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Authors	Julian Allen, Maja Piecyk
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Centre for Sustainable Road Freight

FREIGHT TRANSPORT AND THE KERBSIDE: THE FUTURE OF LOADING AND UNLOADING IN URBAN AREAS

Briefing Report

Technical Report ENG-TR.027

Julian Allen and Maja Piecyk

University of Westminster

November 2022

This briefing report has been produced as part of the Centre for Sustainable Road Freight (SRF – EPSRC grant number EP/R035148/1). Further details about the SRF project are available at: http://www.csrf.ac.uk/

HERIOT WATT UNIVERSITY

UNIVERSITY OF WESTMINSTER

UNIVERSITY OF CAMBRIDGE

Allen J., M. Piecyk †

Freight transport and the Kerbside – Briefing Report

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Centre for Sustainable Road Freight
Department of Engineering
University of Cambridge
Trumpington Street
Cambridge
CB2 1PZ

Heriot-Watt University
Edinburgh Campus
Edinburgh
EH14 4AS

University of Westminster †
309 Regent Street
London
W1B 2HW

www.sustainableroadfreight.org.uk

Introduction

The kerb (like the road) has long been a contested space, much in demand for many different uses and by many different users. This briefing report provides a review of the growing demand for kerb space and time in urban areas in the UK as a result of active travel (i.e. cycling, walking and bus use) policies and place-based street functions being promoted and pursued by national and local government.

It also provides insight into the use of the kerb for freight transport operations including loading, unloading and servicing and the challenges freight operators face from this increasing kerbside demand. A review of studies and trials into kerb use by freight transport is included together with a discussion of approaches to help ensure that the provision of goods and services can take place in an efficient manner and thereby continue to support the economic prosperity and liveability of urban areas.

The report considers technology that is emerging for kerbside management. It also discusses approaches to developing a kerbside management plan based on a hierarchy of uses to aid kerbside space and time allocation decision-making in urban locations.

A set of recommended actions is provided.

It should be noted that this briefing report has been based on a review and use of existing publications and data, rather than through the carrying out of new primary research into the use of the kerbside.

This report has been produced as part of the Centre for Sustainable Road Freight (SRF – EPSRC grant number: EP/R035148/1). A summary slide set is also available from the SRF website to accompany this report. Further details about the SRF project are available at: http://www.csrf.ac.uk/

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1. Background

The kerb is the raised edge of the footway (also known as the pavement and sidewalk) where it meets the carriageway (also known as the roadway). ‘Kerb’ is defined in the Oxford English Dictionary as “an edging of stone or the like, bordering a raised path, side-walk, or pavement” with its first recorded usage in this context in 1807 (Oxford English Dictionary, 2022). Kerbs were used in cities in ancient Rome and can be seen in situ to this day in Pompeii (Poehler, 2017). In 13th century England, Henry III introduced permission for town officials to apply for the right to apply pavage tolls. The toll was levied on goods entering and leaving the urban area, and the revenue raised was to be used for surfacing and repairing roads. This was intended to improve trade between and within towns. Prior to this date, it would appear that it was the obligation of towns to pave and maintain their roads. The earliest recorded granting of the right to raise pavage tolls was to the town of Beverley in Yorkshire in 1249. One hundred towns received pavage grants between 1249 and 1477 with these grants having a duration of between one year and indefinitely. Records from the 14th century also show Londoners leaving money in their wills for road surfacing (Edwards, 2012).

In 1280, King Edward I ordered that each alderman in the City of London elect four men to maintain the streets. They were responsible for repairing, lowering, or raising the pavements, and keeping dung off the streets. By 1302, the first reference is made to the office of Pavior, which indicates that this role was specifically concerned with street repair rather than cleaning (Welch, 1932). During the 14th century some workers who had been elected by the aldermen to clean and repair the streets in the City of London were given the title of Scavenger. Both these Pavior and Scavenger roles existed throughout the 14th and 15th centuries (Harvey, 2012). However, these paved streets in the medieval City of London were often in poor condition, and kerbs were not used in at this time, with the carriageway and footway at the same height and not distinguished from one another and lined with houses and market stalls. The kerb and raised footway in urban areas did not exist in this country until the 18th century, with pedestrians, horses, carts, coaches and market stalls sharing the same space and surface prior to this. In 1750, the wealthy residents of Micklegate in York obtained permission to erect bollards to cordon off a two-foot wide space for pedestrians to improve road safety (Allen and Evans, 2016).

The improvement of London’s roads came about as a result of the long-standing rivalries between the Cities of Westminster and London for pre-eminence in the 18th century, one aspect of which was their efforts to outdo each other in terms of modernisation and beautification of the appearance of their streets. Roads at this time were in a very poor state of repair and traders were complaining about how this was affecting their businesses. In 1762, the Westminster Paving Act and its later amendments, “established an entirely new framework for paving, cleansing and lighting the streets west of Temple Bar” (White, 2010, p. 18). This Act established a paving commission and a parliamentary grant which replaced individual property owners having responsibility for carriageway and footway improvements. “Carriageways were laid in flat stone and kennels (gutters) moved from the centre to the edges; footways were raised above the level of the roadway and evenly paved” (White, 2010, p.18)

An Act of Parliament in 1766 (London Paving and Lighting Act) allowed the City of London to establish a Paving Commission, and to commence carriageway and footway works at a great pace. As in Westminster, the specification was for channels on each side of the carriageway (which was to be paved in granite setts rather than cobbles and cambered to allow water to drain into the kerbed side channels). Footways were to be raised above the carriageway and paved with Purbeck stone and separated from the carriageways by kerbstones (City of London Corporation, 2005).

Similar Acts were passed to improve carriageways and footways in Southwark in 1766 in Middlesex parishes in 1770, and in other urban areas in the UK in subsequent years. Together with these changes in how roads were maintained and the addition of paved footways, street lighting, street naming and house numbering also emerged at this time with these Acts. As a result, kerbs became increasingly commonplace in towns and cities as footways were raised and poor carriageway surfaces were replaced with granite setts, macadam, wood, and, later, asphalt surfaces.

These kerbs form the demarcation between the footway and the carriageway (roadway) and provide structural support to retain paving stones (or whatever material is made for the footway) in place. Kerbs also discourage drivers from parking or driving on the pavement and thereby damaging it. They also help reduce the incidence of vehicles mounting the pavement and otherwise coming into contact with, and injuring, pedestrians. Kerbs also act as a warning sign for sighted pedestrians that they are about to step into a roadway. However, they also present accessibility difficulties for footway and roadway users with disabilities. Kerbs also assist in directing rainwater and into drains located in the gutter.

Prior to the use of kerbs in urban areas in Britain, wooden and sometime metal bollards had been used in some locations to separate pedestrians from horses and carriages and thereby reduce collisions between them. Such collisions had high fatality rates due to the infections they resulted in and the lack of widespread availability of antiseptic and antibiotic medicine until the late 19^{th} and early 20^{th} centuries, respectively.

The kerbside is a much used public space. An inventory compiled by one central London borough showed that it is used for forty different types of transport-related users, including various vehicle parking bays, bus lanes and bus stops, cycle and pedestrian schemes. In addition, kerbsides marked with yellow lines are used for car drivers for waiting and dropping off passengers and by goods vehicles for loading and unloading. The carriageway side of the kerb is subject to many markings to designate these different vehicle activities. In addition to these vehicle-related activities, the footway side of the kerb is also put to many other uses including signage, road markings, pedestrian crossing points, drop kerbs, cycle parking, bus shelters, traffic lights, control boxes, speed cameras, street lighting, and a wide range of street furniture for safety, communications and commerce including railings, bollards, grit boxes, advertising hoardings, telegraph poles, post boxes, telephone and Wi-Fi boxes, litter bins, seating, trees, planters and hanging baskets.

A study has documented a list of at least 160 legitimate current transport and place-based activities and functions that require kerbside space. It also noted that there is not sufficient space to meet all of these competing demands and that these demands “are likely to intensify as home deliveries increase, the weather becomes more extreme and more electric vehicles require charging” (Urban Movement, 2022).

The use of the kerbside for vehicle and other activities changes over time as a result of allocation decisions by policy makers, as well as commercial and technological developments. This can take place gradually or rapidly. Examples of the latter include the provision of footway and carriageway kerbside space for chairs and tables to permit dining and drinking at restaurants and pubs during the Covid-19 pandemic. Similarly, it has been announced that the number of public telephone boxes at the kerbside in the UK will be reduced from 21,000 to 5,000 boxes due to increases in mobile phone ownership and the related fall in public telephone box usage (Ofcom, 2021). At one time there were approximately 70,000 public telephone boxes at the kerbside, many of which have already been decommissioned and removed. However, local authorities that have wanted to retain these iconic boxes how been able to purchase these from BT for a nominal £1 and adapt it for another use. Approximately 6,000 former telephone boxes at the kerbside have been converted to different uses, including community libraries, book exchanges, min art galleries, takeaway coffee shops, mobile phone chargers, and to house defibrillators as part of this scheme (Ofcom, 2021).

'Street furniture', the wide range of extraneous items that are placed at the kerbside and on footways, can have an important role in facilitating the use of the carriageway and in supporting functions such as seating. However, guidance to local authority transport planners and designers informs them, that, "in recent years there has been increasing concern that excessive and poorly-planned and maintained street furniture is seriously degrading the quality of the local environment….Designers should start from a position of having no street furniture and only introduce these elements when they serve a clear function…Street furniture should be laid out so that pedestrian routes along and across the street are kept clear" (Chartered Institute of Highways and Transportation, 2010, p.83).

The kerb is of great importance to urban road freight transport operations, being the place where the vast majority of vehicle deliveries and collections take place from. Drivers stop their goods vehicles at the kerbside to carry out these activities and, from here, these drivers unload/load their vehicles and convey goods between them and the point of delivery/collection. In this sense, the kerbside is a place of work for these drivers and their vehicles. In relation to street furniture and freight transport loading/unloading at the kerbside, Transport for London has noted that, "bollards, pedestrian railings…and other kerbside street furniture (utility cabins, bins, signs) can deter and hinder loading activity and should therefore not be placed alongside lengths of kerb where loading is to be encouraged", specifically noting in relation to bollards that they, "can impede reasonable movement by vehicles….They can also interfere with the transfer of goods to the surface and their movement using manual handling aids. In particular, pallets will be impeded by bollards placed too close together. The same principles apply to other common street furniture and statutory undertakers' equipment. Examples include signposts, post boxes, phone boxes, utilities boxes, benches, refuse bins, Santander cycles (cycle hire scheme) and motorcycle parking (Transport for London, 2017a, p.41).

The provision of suitable and adequate kerbside space for goods delivery and collection has long been overlooked in the UK. Instead, a system was put in place allowing such activity to take place at the kerbside as long as no restriction banning it at specific times or at all times was in force. In more recent times, in some instances specific loading bays are provided (either dedicated for this purpose or sometimes shared with disabled parking facilities), but these remain relatively uncommon.

2. Decriminalisation of parking enforcement and Penalty Charge Notices in the UK

Over the last thirty years, the foremost kerbside issue occupying the focus of the freight transport industry in the UK has been the issuing of Penalty Charge Notices (PCNs) by local authorities for infringements of their parking and loading regulations. The issuing of these PCNs by local authorities was made possible by the Road Traffic Act 1991 which permitted decriminalised parking enforcement. This civil approach to parking enforcement was first introduced in London in 1993 and has subsequently been adopted by the vast majority of local authorities throughout the country. Prior to 1993 the enforcement of parking regulations was carried out by the police under criminal legislation. Upon gaining these powers, local authorities became able to enforce their own traffic regulations (British Parking Association, 2004).

In many cases, local authorities with decriminalised powers for parking enforcement increased the amount of kerbside parking space to cope with the demand for car parking, thereby reducing the length of yellow lines available for loading and unloading by freight vehicles at the kerbside. In addition, these authorities substantially increased their enforcement activities. This appears to have resulted in a substantial increase in the issuing of PCNs to goods vehicles, leading to additional costs for the freight industry, together with the expending of much time and effort in challenging those PCNs that had been incorrectly issued (House of Commons Transport Select Committee, 2006a).

Survey work carried out by the Freight Transport Association and presented at a House of Commons Transport Committee hearing into parking enforcement showed that respondent member companies operating in London were issued with PCNs with a total value of £800,000 in the year prior to the 2002 survey. A subsequent survey in early 2004 showed that respondents had experienced a 75% increase in the number of PCNs issued over the previous twelve months, together with a 140% increase in the administration costs of dealing with fines and appeals. The vast majority of these PCNs were received by members in the boroughs of Camden, Westminster, Kensington and Chelsea, the City of London, Hammersmith and Fulham and from Transport for London on its strategic route network. Respondents cited the following top five reasons for PCNs being issued to their companies: kerbside parking restrictions in force, inflexibility of parking enforcement officers, lack of kerbside loading/unloading provision at delivery location where vehicle needed to stop, delivery being made on a Red Route, and the kerbside loading space already being occupied (by cars or other goods vehicles) (Freight Transport Association, 2005). The Association of International Couriers and Express Services reported that its member experienced a doubling in PCNs issued in London between 2002 and 2004, without any changes to their operations (AICES, 2005). The Brewery Logistics Group reported that PCNs issued in the City of Westminster alone in 2004 were costing its nine member companies approximately £650,000 (Brewery Logistics Group, 2005). The vast majority of the PCNs issued in London were incurred in central London and were issued by the boroughs of Camden, Westminster, the City of London and Transport for London on its strategic road network – these being the busiest and most restrictive locations in terms of parking enforcement. Research carried out by the Freight Transport Association highlighted differences in the way in which parking enforcement with respect to loading and unloading and observation periods, were enforced in different London boroughs (Freight Transport Association, 2004).

Further survey work by the Freight Transport Association among its members in 2013 showed that between 2009 and 2012 the total number of PCNs they had received rose by approximately 50% over this period. Much of this increase took place in urban areas outside London that had more recently acquired civil parking enforcement powers under the decriminalisation legislation. Data for London showed that over this period PCNs issued there had risen by only approximately 2%. However, in absolute terms, central London still accounted for the approximately 60% of all the PCNs respondents had received (Freight Transport Association, 2013).

The operational problems and costs experienced by the road freight industry as a result of decriminalised parking enforcement eventually led to the freight transport industry initiating joint efforts with policy makers to improve the guidance to, and training of, parking attendants to reduce the occurrence of incorrectly issued PCNs, together with guidance to goods vehicle operators and drivers to comply with the extant traffic regulations through both publications and a video. The freight transport industry took these actions due to (for example, see Anon, 2009; Freight Transport Association, n.d., 2005; London Assembly, 2005; Transport for London 2014).

