service using electric vans and trucks for more than 15 years, based on receiving conventional heavy goods vehicles (HGVs) and transferring goods to electric vehicles to make the last mile delivery. The assessment on the freight movements captured by the Elcidis UCC revealed that the service is not fully delivering the expected environmental and financial gains (capturing 100 freight movements per day out of 670 (15%) in the city centre generated by freight carriers - or 4% of 2,288 movements per day overall). As such, the business model is proving to be unprofitable and unsustainable due to the high fixed costs of running the facility compared to the revenue generated through cost savings when not processing a sufficient volume of goods. Reasons for failure included: Location – not being located on strategic routes in La Rochelle, Regulatory framework - does not incentivise the use of the UCC, or indeed electric vehicles. Complementary functions - No additional services beyond the distribution of goods are offered (e.g. recycling processing facility for reverse flows)
Contribution to decarbonisation	Consolidation has the potential to remove a large number of trips from urban centres by aggregating deliveries bound for similar locations onto a single vehicle, rather than deliveries arriving in multiple. This helps to ensure that vehicles are running at optimum capacity, effectively reducing the fleet size required to service an area and the subsequent impacts on carbon emissions.	
Opportunities	Links with mobility hubs and transport interchanges for interface with space capacity on public transport, consolidation as a means of re-moding for the last mile of delivery	
Barriers	Extra cost incurred as a result of additional handling of goods	
Wider links	Last mile logistics, e-cargo bikes. e-walkers, drones, droids, other last mile modes	

Applicability to Policy Objectives

Economy		Environment		Society	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Med	**Air quality** Reduce the impact of the sector through air quality improvements	Med	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Low
Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Low	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Med	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Med
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Low		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Max

Key resources:	La Rochelle Case Study: https://urbact.eu/sites/default/files/la_rochelle_iap_english_summary.pdf

XIV. DYNAMIC KERBSPACE MANAGEMENT

Dynamic Kerbspace Management	**Modes Impacted In UK:**		**Freight Sector**	**B2B and B2C**	**Journey Range**	**Last Mile**	**Technical Maturity**	**Piloting**	**UK Commercial Maturity:**	***Not operating commercially***
Definition: **[Trend]**	Dynamic kerbspace management allows spaces to be booked through a connected digital system. This enables the creation of virtual loading bays and for the use of kerbspace to be changed throughout the day to better suit local demand. It also enables dynamic pricing structures to manage demand for parking across urban areas and to ensure that the roadside is clear ahead of essential works or events.						**Regulatory Maturity**		**Not currently legislated for**	
Sub-models	*Reallocation of road space for hospitality venues during busy periods, time-based loading restrictions/parking tariffs, play/school streets during quieter hours, EV charge point booking*						**Geographical Applicability:**			

Best Practice	**Analysis of existing models and use cases**	
grid	Grid Smarter Cities **Kerb** [Dublin, Westminster]	Grid Smarter Cities have been working with Dublin City Council to better understand and analyse potential use-cases for Kerb, their Intelligent Kerbside Management solution in the city centre—with the ambition to dynamically manage the kerbside with the use of Virtual Loading Bays (VLBs). Kerb is an app that gives commercial vehicles the ability to book a Virtual Loading Bay (VLB) on previously restricted kerb space in the city or to extend loading periods in time restricted locations. This added flexibility helps to ensure that more deliveries are made during in the least disruptive places and periods.
Ford	Ford **GoPark** [London, Islington]	GoPark has been developed in collaboration with city and local government partners to manage their kerbspace more effectively. Previous and current work includes digitally mapping city on-street parking, a parking guidance app for drivers, and using live vehicle data to identify empty parking spaces nearby. the app (still in beta testing) distils all of Islington's convoluted parking rules down to three pieces of information: Can you park here? If so, for how long? And how much will it cost?
ARUP	Arup **FlexKerbs** [Simulation]	To understand if, and to what extent, FlexKerbs could support CAV deployment while maintaining streets' active and placemaking functions, this project simulated FlexKerb functionality on Cheapside—the historic high street in the City of London. An illustrative 24-hour schedule was devised of FlexKerb space allocation, informed by demand data but driven by local policy, which was then tested using microsimulation modelling. This assessment demonstrated that FlexKerbs would serve as a highly effective tool for improving both the operational efficiency and the public realm of a CAV-enabled street especially.
Notable Setbacks		[Currently in piloting and proof of concept stage]
Contribution to decarbonisation	Dynamic and digitised kerbs can increase the efficiency of the freight networks by managing access to congested areas and changing the use of space in response to shifts in demand. This reduces the amount of time that vehicles spend circulating searching for loading or parking space. This intervention may also be used as a policy lever which restricts access to urban areas during certain periods to encourage freight to be shifted on to more sustainable modes such as e-cargo bikes.	
Opportunities	Better management of kerb space, dynamic uses throughout the day to enable space to be used more efficiently, fewer PCN issues to operators, enables other uses such as 'play streets' or 'school streets' during the day. Also offer more clarity to operators and consumers to have the certainty that loading bays will be available and that space can be used as needed, potentially closer to the destination. Targeting PCN hotspots.	
Barriers	Digitisation of kerbside could be costly, enforcement for non-digital users without using physical measures, possible policy and TRO implications. Needs to involve lots of silo organisations, shifted revenue streams	
Wider links	Ride-hailing and Shared CAVs – drop-off and pickup points, parking and demand management strategies	