The Brewery Logistics Group and Freight Transport Association worked closely with the City of Westminster and in so doing PCNs issued to Brewery Logistics Group members reduced from £650,000 in 2004 to £200,000 in 2005 (Brewery Logistics Group, 2005; Westminster City Council, 2013 – see **section 8.2** for further details of this joint working between the freight transport industry and Westminster). Whilst this joint working has helped to reduce the incorrect issuing of PCNs and driver non-compliance with regulations, issues concerning transparency of observation periods applied by some urban authorities to goods vehicles prior to issuing PCNs and lack of standardisation in these observation periods persist.

In its inquiry into parking and parking enforcement, the House of Commons Transport Select Committee noted that, "there are currently no universally accepted definitions of 'loading' and 'unloading'". The Committee called on the UK Government to clarify these definitions and to, "take the lead on clearing up the confusion through consultation with the haulage industry, police, residents, and local authorities. That definition must elucidate precisely what activities are covered. Once arrived at it should be widely publicised in the Department's guidance and by local authorities and applied consistently across the country. Clearer guidance on a standardised 'observation period' (used by parking attendants to confirm loading and unloading activity) would also be helpful" (House of Commons Transport Select Committee, 2006a, p.58). In response, the UK Government declined to take these actions, saying that, "loading/unloading is not defined in primary legislation but there is a good deal of case law. Loading and unloading should be a continuous operation and it should be obvious to a CEO (civil enforcement officer) that the vehicle is engaged in legitimate loading and unloading and that the goods are either too big or too heavy to be carried for any distance" (House of Commons Transport Committee, 2006b).

Together with the parking regime in place and the extent to which such restrictions are enforced, the PCNs issued to goods vehicles are an indicator of the difficulty freight transport operators experience in finding suitable, legal kerbside stopping space sufficiently close to the business and residential addresses which they have to serve.

At the same time as the freight transport industry has sought to engage with national and local government about the issuing on PCNs and how civil enforcement of loading/unloading at the kerbside can be better managed, kerb space management and allocation has also been changing. The following chapters of this report focus on this issue, its impacts on road freight transport operations and the provision of goods and services that it supports, research into freight transport kerbside requirements, and how freight considerations should be better taken account of by policy makers in their kerb strategies and management.

3. Transport strategy and policy in relation kerbside space management and allocation in the UK

Over recent decades, the perspective of policy makers in national and urban government in the UK cities has moved from: i) a ‘Car-oriented city’ (based on road building, car parking and low-density development) to ii) a ‘Sustainable mobility city’ (based on public transport, cycle networks and road space reallocation) and iii) a ‘City of Place’ (the importance of public realm, street activities, traffic restraint and mixed use developments). This change has come about due to policy maker objectives concerning air quality, greenhouse gas emissions, road safety, health and fitness, noise disturbance and the attractiveness and competitiveness of place (Cooper et al., 2019; Jones, 2018).

A landmark document in this policy shift was the UK Government’s 1998 White Paper on the Future of Transport. It marked a major change in the approach taken by previous UK Governments, setting out the new approach to transport in order to tackle road traffic congestion, climate change and pollution. The strategy focused on achieving modal shift from cars to public transport, walking and cycling. It announced the Government’s plans to introduce cleaner, more reliable bus services, increasing bus lanes and enforcing them. Cycling was to be increased through improving its safety and convenience by adapting existing road space to provide more cycle facilities (i.e. cycle lanes), making changes to junctions and roundabouts in favour of cyclists, applying speed restraint to motorised vehicles, and increasing the provision of secure cycle parking. The Government adopted a target of doubling the amount of cycling by 2002 and doubling it again by 2012. Walking was to be made more attractive and safer through reallocating road space to pedestrians, through wider pavements and pedestrianisation, providing more direct, convenient routes and more pedestrian crossings, reduced waiting times for pedestrians at traffic signals (Department of the Environment, Transport and the Regions, 1998).

In reviewing this White Paper, the House of Commons Select Committee on Environment, Transport and Regional Affairs supported the reallocation of road space to promote bus travel, walking and cycling instead of car use, stating that it felt that the “White Paper does not give it sufficient emphasis” (House of Commons Select Committee on Environment, Transport and Regional Affairs, 1999).

This White Paper set the tone for national, regional and local transport policy in the UK ever since. Over the 23 years since its publication, ever-greater emphasis has been placed on increasing active travel (public transport, bus and cycling) and the changes to street and kerbside infrastructure required to achieve this through policy documents, street design guides and policy maker actions. While these policies sought to discourage car use and achieve modal shift of these drivers and passengers to cleaner, more sustainable travel, they had relatively little to say about the implications and impacts of these infrastructure implementations and road space reallocation to freight transport operations. When road freight transport was referred to although its importance to the economy has acknowledged, it was viewed, along with the car, as a contributor to the road congestion, climate change and pollution problem. It was therefore argued by the UK Government that, like car use, road freight transport operations needed to be reduced. The White Paper targeted, “the revival of rail freight” and the need for “sustainable distribution” by road in towns and cities which was to be achieved through greater operational efficiency and the use of cleaner, quieter goods vehicles (Department of the Environment, Transport and the Regions, 1998).

Neither the White Paper nor its so-called daughter document entitled, ‘Sustainable Distribution: A Strategy’ (which stated that there was, “no practical alternative to the lorry and van for urban collections and deliveries - at least in the medium term”) considered or discussed the implications of these changes to urban roads for freight transport operations (Department of the Environment, Transport and the Regions, 1998, 1999).

National design guidance for local streets produced since this 1998 White Paper has failed to explain the kerbside needs of the freight sector to transport planners and to suggest appropriate provision to accommodate these needs. For instance, in relation to freight vehicles, the otherwise ground-breaking 144-page 'Manual for Streets', produced for the UK Government by consultants in 2007, manages to mention only that residential street design should take account of "delivery vans and lorries, needing less frequent access" (Department for Transport and Department for Communities and Local Governments, 2007). Similarly, the follow-up, 'Manual for Streets 2' written by the Chartered Institution of Highways and Transportation (CIHT) with the input of Department for Transport, practitioners, engineers, planners and urban designers, which was a companion guide intended to provide more detailed guidance and its application especially in relation to busier streets including high streets and non-trunk roads, only expands on its predecessor by including four sentences on the need for on-street loading bays in some situations, especially, "where commercial premises can only be accessed from the front" (Chartered Institute of Highways and Transportation, 2010, p.82). These guides were intended to be used by everyone involved in street design, management and maintenance.

Local Transport Notes issued by the Department for Transport to provide detailed guidance to local authorities and other practitioners designing local streets have similarly provided little if any guidance in relation to road freight transport and its loading and unloading needs. For instance, the note on mixed priority routes only refers to the "rationalisation and improvement of the parking and loading arrangements" as an important approach in their design, the note on traffic management and streetscape makes no mention of freight transport or unloading, and the recent note on cycling infrastructure design only mentions that, "[cycling infrastructure] designs should identify and reduce conflict with Heavy Goods Vehicles", that goods being delivered need to be conveyed across segregated cycle lanes, and that cargo cycles use raises the challenges of suitable convenient locations for micro-consolidation hubs and the accommodation of these larger cycles on cycle infrastructure" (Department for Transport, 2008a; 2008b; 2020a).

In 2018, the UK Government set up the independent 'Building Better, Building Beautiful Commission' to produce a report on the design quality of homes and places. Its objectives were to promote better design and style of homes, settlements and streets, to explore how this can be achieved with community consent, and how the planning system can support such developments (UK Government, 2018). In its 2020 report, the Commission argued that the greatest challenge "is to change the model of development from 'building units' to 'making places'" (Building Better, Building Beautiful Commission, 2020, p.4). It stated that the 'most evident factor' behind negative changes in our settlement and building design was the rise of the car and the roads and parking spaces built to support it. The report goes on, "this required that the street must be adapted to the car, not the car to the street, reflecting the principle that the primary purpose of the street is as a conduit, rather than a place to be" (Building Better, Building Beautiful Commission, 2020, p.13). The ensuing development, it argues, deterred people from walking. As one of its recommendation, the Commission puts forward that there, "is an important need to update and improve the government's guidance on street design (known as Manual for Streets)…. Manual for Streets 1 (2007) and Manual for Streets 2 (2010) should be brought together into one combined manual ('Policy Proposition 28: create healthy streets for people', Building Better, Building Beautiful Commission, 2020, p.103). Nowhere in its report does the Commission refer to the goods and services necessary for the quality of life that it proposes for people, nor the loading and unloading on streets that this requires.

Parking guidance produced by professional transport bodies and organisations have, similarly, had relatively little to say about on-street loading/unloading in terms of the needs of freight operations and provision of suitable facilities for this. For instance, the 188-page guidance document on parking strategies and management published by the Chartered Institution of

Highways and Transportation (CIHT) includes only half a page on the loading/unloading needs of businesses and one page on the provision of on-street loading (Chartered Institution of Highways and Transportation, 2005), while the 118-page report published by the RAC Foundation only contains eight references to the term "loading" (Bates and Leibling, 2012).

According to another recent report, "Views on the street are shifting; these spaces are no longer being considered as a means of travel, but places that people can use and enjoy" (Cross River Partnership, 2020). The 'Healthy Streets Approach' has been developed by researcher Lucy Saunders as, "a human-centred framework for embedding public health in transport, public realm and planning" (Healthy Streets, 2021). This approach is based on ten 'Healthy Streets Indicators', each of which describes, "an aspect of the human experience of being on streets. These ten must be prioritised and balanced to improve social, economic and environmental sustainability through how streets are designed and managed" (Healthy Streets, 2021). These ten indicators are:

- Everyone feels welcome
- Easy to cross
- Shade & shelter
- Places to stop & rest
- Not too noisy
- People choose to walk & cycle
- People feel safe
- Things to see & do
- People feel relaxed
- Clean air

An urban designer who is an advocate of active travel, the needs of pedestrians especially those with disabilities and the importance of local places for community and recreational activities has argued that in the 19th century urban design was based on health considerations of those living there. However, this changed in the early 20th century with urban design increasingly dominated by the requirements of motorised vehicles rather than by the needs of residents and that since the mid-20th century heavy goods vehicles (HGVs) have become foremost in urban design decisions (Huxford, 2021). They point to 'Roads in Urban Areas' published in by the Ministry of Transport in 1966 which included recommendations for tracking and swept path analysis to ensure HGVs could be accommodated in urban locations, which was subsequently picked up on vehicle- and HGV-centric design in the 'Manual for Streets' and in Scotland in 'Designing Streets'. This has led they argue to an approach in which considerations about accommodating vehicles takes precedence in urban design rather than starting with buildings which are laid out to create a sense of place, which are then reinforced with a kerbline, and only then checking for accommodating vehicles and their movement (Ministry of Transport, 1966; Department for Transport and Department for Communities and Local Governments, 2007; Scottish Government, 2010).

They make a similar argument for waste management with urban design starting by efforts to accommodate large waste collection vehicles and waste bins which are placed on public streets for collection, and which can present a hazard to pedestrians using the footway, especially if they have sight problems, rather than starting urban design with these vulnerable road and footway users in mind (Huxford, 2021). A similar argument is made by the deputy director of Create Streets, a social enterprise that focuses on "the low quality of too much recent development and of irrational decision-making" that researches the links between urban form and wellbeing, health sustainability, value and popularity (Create Streets, 2020). He argues that "many local authorities have standards stating that bin collectors must be able to pick up rubbish without walking more than a few metres…..this results in a number of unwanted outcomes, firstly, large unsightly and environmentally damaging asphalt turning areas are needed in almost every small side road; and secondly, underutilised dead spaces, which could be used for homes, are left on edges of developments. He goes on to also argue that “developments should place the human experience first. Instead we make a thousand tiny cuts to the quality of future places by requiring street widths and designs on behalf of large bin-lorries and commercial vehicles” (Milner, 2021). As an example of this, a guidance document from Cheltenham requires that, “all developments will need to cater for access by service vehicles of varying types, ranging from refuse collection vehicles to large articulated lorries” (Cheltenham Borough Council, 2012).

The Healthy Streets Approach has been adopted by the Mayor of London in his 2018 Transport Strategy (Mayor of London, 2018). Although provision of goods and services is fundamentally important to the health and wellbeing of those living and working in urban areas, the ten Healthy Street indicators make no reference to this aspect of street function or design, and instead refer only to how people interact with the street infrastructure and environment. Therefore, the loading and unloading activities that need to take place on streets to support people’s health and wellbeing is not discussed in the Healthy Streets Approach or included in its indicators.

The Freight and Servicing Action Plan, a daughter document to the Mayor’s Transport Strategy, notes that, “Our city is set to transform as we deliver our vision for Healthy Streets. Achieving this vision will significantly change the operating environment for freight and servicing vehicles by reallocating road space to walking, cycling and public transport. This reallocation of space is an essential part of achieving our aim for 80 per cent of personal trips to be made on foot, by cycling or using public transport” (Transport for London, 2019a, p.73). Transport for London has further stated that, “working with the freight and servicing operators and local businesses, we will consider the design and management of local access, off-street space for loading and on-street loading restrictions in the early design stages, to reduce the impact of freight and servicing on streets. Understanding the needs of deliveries and servicing vehicles is – and will continue to be – an important consideration in our and the boroughs’ transformational Healthy Streets schemes” (Transport for London, 2019a, p.121).

Transport for London has issued ‘Streetscape Guidance’ for planners and designers to use to, “set a high standard for the design of London’s streets and spaces by applying best practice design principles” (Transport for London, 2019b, p.1). This guidance reflects the Healthy Streets Approach. Its guidance on freight is limited to loading bay design issues.

In line with the recommendations of the Building Better, Building Beautiful Commission, the UK Department for Transport has commissioned the Chartered Institution of Highways and Transportation (CIHT) to develop a revised ‘Manual for Streets’ which will be published in 2022. This document will update the earlier guides published in 2007 and 2010 and will provide, “key guidance for anyone working in the highways and transportation sector” (CIHT, 2020). Although the two previous Manual for Streets already considered the street from the perspective of ‘place’ as well as ‘movement’ (i.e. transport), this revised version is likely to put even greater emphasis on their ‘place’ function, creating streets as healthy places for people including new uses such as leisure, dining and eating as well as considering streets from the perspective of active travel (i.e. walking and cycling) (Gibbons, 2020, 2021). In addition, this work is also reflected in the UK Government’s recently published National Model Design Code (which provides detailed guidance on the production of design codes, guides and policies to promote successful design) and National Planning Policy Framework (which sets out government's planning policies for England and how these are expected to be applied (Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government, 2021a; 2021b). Improving streets to reflect this relationship between place and movement has been referred to in many different ways in recent years including ‘better places, ‘streets for all’, ‘healthy streets’, ‘liveable streets’, ‘summer streets’, ‘lunchtime streets’, ‘twenty minute neighbourhoods’, ‘walkable neighbourhoods', 'home zones', 'low traffic neighbourhoods', 'mini-Hollands', and 'shared space'.

In 2020/21, during the Covid-19 pandemic, the UK Government made £220 million available to local authorities to reallocate road space and create dedicated cycling routes with over £100 million provided to Transport for London for its 'Streetspace' programme. This funding was supported by network management duty (NMD) statutory guidance to support local authorities in implementing cycling and walking schemes and guidance to local authorities on designing cycle infrastructure (Department for Transport, 2020a; 2021e). In May 2020, the UK Government also introduced changes to Traffic Regulation Orders (TROs), which are required to make and enforce changes to a road's use or its design, including the introduction of an emergency procedure for temporary orders and amendment to the usual publicity requirements for other types of orders. These changes to TROs could be used for the implementation of schemes that included installing cycling lanes, widening pavements, restricting certain roads to certain types of traffic, and changing parking and loading provisions reducing speed limits. The amendments included were, "intended to speed up the time it takes for highway authorities to make the traffic orders that are needed to put in place measures to deal with the effects of coronavirus, including the need to encourage social distancing and promote active travel, for example, walking and cycling" (Butcher, 2020; Department for Transport, 2020b; Mayor of London and Transport for London, 2020).

In 2020, the Department for Transport launched a public consultation requesting views on changes to the Highway Code. These proposed changes included: i) ensuring that those road users who can do the greatest harm have the greatest responsibility to reduce the danger or threat they may pose to others, ii) clarifying existing rules on pedestrian priority on pavements and when crossing the road, and iii) and establishing guidance on safe passing distances and speeds when overtaking cyclists or horse riders, and ensuring they have priority at junctions when travelling straight ahead (Department for Transport, 2020c). A large majority of the 21,000 respondents supported these changes. The revised Highway Code which creates a new 'hierarchy of road users' and gives greater cyclist and pedestrian priority at crossings and junctions received Parliamentary approval and came into force on 29 January 2022 (Department for Transport, 2021a; 2022a). The new road user hierarchy is (in order of importance):

i) pedestrians
ii) cyclists
iii) horse riders
iv) motorcyclists
v) cars/taxis
vi) vans/minibuses
vii) large passenger vehicles and heavy goods vehicles

The updated Highway Code clarifies that when pedestrians are crossing or waiting to cross at a junction, other traffic should give way and that if they have started crossing and traffic wants to turn into the road, the people crossing have priority and the traffic should give way. Cyclists should position themselves in the centre of their lane on quiet roads, in slower-moving traffic and at the approach to junctions or road narrowings, keeping at least 0.5 metres away from the kerb edge when riding on busy roads with vehicles moving faster than them. People driving motor vehicles when overtaking cyclists should leave at least 1.5 metres and when passing people walking in the road should leave at least 2 metres (6.5 feet) of space. The new updates to the Highway Code are presently advisory, so non-compliance will not result in a fine (Department for Transport, 2022a, 2022b).

In 2019, the UK Government published its future of mobility strategy for urban areas. It explains the approach that will be taken to harnessing emerging mobility technologies and services in cities in relation to urban mobility. The term 'kerbside' receives only one mention in report, "We will continue to recognise the two-way relationship between urban space and transport to help ensure that new modes and mobility models lead to improved outcomes. This will involve considering how urban infrastructure may need to adapt in the coming decades, from the better management of a potentially contested kerb space to the creation of landing pads to enable new aerial modes." The term 'freight' appears eleven times in the report, but on each occasion in relation to urban consolidation schemes; the report makes no mention of freight transport in relation to the kerbside (Department for Transport, 2019a).

In January 2022, UK Department for Transport announced the creation of a new executive agency, Active Travel England (ATE), as part of its commitment to increase cycling and walking in order to, "help deliver (its) priorities for a healthy, safe and carbon-neutral transport system. ATE is tasked with working to ensure that this takes place, and wider transport investment, is well spent, and will help raise the standard of cycling and walking infrastructure". ATE will perform several tasks on behalf of the UK Government. These include: (i) the management of the national active travel budget, awarding project funding and inspecting finished schemes, (ii) the inspection of and reporting on the performance of highway authorities on active travel and highway provision for cyclists and pedestrians, (iii) provide help to local authorities, training staff and spreading good practice in design, implementation and public engagement, (iv) being a statutory consultee on major planning applications to ensure that the largest new developments properly cater for pedestrians and cyclists. Chris Boardman, the former professional and Olympic Gold medal winning cyclist, has been appointed as the Active Travel Commissioner for England at ATE (Department for Transport, 2022c).

In 2021, the Cross River Partnership commissioned a project that was intended to provide a "vision for the future of street space in central London" for local authorities and landowners. It aimed to "build the case for the removal of unnecessary clutter on streets, integrate Healthy Streets Indicators as an intrinsic element of design, and provide the space and infrastructure for residents, businesses and visitors to travel sustainably to and from these destinations, in turn improving air quality, reducing congestion, and delivering on carbon emissions targets" (Cross River Partnership, 2021a). The work was based on a, "people first approach to street making". Various stakeholders were consulted as part of the engagement work and 'lived experience' interviews with individuals were carried out. Organisations providing views on the needs of freight transport included the Brewery Logistics Group, DHL and Logistics UK. The report contains a 'Logistics & Tech' section that notes the need for: i) "cohesive policies for freight and logistics across the London boroughs", ii) infrastructure provision to allow for safe deliveries, and iii) "wider understanding of importance of accommodating logistics as part of street space". However, the freight elements that are explicitly mentioned in the vision and toolkit provided in the report are: i) adopting digital kerb management technologies (for bookable kerb space), reallocating parking and loading space for alternative uses, iii) consideration of loading bays and parking space for different uses by time of day, and iv) making specific provisions for e-cargo and on-demand delivery (Cross River Partnership and NOOMA Studio, 2021).

In January 2022, Cross River Partnership published a guidance document on highway and footway accessibility in London that it had commissioned on behalf of Transport for London's Central London Sub Regional Transport Partnership and which had been carried out by the consultants DSDHA and David Bonnett Associates. This report, "reviews current and past policies and guidelines for London's streets, identifying gaps and latent opportunities for design-led solutions in light of contemporary conditions that have arisen from Covid-19. The demand for green and public spaces has increased over the course of the global pandemic, which itself has exposed challenges and opportunities in sustainability and equity. Although local authorities have stepped up with proactive and experimental temporary solutions to relieve the immediate pressures on highways and footways, these measures need to be analysed and appraised to inform adjustments and long-term solutions." The issues addressed by the report, "range from broader challenges, such as addressing modal conflict, female safety and devising 24-hour strategies for the public realm, to more specific issues, such as ensuring alternative crossings are safe for all, managing the increase of kerbside activity and designing inclusive cycle infrastructure readdress the issues and barriers faced by underrepresented user groups and those using non-standard cycles." Given the changes made to the Highway Code by the Department for Transport that place pedestrians at the top of the road hierarchy, the report, "sets out a shared vision for accessibility that exceeds minimum safety standards that is founded upon the belief that no matter what form of mobility we rely on or choose to use, we are all pedestrians and that by enhancing their safety and accessibility, we benefit all users of highways and footways. Children, the elderly, disabled people and/or with neurodiverse conditions are given particular attention across the study of different accessibility issues." (DSDHA and David Bonnett Associates, 2022). The report notes the modal conflicts and tensions that exist between different modes of transport and use on highways, footways and at the kerbside, some of which have arisen due to new modal trends (such as e-scooter use, alfresco dining and pocket parks. It also provides insight and guidance concerning 24-hour strategies, female safety, child friendly spaces, designing for neurodiversity, alternative road crossings, shared use, inclusive cycle infrastructure, and pavement clutter. Freight transport is only referred to in the report in relation to the impacts of its loading/unloading activity on pedestrians and other road users at the kerbside with advice for those responsible for street planning to consider with stakeholders the potential for delivery and servicing vehicle reduction and change such as consolidation schemes and delivery retiming, as well as the use of 'loading pads' ("often in the same or similar materiality to the main footway which can used by pedestrians in the absence of kerbside activity.to accommodate different modal demands throughout the day") (DSDHA and David Bonnett Associates, 2022).

In February 2022, Cross River Partnership published a report that examined the street alteration schemes put in place in seven cities around the world (Bogotá, Brussels, London, Melbourne, New York, Nairobi, and Seoul) in response to the Covid-19 pandemic (Cross River Partnership, 2022). The report reviewed the different schemes implemented, including the outcomes, challenges, funding, and future strategies of each city. Goods collection and delivery is on mentioned in relation to one of these seven cities (Seoul) and even then it only refers to the use of pavement robots for the instant delivery of food and drink ordered by individual residents. Otherwise the report focuses exclusively on active travel (cycling and walking) as well as the place-based functions of outdoor dining and parklets. The report provides five key learnings: (i) 1. 'push the boundaries' (i.e. be progressive and ambitious), (ii) 'strategy and funding' (focus on existing strategies and funding streams but also consider alternative plans and funding models), (iii) 'evidence based approach' ("the implementation and management of streetscape interventions should be based on clear quantitative and qualitative data", (iv) 'raising awareness for safety' (noting the importance of road safety in the schemes reviewed), and (v) 'collaborate for Healthy Streets' (emphasising the centrality of the Healthy Streets approach to thinking about street design and use) (Cross River Partnership, 2022). At the launch event for the report, the authors were asked about the lack of consideration of kerbside provision for freight transport deliveries and flows of goods and services in the report given their important contribution to a healthy, vital, and affordable city for all. The response focused on the importance of cargo cycles in future urban freight transport, without any acknowledgement of their carrying limitations for large quantities of goods as well individual bulky or heavy ones.

The only attempt to produce a kerbside management plan in the UK is that produced by the London borough of Southwark in 2017. It noted the importance of a well-managed kerbside in avoiding a "chaotic, dysfunctional and unsafe street that is unappealing to residents, businesses and visitors." However, only a draft version was produced and put out for consultation (London Borough of Southwark, 2017). Elements of this kerbside plan were incorporated into the local authority's Movement Plan (London Borough of Southwark, 2019).

The Department for Transport commissioned an unpublished study by Urban Movement in 2019 entitled 'Future Streets: Designing and Managing the Kerbside' which was intended to study existing and future use of the kerbside and develop a kerbside access strategy (reported on in Urban Movement, 2022 – see **section 10.4** for further discussion of its suggested approach).

In 2022, the Department for Transport also commissioned a study entitled 'Provision of Kerbside Management Discovery' which is being carried out by Deloitte with an expected completion date of 2023. This work is intended to carry out user-focused research "into the as-is, painpoints, and opportunities for the digitisation and re-purposing of the kerbside to support active travel/new forms of mobility and freight distribution/EVs/CAVs, and to consider the constraints of the current regulatory framework (TROs, traffic signing etc.)." The reporting is expected to provide, "expert recommendations for improved management are required reflecting both current and future kerbside needs, clearly identifying the role for local and central government" (Department for Transport, 2022d).

4. Developments in the provision and reallocation of kerbside space in the UK

This section reviews changes in the use of the kerbside in the UK for transport initiatives that have resulted from changes in government transport strategy and policy reviewed in **section 3**. Many of these developments in kerbside use have been adopted relatively recently. These changes impact on the ability of road freight operators to make kerbside deliveries to business and residential addresses in urban areas. London has tended to lead the way in many of these changes in kerbside use, so information about these schemes in the capital has been made use of. Subsections are provided below on:

- Bus lanes
- Cycle lanes
- Bike and e-scooter docking stations and cycle parking
- EV charging devices and charging spaces
- Car Clubs and their dedicated parking bays
- Parklets/pocket parks
- On-street dining during Covid-19
- Low Traffic Neighbourhoods and modal filters
- Pedestrianisation, low traffic streets and Mini-Hollands
- Streetscape schemes
- Red Routes
- Mobility/community hubs

4.1 Bus lanes

The first bus lanes in the UK were introduced in the 1960s (The Times, 1962; Weinstein Agrawal et al., 2012). Roll-out of bus lanes increased in London from the early 1970s on under the Greater London Council (GLC). By the time of the abolition of the GLC in 1986, London had 229 bus lanes (Weinstein Agrawal et al., 2012). The implementation of bus lanes in London has increased again since the introduction of the Mayor of London in 2000. By 2018, there were 290 kms of bus lanes in London, approximately 40% of which was managed by Transport for London and 60% by boroughs (RAC Foundation, 2018). Bus lane implementation has also been taking place in many other towns and cities in the UK. Department for Transport guidance recommends that, “loading in bus lanes should normally be prohibited unless there are special reasons why it should be allowed” (Department for Transport, 1997).

Figure 4.1: Bus Lane on Piccadilly, central London

Source: Chris Samson (https://www.flickr.com/photos/lodekka/3300266734/)

In 2020, prior to the onset of the Covid-19 pandemic, the UK Government announced £3bn of funding during the current Parliament to improve bus services outside London. The objective is to increase bus patronage usage by making bus services more frequent, more reliable, easier to use and better co-ordinated. It is hoped that these measures will make the bus an attractive alternative to car use. The aim is to mirror bus services in London in order to achieve this and thereby reduce traffic congestion, CO_2 and pollution emissions, and provide good quality transport services to people from less advantaged social groups and places as part of the Government's 'levelling-up agenda' (Department for Transport, 2021b). As part of this bus strategy, the Government expects "to see plans for bus lanes on any roads where there is a frequent bus service, congestion, and physical space to install one. Bus lanes should be full-time and as continuous as possible" (Department for Transport, 2021b, p.46). The strategy also notes that, "loading's impact on bus lanes must be minimised, and to achieve this hours should be restricted, or loading bays inset or re-provided close by, away from the main carriageway" (Department for Transport, 2021b, p.46).

Figure 4.2: Bus Lane on Walworth Road, Bermondsey, London

Source: Stephen McKay (https://www.geograph.org.uk/photo/949083)

This increase in bus investment and infrastructure comes after a long period of declining use of bus services in most parts of the country. Between 1985/6 and 2019/20, passenger bus journeys fell continuously everywhere except London, falling by 46% in Scotland, 44% in Wales and 46% in England outside of London. London was the only place where bus usage was higher in 2019/20 than in 1985/6 (by 82%) and even here, fell by 12% between 2013/4 and 2019/20 (calculated from data in Department for Transport, 2021c).