Applicability to Policy Objectives					
Economy		**Environment**		**Society**	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Med	**Air quality** Reduce the impact of the sector through air quality improvements	Med	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Max
Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Med	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Min	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Max
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Min		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Max
Key resources:	Flex Kerbs: https://www.arup.com/-/media/arup/files/publications/f/flexkerbs_roads-for-the-future_arup.pdf				

XV. VTOL MOBILITY

VTOL Mobility	**Modes Impacted In UK:**		**Freight Sector**	**Air freight**	**Journey Range**	**Medium to Long**	**Technical Maturity**	**Piloting**	**UK Commercial Maturity:**	***Not operating commercially***	
Definition: [Signal]	Vertical take-off and landing (VTOL) technology is allowing freight to be transported to and from hard-to-reach locations. Requiring very little infrastructure or runways, VTOL aircraft can provide cost-efficient freight solutions and are opening up new delivery markets and business models. Increasingly, the aircraft are being powered by electric powerplants or by using hybrid technologies to maximise efficiency and provide decarbonised alternatives. The VTOL technologies described in this dashboard operate similarly to drones but can carry much larger payloads and over longer distances, catering therefore to different use cases ad business models.						**Regulatory Maturity**		**Not currently legilsated for**		
Sub-models	*Hybrid airship, eVTOL, Lift and Cruise aircraft*						**Geographical Applicability:**				
Best Practice	**Analysis of existing models and use cases**										
LOCKHEED MARTIN	Lockheed Martin **Hybrid Airship** Rare earth metal mines	With many of the most easily reachable locations for mining rare earth metals already exploited, it is becoming increasingly difficult to access remote areas where there is little infrastructure. Hybrid airships present a possible solution and are being deployed by mining company Quest to shuttle ore concentrate, supplies and personnel from their open pit mine to a nearby town which has a rail connection. The airship can land on virtually any surface including snow, ice, gravel and even water, with no runways required or other expensive infrastructure. The helium-filled, heavier-than-air airships can carry 20 metric tons of cargo and up to 19 passengers. Quest initially planned to build a 168km road at a cost of $350 million, but an airship proved to be more economical costing only $85 million to operate.									
UPS	UPS Flight Forward **eVTOL**	UPS has plans to purchase electric VTOL aircraft for use in small and mid-size markets. The first 10 aircraft are expected to be delivered in 2024 and can carry a payload of 635kg up 250 miles at speeds of up to 170mph. The aircraft has four fixed vertical lift propellers and one pusher propeller for forward flight. It can charge in an hour or less and produces zero operational emissions. It is designed to one day operate autonomously, increasing operational efficiency even further. The new type of aircraft, which looks like a cross between a plane and a helicopter, unlocks new business models that don't exist today, enabling greater payloads to be delivered over longer distances without the use of an airport.									
PIPISTREL	Pipistrel **Nuuva V300**	The Nuuva V300 is a long-range large-capacity heavy-weight autonomous eVTOL Unmanned Aerial Vehicle (UAV) for logistics and aerial cargo delivery. It operates 10x more economically than today's helicopters, requires no runways, and brings enhanced safety and reliability using Pipistrel's type-certified electric engines. The nose section of the fuselage lifts leaving a large opening for cargo loading. Up to 3 Euro-pallets (EPAL) can be easily loaded using a forklift, but other types of containers also fit in. The dispatch is simple, and the flight plan is preloaded at the ground station before the take-off. After lift-off, the Nuuva V300 flies fully autonomously, controlled by a reliable, triple-redundant Flight Control System									
Notable Setbacks	**Regulatory barriers**	Much like drones, seamless inter-aircraft communication demands effective integration of the existing airspace management systems with unmanned aircraft system traffic management will be required to enable operators to interact with multiple vehicles flying simultaneously in a way that is safe. The regulation is not yet mature, and it may be some years until a formalised system is employed at scales that will enable widespread operation. Until then, small scale applications with pre-approved flight plans may be feasible as demonstrators of the technology									
Contribution to decarbonisation	VTOL Mobility promises to enable cargo to be transported more directedly by circumventing congestion and flying over physical barriers. In some cases, this could result in emissions saving, contributing to decarbonising the industry. However, VTOL mobility is much more energy intensive than moving the equivalent load by road, so its application should be targeted and limited to the use cases where it can be environmentally competitive with existing modes of transportation. Increasingly, electric concepts are emerging which promise to be much less damaging to the environment that ICE equivalents.									
Opportunities	Servicing remote locations, use of airships as drone ports, new business models									
Barriers	Regulatory barriers will require technological solutions that have not yet been developed									
Wider links	Cargo Drones, Urban Aerial Mobility									