4.2 Cycle lanes

Cycle lanes and routes have been implemented in London and many other towns and cities in the UK in recent years in efforts to increase cycling and cycle safety, and more are continuing to be introduced. The majority of cycle lanes that have been implemented to date are unsegregated from other road vehicles. However to further improve cycling safety and encourage greater take-up among the public, efforts are being made to upgrade these, especially those located on busier roads.

Figure 4.3: Cycle lanes in London

Source: Felix O (https://commons.wikimedia.org/wiki/File:Mile_end_cycle_lane_2.jpg)

Source: The Lud (https://commons.wikimedia.org/wiki/File:Ludgate_Hill.jpg)

In 2020, the UK Government issued ‘Gear Change’, its cycling and walking strategy (Department for Transport, 2020d). The intention of the strategy is to rapidly and greatly increase cycling to help improve air quality, health and wellbeing, address climate change and inequalities, and tackle road congestion with a target of, “half of all journeys in towns and cities being cycled or walked by 2030” (Department for Transport, 2021d, p.12). The Government pledged to implement, “thousands of miles of safe, continuous, direct routes for cycling in towns and cities, physically separated from pedestrians and volume motor traffic” (Department for Transport, 2021d, p.16). It also stated its intention to introduce more ‘Mini-Hollands’ (segregated lanes on main urban roads) and to install more cycle racks in town and city centres. It also plans to carry out pilot schemes in one or two historic city centres that would involve “extensive bike lanes, a zero emission bus fleet, and a ban on nearly all petrol and diesel vehicles in the city centre, with deliveries made to consolidation hubs and the last mile being done by cargo bike or electric van” (Department for Transport, 2021d, p.46).

In ‘Gear Change: One Year On’, the UK Government reported that in 2020/21, during the Covid-19 pandemic, £220 million had been made available to local authorities to reallocate road space and create dedicated cycling routes with over £100 million provided to Transport for London for its Streetspace programme, and £2 million for funding for electric cargo bikes. It also announced that in 2021/22 increased funding of £438 million would be provided for cycle lanes, Low Traffic Neighbourhoods and school streets (Department for Transport, 2021d). This funding was supported by network management duty (NMD) statutory guidance to support local authorities in implementing cycling and walking schemes and guidance to local authorities on designing cycle infrastructure (Department for Transport, 2020a; 2021e). In addition, a national e-cycle pilot programme and e-scooter trial have also been announced (Department for Transport, 2019b; 2020d).

The Mayor’s Transport Strategy of 2018 contains several targets for active travel in London (Mayor of London, 2018):

i) Eighty per cent of journeys will be made by walking, cycling and public transport by 2041,
ii) All Londoners will achieve 20 minutes of active travel each day by 2041,

iii) Seventy per cent of Londoners will live within 400 metres of the London-wide cycle network by 2041,
iv) Prioritisation of space efficient modes of transport to tackle congestion and improve the efficiency of streets for the movement of people and goods, with the aim of reducing overall traffic levels by 10-15 percent by 2041,
v) Reduce the number of lorries and vans entering central London in the morning peak (07:00-10:00) by 10 per cent by 2026,
vi) Reduce emissions – in particular diesel emissions – from vehicles on London's streets, to improve air quality and support London through various measures,
vii) Make London's transport network zero emission by 2050.

In London, the promotion of cycling and the implementation of cycling infrastructure led to cycling levels rising by approximately 6% between 2000 and 2017, compared with no change in cycling levels nationally (Mayor of London and Transport for London, 2018). As an interim target, the Mayor's intention is to almost double the number of cycle trips made every day in London (from 0.7 million in 2017 to 1.3 million in 2024) (Mayor of London and Transport for London, 2018). In 2016, there were 53km of cycle lanes in London, by early 2020, prior to the onset of the Covid-19 pandemic, this had increased to 162km of cycle lanes that were either complete or under construction (Transport for London, 2020a). Approximately 100km of new or upgraded cycle routes were delivered or are under construction in London since the start of the Covid-19 pandemic in March 2020. Construction work began in March 2021 on new or upgraded cycle infrastructure for four new routes which will add a further 8km to London's cycle network. The Mayor of London has therefore implemented a further 270km of cycle routes in the capital between 2016 and 2021 (Mayor of London and Transport for London, 2021). In 2019, it was announced that London cycle network would "grow more than three-fold over the next five years (i.e. by 2024), with investment in over 450km of new cycle routes" (Transport for London, 2019c, p.20). Three Mini-Holland programmes have also been implemented in Enfield, Waltham Forest and Kingston (Transport for London, 2020a). During the Covid-19 pandemic, the London Streetspace programme was launched to quickly add to the strategic cycling network using temporary materials, with the intention of reducing crowding on public transport services. This included making changes to town centres in London to ensure safe cycling and walking (Mayor of London and Transport for London, 2021).

4.3 Cycle and e-scooter docking stations and cycle parking

Bike sharing schemes in the UK were first launched in London in 2010, with Transport for London's Cycle Hire scheme in partnership with Santander. Other providers have since also commenced services in London. Similar schemes have since been launched in other UK cities and there are currently a total of approximately 18,000 such bikes available in the UK (CoMoUK, 2021).

Figure 4.4: Transport for London hire cycle docking station in Southwark

Source: Steven Craven (https://www.geograph.org.uk/photo/1974553)

While some of these hire schemes use dockless bikes, others such as the Santander scheme in London use docking stations, especially in central and inner urban locations, which use kerbside space. There are currently approximately 12,000 Santander cycles in London and 800 docking stations (Transport for London, 2021a). In 2021, Transport for London announced it would increase the Santander cycle hire fleet by 15% to 14,000 (Mayor of London and Transport for London, 2021a). Experiments have also been taking place in London with pop-up docking stations and different ways of parking bikes (Mayor of London and Transport for London, 2018).

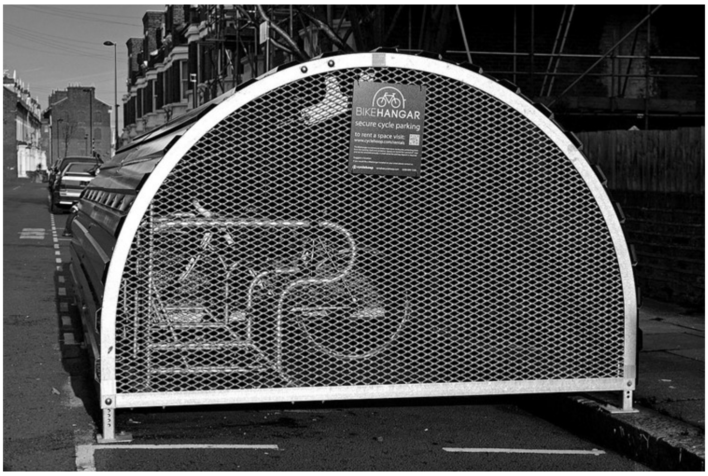
In 2020, during the Covid-19 pandemic, the Department for Transport launched and fast-tracked e-scooter rental trials for local authorities in the UK with the intention, “to support a ‘green’ restart of local travel and help mitigate reduced public transport capacity….E-scooters offer the potential for fast, clean and inexpensive travel that can also help ease the burden on transport networks and allow for social distancing” (Department for Transport, 2020e). Local authorities had to bid to the Department for Transport to be part of this 12-month e-scooter trial. These trials can make use of short term e-scooters hire that uses on-street docking stations or dockless schemes, and long-term lease arrangements. Some of these e-scooter trails therefore provide on-street docking stations or parking bays, similar to those provided in London for the Santander cycle hire scheme, using kerbside space.

Figure 4.5: E-scooter hire docking station in Marylebone, London

These e-scooter trials are taking place in more than 30 locations in the UK. An e-scooter trial commenced in London in June 2021, run by Transport for London and London Councils. Ten boroughs initially signed up to take part with more expected to join over time. The scooters are provided by three operators, Dott, Lime and TIER. Initially, 60-150 e-scooters are available for hire in each borough. Each e-scooter must be parked in a designated e-scooter parking bay to end the hire period, with this enforced using geofencing (Transport for London, 2021b, 2021c).

In 2019, Transport for London launched London's first-ever Cycle Parking Implementation Plan as a means by which to further encourage cycling. The vision included in this plan for cycle parking is a long-term one, and will be achieved through, "a step change in how cycle parking is valued and prioritised by organisations and decision-makers across London" (Transport for London, 2019c, p.6). In 2018, there were approximately 145,000 cycle parking spaces on London streets, spread across approximately 23,500 locations, with greater provision in inner than outer London. In addition, there were also 21,000 Cycle Hire spaces at the Santander docking stations. Transport for London research indicates that, "a minimum of 36,000 additional on-street spaces is needed to meet current demand" and that "by 2025, we estimate that a further 12,000 on-street cycle parking spaces will be required across London on top of the 36,000 needed today (Transport for London, 2019c, p.14). In 2020, Transport for London announced that it was working with London boroughs to increase the provision of cycle parking for non-hired bicycles with 7,800 new parking spaces committed with £3.5 million of investment which would be provided to thirty boroughs in central, inner and outer London to create these cycle spaces in town centres, stations, schools and residential areas (Transport for London, 2020b). As part of the plan, Transport for London has a target to provide 20 cycle parking spaces at every tube and rail station outside Zone 1 to encourage commuters to cycle to their local station rather than use a car (Transport for London, 2019c). This is the initial investment to meet the shortfall in cycle parking in London.

Figure 4.6: Cycle shelter in residential street, Lambeth, London



Source: George Rex
(https://upload.wikimedia.org/wikipedia/commons/b/bc/Bike_Hangar_SW2_%2823699469465%29.jpg)

During the Covid-19 pandemic, Transport for London provided approximately 19,000 square metres of additional space for walking and cycling, and added, "an initial 1,000 extra cycle parking spaces across London, focused around busy areas like high streets and transport hubs" (Mayor of London and Transport for London, 2021a).

4.4 Electric vehicle charging devices and charging spaces

A total of approximately 26,000 public electric vehicle (EV) charging devices had been installed in 16,000 locations in the UK by October 2021, of which about 20% were rapid chargers (i.e. 43kW or greater) (Zap-Map, 2021). In April 2021, about 7,000 of these public electric vehicle charging devices had been installed in London (Mayor of London and Transport for London, 2021a). This equates to approximately 37 public charging devices per 100,000 of population in Britain in 2021 (Zap-Map data provided by Department for Transport and Office for Zero Emission Vehicles, 2021). It should be noted that not all these public charging devices are located at the kerbside, some are in car parks and other locations – as of March 2022, approximately 32% of these public charging devices were at the kerbside, 58% were in car parks, workplaces and other destinations, 7% were along the strategic road network, and 3% were at other locations including rail stations and airports (Department for Transport, 2022e).

Figure 4.7: Electric vehicle charging point and charging bay in London

Source: frankh (https://www.flickr.com/photos/f-r-a-n-k/359123912/sizes/o/)

Source: Philafrenzy (https://commons.wikimedia.org/wiki/File:Source_London_charging_point_East_Finchley.JPG)

Given that a total of 32 million cars and 4.4.vans were licensed in Britain at the end of June 2021 and only 528,000 (1.6%) of these cars and 22,000 (0.5%) of these vans were electrically-powered (either battery electric or plug-in hybrid), the number of public charging devices required in future as an increasing proportion of this vehicle parc switches to an electric power source will need to grow very substantially (Department for Transport, 2021f).

The number of newly registered electric cars in Britain increased by 303% in April-June 2021 compared with April-June 2020, and the number of newly registered electric vans in Britain increased by 307% between these same two periods (Department for Transport, 2021f). By comparison, since 2015 the annual rate of implementation of public charging devices in the UK has been between 40-60% per annum, however this fell to about 30% between 2020-21 due to the Covid-19 pandemic (calculated from Zap-Map data provided by Department for Transport and Office for Zero Emission Vehicles, 2021). This indicates that the rate of implementation of public charging devices is likely to need to accelerate rapidly to meet demand, resulting in further loss of kerbside space.

The Competition and Markets Authority reports that, “more than a quarter of drivers do not have access to a driveway or garage and cannot install a home chargepoint (over 8 million households)” (Competition and Markets Authority, 2021, p.8). The estimated proportion of UK households without off-street parking facilities ranges from 25% in one study, to 32% in another, 34% in another, to 35% in yet another (Cliff, 2020; Jennings et al., 2018; Nagler, 2021; Wills, 2020). The situation is far worse in urban areas, with 35-40% of households in Manchester, Edinburgh and Cardiff and 45-50% of households in London having no off-street space for their vehicles (Jennings et al., 2018; Nagler, 2021).

It has been pointed out that on-street charging at the kerbside will be more convenient, easier and cheaper for users than rapid charging en route at off-street charging hubs or at destinations. Kerbside charging is also said to have substantial benefits for the national grid, “as when EVs are plugged in they can help manage the intermittency of renewable energy sources by providing flexibility as well as smoothing demand” (Competition and Markets Authority, 2021, p.8). It has been calculated that the number of public EV charging points will need to increase approximately ten- to twenty-fold by 2030 (from the current level to 280,000-480,000) and that “and on-street charging at the kerbside…will be particularly important” (Competition and Markets Authority, 2021, p.5). It has been recommended that, “local authorities take a more active role in planning and managing the roll-out of on-street charging to maximise competition and protect local residents” and that, “governments take action to properly equip and incentivise LAs to drive forward roll-out, while also providing greater support and oversight” (Competition and Markets Authority, 2021, p.81).

The speed with which kerbside EV charging infrastructure is being implemented is hampered by several factors including a lack of planning in some local authorities to understand EV charging needs and requirements, the lack of a formal requirement for local authorities to oversee or support the delivery of EV charging, the lack of resources and funding available for local authorities for EV charging efforts, and the commercial case for private sector financing of charging infrastructure being very challenging due to the low EV parc at present. Another important factor is that some local authorities regard the switch the EVs as failing to address the need for lifestyle changes in transport activity, and incompatible with efforts to reduce car mileages and achieve modal shift to active travel (i.e. public transport, cycling and walking). In this view, providing EV charging infrastructure risks ‘locking in’ car use into the future and compromising these other policy objectives (Competition and Markets Authority, 2021; Local Government Association, 2021).

In its response to the Competition and Markets Authority and in the policy paper it published, the UK Government’s Department for Transport stated that its own analysis suggests that there will need to be minimum of 300,000 to around 700,000 public EV chargepoints in the UK by 2030 (a minimum of ten times the current number) by which time they expect there to be 10 million battery EV vehicles on the roads (Department for Transport, 2022e, 2022f). In London, The Mayor published estimates that by 2030, 43,000-92,000 public charging points will be required depending on EV vehicle uptake (compared with the current 7,000 public charging points in London (Mayor of London and Transport for London, 2022).

A research project commissioned by the Department for Transport into how best to accelerate the uptake of electric vehicles shortlisted 23 policy ideas felt to have the greatest potential impact (Reiner et al., 2020). Three of these ideas have direct relevance to the use of parking space: i) allowing EV users to have a chargepoint installed on the kerb-side outside their home, along with a private parking space adjacent to the chargepoint, ii) all EV parking/charging spaces to be painted green or otherwise made more distinct to make the benefits of EV use more obvious and salient, iii) making public (i.e. council car park) parking free of charge for EVs. While the third point relates to public car parks rather than the kerb it would have a potential impact on service vehicle drivers who use such facilities.

An alternative to the use of chargepoints that vehicles can be plugged into is wireless (also called inductive) charging. Such technology could allow vehicles to recharge without the need for plugging in. However, vehicles may still need to visit a specific location where such recharging can take place and in addition this technology is currently relatively immature and extremely expensive.

4.5 Car Clubs and their dedicated parking bays

Car clubs are car and van hire services that allow members to share vehicles and which are intended to reduce the level of vehicles required and private car ownership and make use of up-to-date vehicles, thereby supporting transport sustainability objectives of local authorities. Car clubs usually make use of dedicated on-street parking bays in the UK where these vehicles are parked when not in use, which are provided by local authorities.

Figure 4.8: Car club parking bay in Marylebone, central London

Source: David Hawgood (https://www.geograph.org.uk/photo/1388196)

Data shows that there were 6,060 car club vehicles in Britain in 2020 (of which almost 4,000 were in London). Approximately 90% of these vehicles were cars and 10% were vans. There were approximately 635,000 members, 230,000 of whom had used a vehicle in the previous 12 months (compared with approximately 190,000 in 2015). 10% of the car club fleet was battery electric and 22% was plug-in hybrid in 2020 (with the rest either petrol or diesel powered) (CoMoUK, 2020). In London, there are six car clubs (London Councils, 2020). The national car club fleet has grown from approximately 3,000 vehicles in 2015 (CoMoUK data in Wu et al, 2020).

4.6 Parklets/pocket parks

A parklet (sometimes also referred to as a 'pocket park') is "a temporary or permanent pavement extension that sits in existing parking bay(s). They usually act as a space for people to sit and rest, but can also include features such as bicycle parking, outdoor dining and local art or information. Temporary parklets can be a great route to delivering permanent installations as they can act as a trial for assessing the community and business response to the parklet" (Cross River Partnership, 2021b).

Parklets first began to be introduced in American cities from 2010 onwards. Evaluation of parklets in America indicates that a successful parklet needs to create an active, aesthetically pleasing, public space, with the provision of safe, comfortable seating that facilitates community interaction and includes the participation of local businesses (Brozen et al., 2019).

Figure 4.9: Parklet in San Francisco

Source: Mark Hogan (https://www.flickr.com/photos/markhogan/6343548530/)

The implementation of parklets in the UK reflects the concepts advocated in the ‘Healthy Streets Approach’ (Healthy Street, 2021). It has been suggested that London, “has only two thirds of the greenspace it needs for a population its size so we need to find more space for parks and playgrounds” (CPRE London, 2020, p.2). The conversion of parking space into parklets and play spaces has been proposed as a means by which this lack of green space can be increased (CPRE London, 2020). This former parking space can also be used to provide more seating for pedestrians (especially the elderly and mobility impaired), improve air quality, store and park bicycles, offer outdoor fitness and gym facilities, and support local economies (CRP, 2020; Loukaitou-Sideris et al., 2012).

Figure 4.10: Parklets in Hammersmith and Fulham, London

Source: Meristem Design in Cross River Partnership, 2020.

Source: Cyclehoop in Cross River Partnership, 2020.

Parklets can be accommodated on a single parking space but more they occupy two or three parking spaces, with dimension of 2 metres x 10-15 metres (CRP, 2020). The Covid-19 pandemic increased the level of UK Government support and funding provided to local authorities for parklets together with other transport interventions that supported walking and cycling at a safe distance (Department for Transport, 2021e).

4.7 On-street dining during the Covid-19 pandemic

During the Covid-19 pandemic, once pubs, bars, sit-down restaurants and cafes were allowed to reopen to serve customers drink and food outdoors in public areas, the UK Government provided increased support to help businesses obtain licences to place furniture on the highway. This was enabled through the Business and Planning Act 2020 which included a "temporary streamlined and cheaper route for businesses such as cafes, restaurants and bars to secure a licence to place furniture on the highway". In March 2021 the government announced this would be extended for a further 12 months". Where granted, these licences were permitted to remain in place for a year, up until 30 September 2022 (Department for Levelling Up, Housing and Communities, 2021c). These Covid-19 measures that supported on-street dining and drinking included (Department for Levelling Up, Housing and Communities, 2021d):

- Funding for local authorities to prepare for the safe reopening of high streets and other retail spaces including safety measures such as new signs, street markings and temporary barriers,
- Reducing the consultation period for applications for pavement licences from 28 calendar days to 5 working days and automatic deemed consent after 10 working days if the council does not issue a decision,
- Setting a lower application fee for a pavement licence of up to £100,
- Flexibility in the use of high street buildings (such as shops, restaurants, services (like banks), gyms, and offices) - allowing them to convert between commercial, business and service uses without needing planning permission.

Figure 4.11: On-street dining in St Johns Wood High Street, London

Such pavement dining was implemented in many towns and cities across the country with take-up greatest in large cities such as London, Birmingham, Bradford, Liverpool, Manchester and Newcastle. In addition to this seating, in some locations, there was also the suspension of parking and loading bays, the widening of pavements and the use of road barriers and street closures at certain times of day, with gazebos and umbrellas erected to provide shelter from rainfall for customers. This supported local businesses that had been greatly affected by lockdown and allowed customers to dine and drink out. However, it also led to complaints from some disabled people who struggled to navigate through the tables and chairs on the pavement and street, in some cases not being able to use certain routes at all, and from some residents, who complained of late night noise and anti-social behaviour (Butler, 2021). It also impacted road freight operators trying to make deliveries in some of these locations.

Westminster City Council supported approximately 900 business, bars and restaurants to provide outdoor dining with a total of 17,000 outdoor seats provided during the reopening after the initial Covid-19 lockdown in 2020. These were located in areas including Soho, Covent Garden, and St Johns Wood. The Council implemented parking and loading bay suspensions, and timed street closures to facilitate this (Westminster City Council, 2021a). The Council banned gazebos and umbrellas on roads in July 2021 and ended dining on public roads in Soho in September 2021. However, restaurants and cafes in Soho are still allowed to put seats and tables on pavements (Witts, 2021). Meanwhile, schemes in place in parts of Covent Garden, St. John's Wood, Pimlico, Eccleston, Elizabeth Street and North Audley Street (some of which involve timed street closures, while others involve footway widening and suspension of some parking and loading kerbside space), will continue in Westminster, following consultation exercises in which the vast majority of respondents supported these schemes (Westminster City Council, 2021b; 2021c). The Council is currently working with Soho's communities to design a vision for the area, "which will take into account movement and transport, resident amenity, business needs, the environment, and accessibility to design a holistic plan for the area" (Westminster City Council, 2021d).

In the background notes to the Queen's Speech in May 2022, the UK Government announced plans in the forthcoming Parliament to "ensuring everyone can continue to benefit from al fresco dining" (Prime Minister's Office, 2022). This suggests long-term UK Government support for on-street dining and drinking and the space implications that has for street space.

4.8 Low Traffic Neighbourhoods and modal filters

Low Traffic Neighbourhoods (LTNs) are traffic schemes implemented in residential neighbourhoods which seek to reduce through motor traffic from these streets by putting in place road closures for motor traffic through a range of approaches referred to as 'modal filters', including physical restrictions (such as the use of bollards and planters), one-way street systems with cycle contraflows, and/or camera-enforced Penalty Charge Notices for motor vehicles that attempt to travel through these roads. These schemes are intended to improve local air quality and increase levels of walking and cycling, thereby meeting health and wellbeing and environmental objectives.

Figure 4.12: Low Traffic Neighbourhood with modal filter in London

Source: Transport for London.

Following UK Government funding and support for active travel during the Covid-19 pandemic, many temporary LTNs were introduced in towns and cities around the country (Department for Transport, 2021e). During 2020, 89 LTNs were implemented across London boroughs, with 4% of the London population living within 500 metres of a new modal filter (Aldred et al., 2021; Mayor of London and Transport for London, 2021a).

LTNs introduced via temporary or experimental TROs during 2020, and therefore not requiring consultation, proved extremely controversial with some residents, taxi drivers and car users. This resulted in substantial negative media coverage, vandalism of some schemes and even legal challenges. Several local authorities have removed some or all of their LTNs due to the complaints received from residents (Walker, 2021).

Some critics have argued that LTNs lead to displacement of motor traffic onto surrounding roads outside the boundaries of the schemes as well as onto arterial roads. There has been insufficient analysis of these schemes to date to fully determine the validity of this argument, and the effects of Covid-19 restrictions on mobility and travel patterns need to ease before such analysis is able to provide helpful insight to address this issue.

For freight operators making deliveries in residential areas within LTNs, analysis has indicated that for vans and heavy goods vehicles travel distances and delivery times are likely to be greater than prior to the introduction of the LTN, due to the routeings that are necessary to access streets and properties within the LTN. The extent of the extra delivery time and distance depends on the layout of the LTN and the delivery activity that the driver has to carry out within LTNs as part of their daily operations. By comparison, whereas cargo cycles can make such deliveries without these time and distance penalties (Jessener, 2021).

4.9 Pedestrianisation, low traffic streets and Mini-Hollands

Pedestrianisation schemes in which retail and other city centre streets or sets of streets used by many workers, visitors and residents are designed for pedestrian-only often with level surfaces and landscaping and in which most or all motorised traffic is prohibited (i.e. cars, motorbikes, goods vehicles and buses - either during the working day or at all times) were designed into several New Towns built after the Second World War. The first of these was Stevenage New Town in 1946, followed by Basildon, Harlow and Hemel Hempstead. The bombed city centres of Coventry and Plymouth were rebuilt as pedestrianised zone in the 1950s. Numerous shopping streets in traditional towns and cities were converted to pedestrianisation from the mid-1960s, such as the iconic Carnaby Street in London, Norwich city centre retail streets in Norwich, Liverpool and Birmingham. Pedestrianisation projects are continuing to be implemented with projects currently taking place in the city centres of Manchester, Stoke and York, all of which commenced temporarily during the Covid-19 pandemic and have since become permanent.

Figure 4.13: Pedestrianised retail streets in Newcastle and Taunton

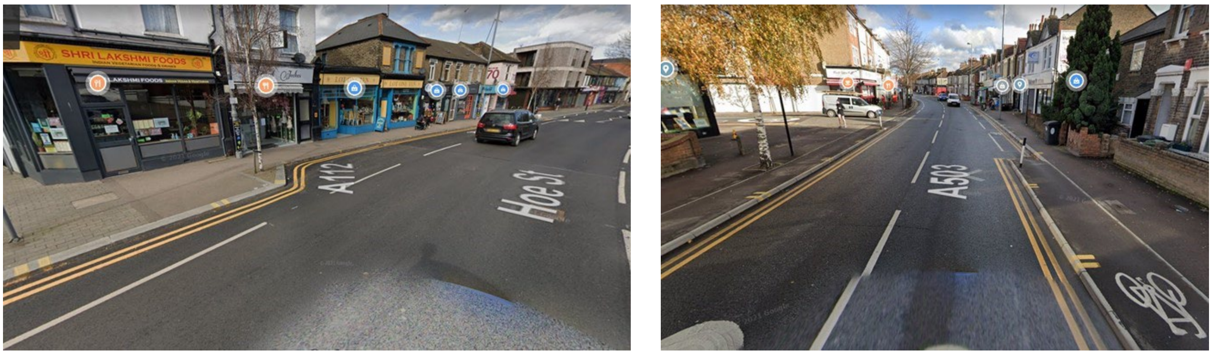
Source: John Salmon (https://upload.wikimedia.org/wikipedia/commons/5/51/Pedestrianised_street%2C_Newcastle_-_geograph.org.uk_-_974057.jpg)

Source: Roger Cornfoot (https://upload.wikimedia.org/wikipedia/commons/2/29/Pedestrianised_street%2C_in_central_Taunton_-_geograph.org.uk_-_1554161.jpg)

Other city centre projects in retail streets and districts permit cyclists as well as pedestrians but not motorised vehicles during the working day. Some of this has led on from restrictions first introduced during the Covid-19 pandemic. For example, in June 2020, as part of its efforts to ensure social distancing, the City of London Corporation implemented temporary traffic restrictions for motorised traffic from 07:00 to 19:00 on certain roads including St Mary Axe, with vehicles allowed to enter only for access purposes. From January 2021, the decision was taken to upgrade this to a 17-month trial during which all cars would be prohibited from entering the street between the peak hours of 08:00-09:30, 12:00-14:00 and 16:30-18:30 on weekdays. From Autumn 2022, it is planned that St Mary Axe and other surrounding streets will be subject to a Zero Emission Zone (ZEZ) from 07:00 to 19:00. This is part of the Corporation's Transport Strategy in which it intends to increase the total length of pedestrianised or pedestrian priority streets from 25 kilometres in 2019 to 35 kilometres by 2030, and to at least 55 kilometres (half of all streets) by 2044. This will include a mix of pedestrian priority streets (which allow access for motor vehicles but in which vehicles, including cycles, have to give way to people walking), timed pedestrianised streets (which do not allow motor vehicle access at certain times), and fully pedestrianised streets (which do not allow motor vehicle access at any time) (City of London Corporation, 2019a; Tharme, 2020 – see **section 4.10** for further details).

Meanwhile, Mini-Hollands are route based approaches in a specific geographical area including high streets, shopping streets and adjacent residential streets intended to encourage greater use of cycling and walking through the implementation of Dutch-style road infrastructure but without necessarily closing the roads to motorised traffic. These implementations can include segregated cycle lanes, provision of cycle hubs and other cycle parking facilities, redesigned footways, new and improved pedestrian crossings and the addition of parklets and other landscaping features. Three Mini-Holland schemes have been implemented in three outer London boroughs (Enfield, Kingston and Waltham Forest) as part of the Mayor of London's Healthy Streets approach with a total investment of approximately £100 million (Mayor of London, 2021a).