Applicability to Policy Objectives					
Economy		**Environment**		**Society**	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Max	**Air quality** Reduce the impact of the sector through air quality improvements	Min	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Min
Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Med	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Min	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Min
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Min		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Min
Key resources:	Deloitte, Managing Evolving Skies: https://www2.deloitte.com/global/en/pages/energy-and-resources/articles/managing-evolving-skies.html				

XVI. DIGITAL TECHNOLOGIES IN RAIL FREIGHT

Digital Technologies in Rail Freight		**Modes Impacted In UK:**		**Freight Sector**	**Rail freight**	**Journey Range**	**All ranges**	**Technical Maturity**	**Mature technical operation**	**UK Commercial Maturity:**	**Mature commercial operation**
Definition: [Trajectory]	The rail industry is constantly innovating to produce technologies that improve operational efficiency and safety. Many solutions are focussed on making data more transparent, more efficient to collect and more easily shared. This can also be an enabler of new business models, as better oversight of freight movements may enable operators to identify new opportunities for aggregation or consolidation onto more efficient container loads.							**Regulatory Maturity**		**Permitted within certain constraints**	
Sub-models	*Timetable advisory system, mobile consisting application, positive train control, freight collaborative decision making*							**Geographical Applicability:**			
Best Practice	**Analysis of existing models and use cases**										
3SQUARED®	3Squared **RailSmart MTISA** Timetable advisory system	Tablet computers have been given to drivers across a number of freight operators which inform them of how the train is progressing in relation to their timetable. The UK Government's rail freight strategy claims this could lead to fuel savings of up to 3% and capture large amounts of data which can optimise future timetables and assist with performance issues. The system also allows drivers to provide clear and concise reasons for their delays which can be mapped and attributed along their journey. Over time this can lead to more detailed insights into operations and can improve safety by avoiding failure to stop incidents through the provision of enhanced driver information.									
3SQUARED®	3Squared **RailSmart** Mobile Consisting Application	Before a freight train departs, significant amounts of information about the train's cargo must be collected. This is currently a manual process requiring someone to record on paper the necessary details which are then passed on to Network Rail. The application allows data to be collected using a tablet computer and transferred directly into the necessary systems, helping to reduce the amount of time the train spends idle. This will lead to improved asset utilisation and provide better visibility to network rail of trains being prepared across the network.									
SIEMENS	Siemens **Trainguard Sentinel** Positive Train Control	Positive train control systems are designed to prevent critical safety errors such as train-to-train collisions, over-speed derailments, incursions into established work zones, and movements of trains through switches left in the wrong position by monitoring and changing key metrics such as a train's position and speed, as well as any potential hazards on the wayside. This allows for complete fleet monitoring in real-time and is faster and more efficient than manual systems. Safety is assured by communicating with wayside track point controllers to detect, set, and lock track points. UK systems already offer much/all of these features, although there is relevance to private sidings and intermodal terminals.									
Notable Setbacks	**Lack of electrification**	Despite the opportunities for improvements in operational efficiency, there still remains a fundamental problem unsolved in that according to the rail freight strategy, only around 5% of the current rail freight fleet is currently powered by electric traction. This is likely to improve over time as more lines become electrified, but it still remains a major barrier to meeting decarbonisation targets. However, in the shorter-term, rail freight is still significantly less impactful compared with a road-based diesel-fuelled alternative, but digitisation is still a means of making rail freight more efficient and attractive, reducing emissions overall.									
Contribution to decarbonisation	Digital technologies in freight are helping to increase the operational efficiency of the freight network, which is making rail a more attractive mode compared to transportation by road. As a consequence, a greater share of freight can be expected to shift to rail, which is a far more environmentally friendly mode of transportation, resulting in reduced emissions of harmful gases,										
Opportunities	New business models arising from having better transparency of freight, integration with freight on passenger services										
Barriers	Infrastructure capacity, flexibility of rail freight service (responsiveness of train path allocation), costs incurred due to additional journey legs for door to door deliveries										
Wider links	Freight on public transport, Vehicle booking systems, Load sharing										

Applicability to Policy Objectives					
Economy		**Environment**		**Society**	
Freight efficiency: Improved journey times, connectivity and integration between modes. Reduced impact from and on congestion	Med	**Air quality** Reduce the impact of the sector through air quality improvements	Min	**Safety** Improve the safety of the sector to reduce the number of accidents involving goods vehicles	Min
Industry contribution Improved jobs and opportunities for the sector to address skills shortages, support for inward investment, land availability, infrastructure provision	Med	**Greenhouse gas emissions** Reduction in greenhouse gas emissions from the sector to achieve net-zero by 2050	Min	**Community disturbance** Reduce the impact of freight on communities, noise levels, air quality and informal overnight lorry parking	Min
Connectivity Improved connectivity to international gateways in the Transport for the South East area	Min		.	**Placemaking** Better integrate freight into land use planning, development, construction and servicing plans, better freight data	Min
Key resources:	Rail freight strategy: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/552492/rail-freight-strategy.pdf				

Three White Rose Office Park
Millshaw Park Lane
Leeds
LS11 0DL

wsp.com