Figure 4.14: Examples of the Mini-Holland scheme in Waltham Forest with kerbside loading/unloading restrictions



Source: Google Earth.

Some streetscape projects in busy central urban locations include footway widening which provides more space for pedestrians but can affect the use of kerbside space for loading and unloading if the carriageway becomes too narrow to support vehicle stopping. Many temporary footway widening schemes were introduced in urban areas during the first Covid-19 lockdown in 2021 using temporary barriers to allow pedestrians to use part of the carriageway as an extended footway (see **Figure 4.15** for a temporary footway widening scheme during Covid-19 as well as an example of permanent footway widening).

Figure 4.15: Temporary footway widening in Farnham, Surrey during Covid-19 and permanent footway widening in the City of London

Source: Farnham image – Danski454
https://commons.wikimedia.org/wiki/File:Farnham_social_
distancing_lane_closure_2.jpg

<u>4.10 Major streetscape schemes</u>

Major streetscape projects can result in substantial changes in kerbside availability and regulations. The Oxford Street Transformation project, proposed in 2017 by the City of Westminster and the Mayor of London, aimed, “to create a better environment, address poor air quality and road safety, support a cultural heartland and the thriving business district and protect and enhance quality of life for residents" (Transport for London, 2018a). At the heart of the project was the pedestrianisation of the western end of Oxford Street and the creation, of, "beautiful, safe, accessible and inspiring public spaces full of life and spectacle to address some of the very serious and pressing issues of poor road safety and air quality in the Oxford Street area". In addition, measures were to be implemented to also reduce all types of motorised traffic in the surrounding streets (Transport for London 2018b).

In terms of freight deliveries, the project aimed to move any loading/unloading away from Oxford Street to the side and surrounding streets, on which loading bays would be provided. The provision of this loading/unloading capacity, in terms of total space and time, was to be less than existed under the currently arrangements in which goods vehicles used kerbside with single and double yellow lines. The scheme proposers had planned that a freight strategy was to be developed with the aim to reduce the total freight movements across the whole area as well as replacing many deliveries made by heavy goods vehicles and vans with cargo cycles. The freight industry raised objections to various aspects of the proposed scheme, especially in terms of the loading/unloading provisions being insufficient for the goods that needed to be delivered according to customer's requirements. The Oxford Street transformation project was never implemented due to the City of Westminster deciding not to pursue pedestrianisation and to develop its own scheme.

In 2015, the London Borough of Camden gained approval for the 'West End Project', a scheme to transform the areas around Tottenham Court Road, Gower Street, Bloomsbury Street, Princes Circus and St Giles. The key aspect of the scheme was to alter Tottenham Court Road and Gower Street/Bloomsbury Street from one-way to two-way streets for motorised vehicles. The intentions of the scheme were, "reducing congestion and air pollution and speeding up bus routes. There will be new safer provisions for cyclists as well as new and regenerated public and green spaces" (London Borough of Camden, 2021a). Prior to the scheme, goods vehicles used kerbside single and double yellow lines for making deliveries to businesses and other customers' properties on these streets. On completion of the scheme, some stretches of Tottenham Court Road will not be accessible to vehicles between 08:00 and 19:00 Monday to Saturday, requiring freight operators, "to re plan some of the routes you use to make deliveries, or move your deliveries outside of these times". Where and when deliveries are permitted, this has to take place in dedicated loading bays. On Gower Street / Bloomsbury Street loading will also only be permitted in designated loading bays. Gower Street / Bloomsbury Street loading bays can only be used between 10:00 and 14:00. Unloading can also take place of side streets to service these main roads. (London Borough of Camden, 2021b).

The City of London Corporation adopted a new Transport Strategy in 2019 that prioritises the needs of people walking and cycling. In order to achieve this, the Strategy will significantly reduce, "motor traffic, including the number of delivery and servicing vehicles in the Square Mile" and will make use of "timed and temporary street closures to help make streets safer and more attractive places to walk, cycle and spend time". The use and management of the kerbside will be kept under frequent review to, "identify opportunities to reallocate space from on-street car and motorcycle parking to increase the space available for people walking, support the delivery of cycle infrastructure and provide additional public space and cycle parking". This includes identifying, "opportunities to reduce obstructions caused by vehicles loading or waiting to pick up passengers". However, the Strategy also pledges to ensure adequate on-street provision of short stay commercial parking and loading bays. The kerbside review will consider the potential to, "reduce the maximum loading period from the current 40 minutes when the City's Controlled Parking Zone restrictions apply" and "introduce more dedicated loading bays and use technology to allow real-time management of loading activity". Measures to be taken include a freight consolidation scheme, support for the use of cargo cycle and investigation of retiming deliveries to outside peak hours. The Strategy seeks, "to reduce the number of motorised freight vehicles in the Square Mile by 15% by 2030 and by

30% by 2044" and to reducing the number of motorised freight vehicles at peak times (07:00-10:00, 12:00-14:00 and 16:00-19:00) by 50% by 2030 and 90% by 2044 (City of London Corporation, 2019a).

The examples provided above of these three streetscape projects in London indicate the potential effects of them on freight transport and its related loading/unloading requirements at the kerbside. The initial designs of these schemes indicate a possible lack of consideration of such major schemes on kerbside loading. This can arise in several ways: (i) through of lack of understanding and knowledge of freight operations and requirements to meet the needs of their business and residential customers, (ii) through a conscious intention by designers and planners to prioritise walking and cycling, exercise greater control over when and where freight activities can take place and to reduce and displace the extent of these freight activities from flagships streets, (iii) through a lack of streetspace to accommodate the needs of all users. Formal consultation exercises as well as meetings between the planners and designers responsible for these schemes and freight industry representatives (through the Central London Freight Quality Partnership – CLFQP) helped to mitigate some of these adverse impacts on kerbside loading through changes to scheme design (see **section 8.2** for further details).

4.11 Red Routes

As part of the Road Traffic Act 1991, a Traffic Director for London was appointed by national Government among whose tasks was the implementation of a Priority Route Network (so-called 'Red Routes') on radial and orbital roads designated as strategic within London (approximately 5% of the total London road network (580 km) but which carry up to 30% of London's road traffic – Transport for London, 2021d). These Red Routes were implemented over several years during the 1990s onto these key traffic routes in London. Initially, the purpose was to improve traffic flow on these roads and thereby tackle London's worsening traffic congestion, but over time this altered and by 1998 was, "to seek to encourage a shift from the use of the car for personal travel to public transport, walking or cycling" (The Traffic Director for London, 1998). The Traffic Director stated that the aims of Red Routes had become to (The Traffic Director for London, 1998):

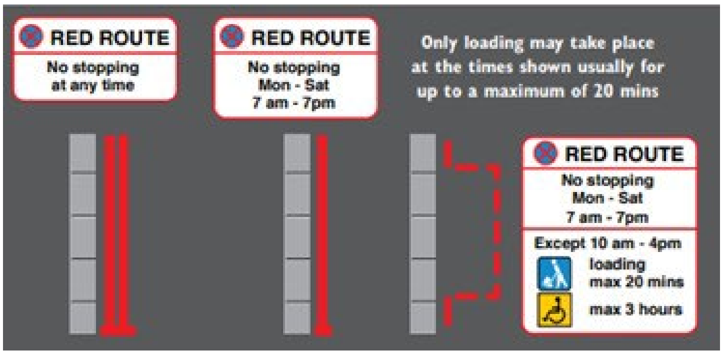
- facilitate the movement of people and goods in London—reliably and safely, and with minimum overall environmental impact,
- encourage walking,
- improve conditions for cyclists and contribute to the National Cycling Strategy,
- to provide better conditions for people with disabilities,
- provide priority for buses so as to achieve their efficient movement,
- improve the local environment and reduce the impact of congestion,
- contribute to London's targets for reduced traffic accidents and road vehicle emissions,
- support reduced car commuting, especially into or across inner London,
- assist measures to reduce traffic on local roads by providing the first choice for non-local traffic, consistent with achieving the other aims for Red Routes.

Key components of these Red Routes included:

- removal of single and double yellow lines at the kerbside and replacing them with red lines,
- altering the times at which parking and loading can take place at the kerbside on these red lines (typically between 19:00-07:00 on single red lines and not at all on double red lines – previously loading could take place at any time as long as there was no loading restriction in force),

- installing loading bays and disabled parking bays marked by white or red dashed lines at the kerbside on these Red Routes and adjoining side streets (with red bays typically available for use only between 10:00 and 16:00 and white bays available all day),
- introducing bus lanes on these Red Routes (to improve bus priority and encourage modal shift from cars to buses),
- allowing cyclists to use these bus lanes (to improve cyclist safety and encourage modal shift from cars to cycling),
- the implementation of camera enforcement.

Figure 4.16: Red Route loading regulations in London



Source: Logistics UK.

The overall effect on loading/unloading of the introduction of Red Routes on these priority main roads was to substantially reduce its total capacity. When London became a devolved authority in 2000, responsibility for Red Routes were transferred to the new Mayor of London. These Red Routes remain in force on London's key strategic roads. Red Routes were also later introduced in the city of Leeds and in urban areas in the West Midlands.

In 2020, a report argued that as Red Routes have substantially worse air quality and higher road collisions than other roads in London, further action should be taken to alter their primary purpose from vehicle flow to the wellbeing of those who live on and walk and cycle along them. This included, in the short-term, adding infrastructure including, "more greenery, sustainable drainage and climate resilience, converting car parking into more walkway or parklets, and potentially pollution or noise barriers as a temporary mitigation" as well as, "delivering safer walking and cycling infrastructure across the network, reducing speed limits, better public transport connectivity and bus priority" (Camargo and Lord, 2020, p.22). In the longer-term the report advocates re-evaluating and reducing the size of the Red Route network, particularly in central London, "where there is potential to reallocate more space for people and to 'deprioritise' motor traffic, such as happened in Trafalgar Square", introducing measures to limit vehicle movement at certain hours, prioritising cleaner and quieter road vehicles, and implementing freight consolidation schemes and the use of cargo bikes (Camargo and Lord, 2020, p.23).

4.12 Mobility/Community hubs

Some urban designers have advocated 'mobility hubs' (also called 'community hubs') as a means by which to "create space designed specifically to house public and shared mobility modes and improve the public realm for local residents and businesses as well as travellers". These urban facilities are intended to alter how transport takes place, by addressing air quality and greenhouse gas emissions associated with transport, supporting active travel, and revitalising urban places to encourage more footfall and consumer expenditure. Those advocating these hubs perceive that they will also reducing traffic congestion by promoting non-car-based modes and making better use of space currently "dominated by inefficiently used private cars". Mobility hubs are defined as "a recognisable place with an offer of different and connected transport modes supplemented with enhanced facilities and information features to both attract and benefit the traveller". The features that such a hub could incorporate include public transport interchanges, cycle hire, parking and repair facilities, car clubs, ride hailing services, vehicle recharging infrastructure, community meeting rooms, workspaces, cafes, recreational and fitness facilities, gardens and allotments for growing food. Mobility hubs are viewed as a means by which to "raise the profile and visibility of the range of shared and sustainable travel modes….with the associated benefits of reduction in car use". They are also seen as a way to improve the public realm by allowing for "space to be reorganised for the benefit of pedestrians, cyclists and business owners addressing parking problems and creating more pleasant urban realm. Converting space previously used only for private parking to green space, waiting areas and additional facilities makes for a better experience for the traveller, increasing patronage". These hubs are also seen as a means by which to support densification of urban development through the associated change in car driving habits and reduction in kerbside parking provision they are expected to result in. These hubs are also foreseen as a way in which to prevent 'street clutter' from the various facilities required to support cycling and other active travel modes including dockless cycle hire schemes and the recharging infrastructure required (CoMoUK, 2019). Current freight operations that take place at the kerbside are not directly discussed in the guidance provided on mobility hubs, indicating a lack of consideration of the importance of these activities but would be likely to reduce kerbside stopping space for deliveries and collections to businesses in localities with such a hub.

These mobility hubs could also include logistics features including a depot from which local collections and deliveries of parcels ordered online can be made using clean vehicles, together with other logistics facilities such as pick up and drop off (PUDO) facilities for locals to collect and return goods ordered online (either locker banks or staffed facilities), and storage facilities for local businesses. They could range in size depending on the location served and facilities provided (Douglas and Brooker, 2021; Smart and Young, 2021).

Those advocating such mobility hubs envision their planning being incorporated into local, regional and national land use policies to ensure the allocation of suitable and sufficient space for them. They also foresee that in some cases property developer contributions could be used to fund these mobility hubs. They expect mobility hubs to range in scale depending on their location and service requirements, forming a network of such facilities across the urban area (CoMoUK, 2019).

Some of these advocates of logistics hubs are of the opinion that such a facility could be operated by either a national company presenting a suitable ethos, while others are of the opinion that it should be managed and operated by the local community.

4.13 Summary

Table 4.1 shows whether each of the changes in kerbside use reviewed in sections 4.1-4.12 are concerned with movement (i.e. the promotion of active travel – walking, cycling and bus use) and/or place (i.e. public realm, socialising and attractiveness) functions of streets.

Table 4.1: Kerbside use: movement and place functions

Kerbside use	Promotion of movement function of streets	Promotion of place function of streets
Bus lanes	✓	
Cycle lanes	✓	
Bike and e-scooter docking stations and cycle parking	✓	
EV charging devices and charging spaces	✓	
Car Clubs and parking bays	✓	
Parklets / pocket parks		✓
On-street dining		✓
Low Traffic Neighbourhoods and modal filters	✓	✓
Pedestrianisation, low traffic streets & Mini-Hollands	✓	✓
Major streetscape schemes	✓	✓
Red Routes	✓	
Mobility hubs	✓	✓

Table 4.2 provides an indicative assessment by the authors of the extent to which the kerbside activities and uses reviewed in **sections 4.1-4.11** are likely to result in greater kerbside space reallocation over the next decade based on government publications and recent trends. This reallocation of kerbside space has been divided into main roads and high streets and residential streets.

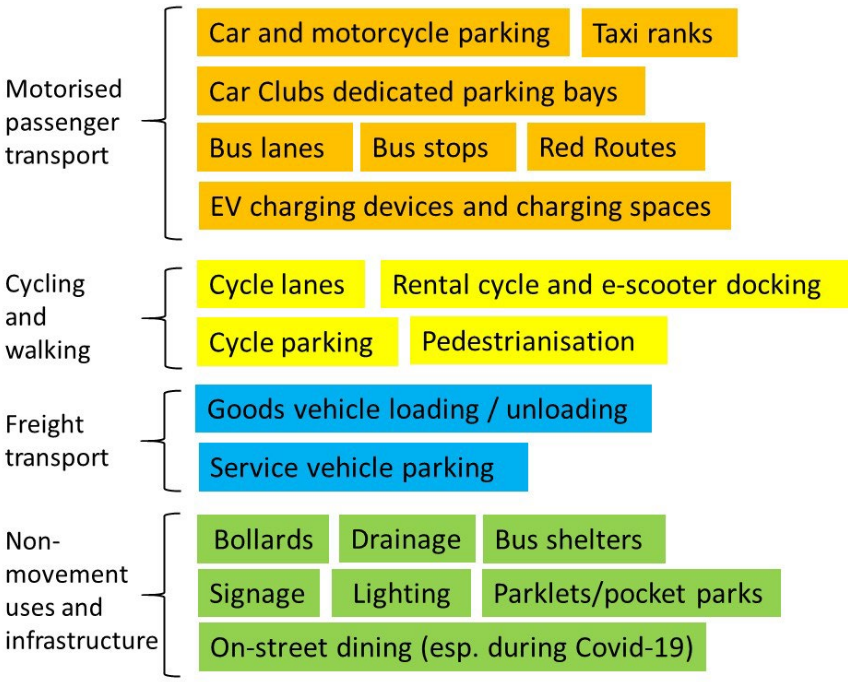
Table 4.2: Indicative assessment of change in kerbside space provision for various uses in the next decade

Kerbside use	Main roads and high streets	Residential streets
Bus lanes	↑↑	0
Cycle lanes	↑↑	↑↑
Bike and e-scooter docking stations and cycle parking	↑↑	↑↑
EV charging devices and charging spaces	↑↑↑	↑↑↑
Car Clubs and parking bays	↑	↑
Parklets / pocket parks	↑	↑
On-street dining	↑	0
Low Traffic Neighbourhoods and modal filters	0	↑↑
Pedestrianisation, low traffic streets and Mini-Hollands	↑↑	0
Major streetscape schemes	↑↑	0
Red Routes	↑	0
Mobility hubs	↑	↑

Key:
0 – no change in kerbside space allocation
↑ - small increase in kerbside space allocation
↑↑- substantial increase in kerbside space allocation
↑↑↑ - very substantial increase in kerbside space allocation
Source: authors' own estimations.

Figure 4.17 shows all the potential uses of the kerbside including passenger transport, freight transport and non-movement uses.

Figure 4.17: Competing uses for kerbside space and time



Given this multitude of demands for kerbside space and time, the demand for the kerbside exceeds the capacity of kerbside space in most locations, especially within towns and cities.

Section 5 discusses freight transport operations at the kerbside and considers the issues and requirements for different types of goods and service transport activities.

5. Freight transport operations at the kerbside

5.1 Delivery and collection operations at the kerbside

The availability and use of kerbside loading/unloading provision in urban areas varies depending on the location served. **Table 5.1** shows the proportion of goods loading/unloading taking place at the kerbside (i.e. on-street) and on private land (i.e. off-street) in UK freight surveys. In London, where off-street loading/unloading space is especially limited, surveys of high streets and other busy commercial locations have found that 70% or more of goods vehicles making collections and deliveries to businesses stop at the kerbside, with more than 90% of such stops taking place at the kerbside in approximately half of these surveys, especially those in inner urban and city centre locations.

Table 5.1: Proportion of loading/unloading that takes place on-street and off-street in freight studies in towns and cities in the UK

Study	On-street	Off-street	Study location	Year
Camden, London	100%	0%	High street	2015
Acton, London	96%	4%	High street	2015
Norwich	95%	5%	Retail street	2003
Kingsland, London	93%	7%	High street	2015
Regent Street, London	92%	8%	Major retail and commercial street	2009
Covent Garden, London	92%	8%	Retail street	2009
Reading	90%	10%	Town centre street	2003
Wallington, London	90%	10%	High street	2005
Lisson Grove, London	89%	11%	High street	2008
Stratford, London	89%	11%	High street	2015
North Harrow, London	87%	13%	High street	2008
City of London	85%	15%	Office and retail streets	2011
Clapham Junction, London	85%	15%	Retail street	2007
Winchester	82%	18%	High street	2001
Hatch End, London	79%	21%	High street	2007
Worthing	71%	29%	Major retail chains in town centre	2005
Colchester	70%	30%	Town centre streets	2005
Chichester	69%	31%	Major retail chains in town centre	2005
Norwich and London	64%	36%	Wide range of business types inc. offices	1999
Horsham	61%	39%	Major retail chains in town centre	2005
Torbay	59%	41%	Shops, hotels, supermarkets, manufacturers, and hospital	2003
Park Royal, London	22%	78%	Industrial estate	2002
Broadmead, Bristol	13%	87%	High % of receivers in shopping centre	2003
Crawley	13%	87%	High % of receivers in shopping centre	2005
Sutton and Croydon, London	13%	87%	High % of receivers in shopping centre	2007
Bromley, London	10%	90%	High % of receivers in shopping centre	2007

Source: adapted from Cherrett et al., 2012; Transport for London, 2015a, 2015b, 2015c, 2015d.

These surveys indicate that kerbside stopping is far less prevalent when making goods deliveries and collections to businesses in industrial areas and in shopping centres and malls. However, even when off-street loading facilities exist, this does not necessarily mean that they are always used. In the 2002 Park Royal industrial park survey while 14% of respondents said that their establishment had off-street facilities for goods vehicles, 22% of them said that deliveries were made from vehicles parked on-street (MVA, 2002).

Another study carried out in London in 2017 investigated a range of individual business premises (retail, office, restaurant/pub/hotel, leisure and industrial) spread across the city rather than focusing on a specific geographical location. The survey work indicated that, overall across all 117 sites studied, 81% of all freight vehicle deliveries and collections took place with the vehicle on-street at the kerbside. Rates of on-street stopping at the kerbside to makes these deliveries and collections ranged by type of premises from 76% to 92% with the exception of industrial sites at which only 36% of vehicle deliveries took place at the kerbside (as these premises were far more likely to have off-street facilities available on private land for goods vehicles) (Systra, 2017). Virtually all goods delivered to residential addresses require use of the kerbside for loading/unloading as, even when flats have private off-street parking, use of this land by goods and service vehicles is typically not permitted.

A study of urban delivery rounds by four different freight operators in Seattle, USA found that 74% of the vehicle stops took place at the kerbside. This work also identified three key factors in drivers' choice of stopping location: (i) safety - choosing kerbside spaces that were sufficiently large to accommodate the vehicle and which provided plus extra space to load/unload goods and selecting spaces at the end of blocks wherever possible to avoid the need for reversing and other manoeuvring to exit the space; (ii) avoiding parking locations that could lead to potential conflicts with other drivers and road users; and (iii) 'coopetition' - although regular delivery drivers have to compete with each other for the same kerb space, those with smaller vehicles try to avoid taking a space suitable for a larger goods vehicle wherever possible (Dalla Chiara et al., 2021).

Research has identified that vehicle dwell times at the kerbside can be influenced by a range of factors including (Allen et al., 2000):

- The distance from the goods vehicle to the premises being served
- The size of the delivery and the weight of the goods
- The type of product and whether or not the goods are unitised
- The means of getting goods off the vehicle and conveying them to the premises
- Whether the driver has to close and lock the vehicle
- The number of people performing the delivery
- Whether staff at the receiving establishment assist with loading/unloading
- Whether the goods have been pre-ordered by the establishment
- Whether goods have been sorted for delivery prior to the vehicle's dispatch from the warehouse
- The extent to which the receiver checks the goods
- Whether the staff at the receiving establishment need to be present at the time of delivery
- Whether the driver requires a signature / proof of delivery for goods delivery
- Whether other deliveries/collections are taking place at the receiving establishment at the same time
- Number of deliveries made from stopping location

Analysis of urban freight surveys in the UK that collected vehicle dwell time data has indicated that, for freight planning in urban areas, approximately 30 minutes should be allowed for the average articulated HGV delivery, 20 minutes for deliveries by rigid HGVs, and 10 minutes for delivery by van. This analysis also indicated that, across all the types of business served, there was not a strong correlation between premises size and the mean dwell time of goods vehicles making deliveries. One might expect larger stores to receive greater volumes of goods in a typical delivery and therefore to have a greater mean dwell time but this was not found to be the case (Cherrett et al., 2012).

Some goods deliveries and collections that take place at the kerbside can take far longer than 30 minutes, such as large deliveries of beer kegs to pubs, and removals and scaffolding collections and deliveries to/from residential and commercial buildings. Deliveries to large construction sites usually take place off-street but unless carefully planned and co-ordinated can result in goods vehicles queuing on-street outside or near to the site for more than 30 minutes. Even when well planned, concrete pours are also likely to require on-street vehicle holding areas (with permission provided from the local planning authority) (Piecyk and Allen, 2021).

Observational studies of next-day parcel deliveries in central London in 2017 that involved researchers travelling in-vehicle with the driver found that on average, 62% of the total time that the vehicles are away from their depot each day is spent parked at the kerbside whilst drivers are making collections and deliveries on foot. The vast majority (95%) of vehicle stopping locations were on-street, with vehicles being parked on multiple occasions over the course of their working day (typically 25-40 parking stops per vehicle per day) with short driving distances between vehicle stops. The mean drive time between stopping locations was 3.7 minutes, with on average, 8.1 minutes dwell time at each vehicle stop (with on average 1.9 addresses delivered to/collected from and 3.4 parcels delivered/collected per vehicle stop). Mean driving and parking times per parcel delivered/collected were 1.5 and 2.3 minutes (Allen et al., 2018a). Studies of meal deliveries in London indicate average vehicle dwell times at restaurants (which includes waiting for and collecting meals and waiting between jobs) and an average delivery time of less than 5 minutes at the delivery point (Allen et al., 2021a).

The UK urban freight surveys reviewed indicate similarity in the proportion of all delivery trips made to all establishments on weekdays (i.e. there was little difference in the proportion of delivery trips taking place each day from Monday to Friday). Meanwhile weekends accounted for only approximately 5-10% of all delivery trips received in surveys based in predominantly retail areas and 10-15% on industrial estates. These survey results also indicate the importance of morning deliveries, with approximately half of all deliveries taking place before 12:00.

In the majority of these freight surveys vans ('light goods vehicles') were the dominant vehicle type, responsible for 40-65% of all vehicles loading and unloading depending on survey location. Vans were followed in freight trip frequency by rigid HGVs (approximately 20-50% of all loading/unloading stops) and articulated HGVs vehicles (between 0-20% of all loading/unloading stops except in industrial areas and to shopping centres and malls where their use is greater). Cars accounted for less than 5% of vehicle deliveries in the majority of surveys, as did other vehicles (including motorcycles, bicycles and pedestrians).

Freight trip generation rates vary by land use type, with some types of businesses generating far more vehicle activity than others. Survey results indicate that certain types of retailer, including grocery stores selling fast moving consumer goods, chemists, opticians and charity shops, as well as and hotels, pubs, hot food takeaways restaurants and cafes, generating far more freight vehicle activity than others (Cherrett et al., 2012). The type of supply chain that the business is part of also impacts on the number of freight vehicle trips, with independent retailers using a range of suppliers tending to generate more trips than chain stores which receive deliveries from a single distribution centre thereby allowing more consolidated goods flows (Allen et al., 2000).

The type of goods being delivered or collected has an important bearing on the vehicle and operational requirements. Some types of goods can require specialist on-board handling equipment to enable loading and unloading (such as construction deliveries) and specialist vehicles (such as car transporters). Deliveries of certain types of very heavy goods or equipment (such as beer kegs) necessitate the vehicle being at the kerbside adjacent to the premises receiving the delivery. Collections and deliveries of cash and valuables from banks, shops and other business premises also require that the vehicle stops at the kerbside immediately outside the building served. For deliveries and collections of bulky, heavy goods that take place on an occasional basis, such as scaffolding and removals, that may take a considerable time to carry out, local authorities typically operate dispensation schemes in which the freight transport operator can, in return for a fee, apply in advance for the permission to load/unload outside the building while carrying out this activity.

Figure 5.1: Loading and unloading operations at the kerbside

Source: Logistics UK

Source: Logistics UK

Source: authors' own

Source: Logistics UK

Table 5.2 shows the work stages involved in the delivery of goods in an urban area together with the location where they take place. It assumes that the vehicle stops at the kerbside to load/unload, a small proportion of deliveries take place with the vehicle stopped off-street if such facilities are available at the receiver's building.

For all kerbside deliveries and collections, goods need to be conveyed across the footway between the vehicle and the building served. This can involve the driver simply carrying the goods if they are lightweight and not bulky. However, in many cases, drivers make use of manual handling equipment such as barrows, roll cages, and pallet trucks to convey goods across the footway.

The driver is away from the vehicle and not visible from the kerbside while making the collection or delivery at the building served, especially when this requires entering the building or if the building is some distance from where kerbside loading space is available. This can result in the issuing of PCNs if the 'observation period' specified by a local authority is deemed by a parking attendant to have been exceeded, even if continuous loading/unloading is taking place. This results in fines and time-consuming and expensive appeals having to be submitted by freight transport companies when such loading regulations have not been broken (see **section 2**).

Table 5.2: Stages, tasks and locations in making an urban goods delivery by road

No.	Location	Stage number and task description
1	At depot	Sort goods at depot for vehicle delivery journey
2		Determine sequence in which make deliveries (if multi-drop)
3		Load goods onto vehicle at depot (in line with delivery sequence if multi-drop)
4	Driving on road	Drive vehicle from depot to delivery location (using routing knowledge / information)
5		Identify best place/s to stop vehicle
6		Search for stopping location (including queuing or circulation if space not available)
7	Driving on road / at kerbside	Park vehicle (at kerbside or off-street)
8	At kerbside / on footway	Decide how many addresses to deliver to when vehicle is stopped (if multi-drop)
9		Locate goods on vehicle for delivery
10		Load goods onto manual handling device (if too large/heavy to carry by hand)
11		Determine walking route (and sequence if more than one) from vehicle to delivery point
12	On footway	Transport goods on-foot from vehicle to delivery point
13		Locate point of delivery at building
14	At receiver's building	Enter building and continue walking / using lifts if delivery is to large or multi-tenanted building
15		Arrive at point of goods handover to receiver
16		Carry out necessary administration to complete delivery
17	On footway / in building	If more than one delivery to be made on foot, continue to next delivery point (and repeat stages 11-16 for each)
18	On footway	Return on-foot to vehicle once all products conveyed to building/s have been delivered
19	At kerbside / on footway	Return any manual handling device to vehicle
20	At kerbside / driving on road	Egress from stopping location into carriageway
21	Driving on road	Drive on to next delivery stopping point (multi-drop – repeating stages 4-18 each time) or return to depot (single drop)

Drivers may discover on arrival at the building or street where delivery/collection is scheduled to take place that no kerbside loading space is available. This can result in the driver having to circulate in the hope that space becomes available or in an effort to find somewhere else to stop, and disruption to urban businesses and other receivers if, as a result, delivery is delayed or unable to take place when intended.

Searching for kerbside stopping space results in greater vehicle kilometres travelled and driving time as drivers circulate within the locality which results in greater fuel consumption, greenhouse gas and local air pollutant emissions, and increased freight transport costs. If space is not available close to the point of delivery/collection this increases the vehicle dwell time at the kerbside as the driver has further to travel on-foot between the vehicle and delivery/collection point. Lack of availability of kerbside space sufficiently close to the point of delivery/collection can even make the delivery/collection unviable if very heavy/bulky goods are involved. For instance, in the case of keg deliveries to pubs, this can result in the need for additional drivers' mates to assist with the delivery (which requires pre-planning) and additional delivery costs given the time take to convey such goods over relatively long distances.

Research in London and Norwich from 1998 to 2000 into the difficulties experienced by goods vehicle drivers making goods deliveries and collections and providing services showed that drivers were experiencing considerable problems finding suitable kerbside parking locations twenty years ago. The difficulties that drivers reported included: difficulty in finding kerbside parking spaces in general and especially in close proximity to buildings being served, (especially when the nature of goods required a close stopping point), illegal parking by cars hampering efforts to acquire suitable kerbside parking space, and restrictions for loading/unloading being inadequate for some types of deliveries and collections (Allen et al., 2000).

The most comprehensive freight surveys to have taken place in recent years are those conducted on four high streets in London in 2014/15. These were commissioned by Transport for London and carried out by Atkins (Transport for London, 2015a, 2015b, 2015c, 2015d). These surveys included the collection and analysis of a wide range of data including road traffic data, land use and street kerbside audit (including waiting and loading restrictions, and facilities for buses, cyclists and pedestrians), video surveys and business and driver questionnaires (Atkins, 2015). Given that they are among the most recent surveys of freight kerbside use carried out, their comprehensiveness and the detail they provide, results from these four surveys are discussed further below.

Goods vehicle dwell times in these four high streets are shown in **Table 5.3**. These four high street surveys also found that depending on high street, 56-70% of loading/unloading at high street premises took place between 07:00 and 19:00 (Transport for London, 2015a, 2015b, 2015c, 2015d).

Table 5.3: Vehicle dwell time for loading/unloading on high streets in 2014/15

Stopping location	Acton	Camden	Kingsland	Stratford
Kerbside: on high street	13 mins	17 mins (TLRN) 20 mins (BR)	9 mins	11 mins
Kerbside: on side street	20 mins	28 mins (TLRN) 17 mins (BR)	21 mins	15 mins
Off-street	14 mins	Not applicable	48 mins	9 mins

Notes:
TLRN – Transport for London road network
BR – Borough road
Survey included dwell times for vehicles providing servicing to the businesses as well as those providing goods deliveries and collections.
Source: Transport for London, 2015a, 2015b, 2015c, 2015d.

Table 5.4 provides the vehicle types used for freight trips in these high street surveys in London in 2014/15. In three of these locations, 20-30% of freight trips were observed to be made by motorbike. This was due to the substantial proportion of motorcycle trips were generated by hot-food takeaways making last-mile deliveries and financial and professional services receiving couriered documents and packages.

Table 5.4: Relative importance of types of freight vehicle loading/unloading on London high streets in 2014/15

Vehicle type	Acton	Camden	Kingsland	Stratford
Van	38%	37% (TLRN) 55% (BR)	35%	70%
Rigid HGV	23%	29% (TLRN) 40% (BR)	38%	19%
Articulated HGV	0%	2% (TLRN) 3% (BR)	0%	0%
Car	11%	2% (TLRN) 2% (BR)	6%	7%
Motorcycle	28%	30% (TLRN) 2% (BR)	21%	4%
TOTAL	**100%**	**100%**	**100%**	**100%**

Notes:
TLRN – Transport for London road network
BR – Borough road
Source: Transport for London, 2015a, 2015b, 2015c, 2015d.

These four London high street surveys found that goods deliveries increased through the morning, peaking at about 11.00, with a declining level of activity during the afternoon and a low, flat profile into the evening. By contrast, meal collections from restaurants for last-mile delivery to customers began to increase from about 16:00 onwards and increased further through the evening. While vehicle making deliveries were far lower at weekends than on weekdays, these collections of meals from hot-food takeaways for last-mile delivery to customers generated substantial weekend vehicle activity.

Table 5.5 shows the five most important land uses in each of the four London high streets in terms of the freight vehicle activity that they generate. Retail (land use class A1) and hot-food takeaways (land use class A5) can be seen to generate the greatest number of freight trips, followed by drinking establishments (land use class A4) and restaurants and cafes (land use class A3).

Table 5.5: Proportion of freight vehicle trip generation for top 5 land uses on London high streets in 2014/15

Top 5 land uses	Acton	Camden	Kingsland	Stratford
Land use no.1	A5 – 30%	A1 – 46%	A1 – 38%	D1 – 19%
Land use no.2	A1 – 27%	A5 – 29%	A5 – 26%	A4 – 18%
Land use no.3	A2 – 9%	A3 – 8%	A3 – 15%	B1 – 13%
Land use no.4	A3 – 9%	C3 – 6%	A4 – 6%	A1 – 13%
Land use no.5	A4 – 5%	A4 – 5%	A2 – 5%	C1 – 9%
Other land uses	20%	6%	10%	28%
TOTAL	**100%**	**100%**	**100%**	**100%**

Notes:
A1 Retail
A2 Financial & Professional Services
A3 Restaurants & Cafes
A4 Drinking Establishments
A5 Hot-Food Takeaways
B1 Businesses
C1 Hotels, boarding and guest houses
C3 Dwelling Houses
D1 Non-residential institutions
Source: calculated from data in Transport for London, 2015a, 2015b, 2015c, 2015d.

Table 5.6 shows the proportion of retail frontages that 'retail' (land use class A1) and 'hot-food takeaways' (land use class A5) accounted for and the proportion of freight vehicle trip generation they generated. This shows the far greater rate of freight trip generation by hot food takeaways than retail per frontage. It is important to note that this is based on number of frontages rather than retail area (i.e. square metres) which would be likely to show even greater relative importance of freight trip generation by hot-food takeaways.

Table 5.6: Retail and Hot-Food Takeaway frontages and freight vehicle activity generated on London high streets in 2014/15

	Frontages (% of total)		**Freight vehicle trip generation (% of total)**	
London high street	**Retail (A1)**	**Hot-Food Takeaways (A5)**	**Retail (A1)**	**Hot-Food Takeaways (A5)**
Acton	34%	9%	27%	30%
Camden	49%	4%	46%	29%
Kingsland	40%	5%	38%	26%

Source: Transport for London, 2015a, 2015b, 2015c.

Table 5.7 shows stops by freight vehicles for loading/unloading as a proportion of total vehicle stops by all motorised vehicle types for all purposes in the four high street surveys. Freight vehicle stops accounted for 6-7% of all vehicle stops in three of the high streets and for 3% of all vehicle stops in Stratford High Street. This is due to the differences between Stratford and the other high streets surveyed. Stratford High Street has is a strategic transport link for traffic, buses and cyclists (with Cycle Superhighway Route 2) in a way that the other three are not. Also, unlike the other three high streets, it does not have a large retail presence. As a result of these factors, Stratford High Street and the first 10 metres of most adjoining side streets are subject to ‘no waiting and loading at any time’ restrictions (Transport for London, 2015d).

Table 5.7: Proportion of total vehicle stops at the kerbside by reason for stop on London high streets in 2014/15

Reason for stop	Acton	Camden	Kingsland	Stratford
Freight loading/unloading	6%	7%	6%	3%
Parking	28%	22%	14%	14%
Drop-off and pick-up (inc. buses)	60%	62%	74%	74%
Waiting	6%	9%	6%	9%
TOTAL	**100%**	**100%**	**100%**	**100%**

Source: Transport for London, 2015a, 2015b, 2015c, 2015d.

A study of Norbury High Street in London in 1992 found that freight loading/unloading accounted for 6% of all vehicle stops, a figure very similar to three of the London high streets studied in 2014/15 (Jones, 1992).

Table 5.8 shows the total time spent at the kerbside by all vehicles for all stopping purposes. Freight loading/unloading accounted for 6-11% of total time spent at the kerbside by all vehicles for all stopping purposes, whereas car and other vehicle parking accounted for 77-85% of total vehicle time at the kerbside.

Table 5.8: Time spent at kerbside by activity on London high streets in 2014/15 (% of total time spent at kerbside by reason for stop)

Reason for stop	Acton	Camden	Kingsland	Stratford
Freight loading/unloading	9%	11%	10%	6%
Parking	85%	77%	81%	84%
Drop-off and pick-up (inc. buses)	5%	7%	7%	8%
Waiting	1%	5%	2%	2%
TOTAL	**100%**	**100%**	**100%**	**100%**

Source: calculated from data in Transport for London, 2015a, 2015b, 2015c, 2015d.

Table 5.9 shows the proportion of the total kerbside length surveyed at which loading/unloading was permitted in each of the four high streets surveyed. The kerbside included in each of these surveys included both the high street and adjoining side streets. The proportion of total kerbside length surveyed at which loading/unloading was not permitted at any time ranged from 50% in Acton to 74% in Kingsland. It should be noted that loading/unloading is not permitted on any of Stratford High Street and only on 25% of Kingsland High Street, so in both of these locations the majority of loading/unloading takes place on adjoining side streets on which it is permitted.

Table 5.9: Kerbside on London high streets and side streets at which loading/unloading is and is not permitted, 2014/15

Loading/unloading status of kerbside surveyed	Acton	Camden	Kingsland	Stratford
Permitted at all times	25%	13%	6%	39%
Permitted at certain times	25%	15%	20%	0%
Not permitted at any time	50%	72%	74%	61%
TOTAL	**100%**	**100%**	**100%**	**100%**

Source: Transport for London, 2015a, 2015b, 2015c, 2015d.

The four high street surveys included capacity analysis of kerbside space and time available for all vehicle users including freight vehicles that were loading/unloading. This analysis compared the supply of and demand for kerbside space by vehicle type. This work found that in Acton, "although capacity is not an issue when looking at the whole street, the fact that 'convenience' of location is paramount results in some localised issues of conflict between different trip types legal use of shared capacity or illegal use of other parts of the High Street" (Transport for London, 2015a, p.12) In Camden, capacity analysis showed that, "during the busiest hours, delivery and servicing vehicle drivers may have problems in 'legal' loading space to complete deliveries close to businesses in this part of the High Street (the eastern kerbside)….Problems can then arise because either delivery drivers are forced to load and unload illegally or have to park at further distances or across roads where the transit of heavy goods or cash is much more difficult or subject to security or safety risk" (Transport for London, 2015b, p.15). Loading/unloading capacity problems for freight vehicles were found to not exist in the surveys of Kingsland and Stratford High Streets (Transport for London, 2015c, 2015d).

Illegal kerbside loading/unloading was a feature of all the four high street surveys carried out in London in 2014/15 (i.e. taking place at a kerbside location where it is not permitted either at certain times or at all times). In Stratford, loading/unloading is not permitted on the main road at all times, so any goods vehicle stopping observed there was illegal. This represented 25% of all loading/unloading activity servicing businesses on the high street, with the vast majority (75%) taking place from side street stopping locations. In the other three high street surveys, illegal loading/unloading accounted for approximately 15-75% of all loading/unloading activity, varying greatly by time of day and location. Illegal activity was greatest at times when the kerbside is in greatest demand from all vehicle users and when loading time restrictions are in force. Lack of available legal loading space results in a greater incidence of illegal loading events. This illegal activity included stopping to load/unload in dedicated parking bays, in locations where loading is only permitted at certain times including Red Routes, and in locations in which loading not permitted at any time including bus stops (Transport for London, 2015a, 2015b, 2015c, 2015d).

A study carried out into parking and loading in the vicinity of the Broadway, the mail retail street in Bexleyheath, outer London, in 2001 considered the use of the four dedicated kerbside loading bays provided as well as other sections of kerbside where loading was not legal (including yellow line regimes with loading restrictions). As well as loading/unloading, these four dedicated bays also permitted disabled car parking. Three of these loading bays were provided on the main road, while one was provided on a parallel street behind the main road. The survey found that demand for the three loading bays on the main road exceeded supply with goods vehicles requiring to load/unload often having to "overspill" to adjacent areas of the kerbside and carry out illegal loading/unloading. Approximately 45-55% of the vehicle stops taking place in these four loading bays were illegal parking of cars. Goods vehicle loading/unloading only accounted for 16-32% of the total survey time in the three loading bays on the main road (with this loading space used for car parking for the remaining 68-84% of survey time (the vast majority of which was illegal). The occupancy of these three loading bays was between 108-126% during the survey, indicating that demand exceeded supply, with goods vehicles queueing to use them. In total, 40% of deliveries/collections observed during the survey were carried out illegally. Some of these instances of illegal deliveries were due to the loading bays being occupied by other goods vehicles carrying out loading/unloading or legal disabled car parking, while others were due to the loading bays being full due to illegal car parking. In some instances, goods vehicle drivers chose to illegally park closer to the delivery point either due to the size of the delivery and difficulty of conveying it over a longer distance, to keep the vehicle within sight or to save time (Intermodality, 2004). This survey work in Bexleyheath indicates the importance of providing sufficient total kerb space for loading/unloading and ensuring that it is appropriately located for the specific delivery points served, as well as the need for enforcement of restrictions to prevent misuse of loading bays and other kerbside locations.

The scale of consumer online ordering (especially of meal deliveries from hot-food takeaways, restaurants and cafes but also of grocery and non-food products) is likely to have substantially increased freight trip generation rates from food catering and retail businesses in urban areas compared to these surveys carried out in 2014/15. In addition, Deliveroo Editions kitchens (referred to by some as 'dark kitchens') often based in small, former urban industrial sites from which deliveries are made to nearby residential areas can generate up to 200 vehicle trips per hour (Morris, 2018, Satariano, 2018). Given the rise in demand for meal deliveries is recent years, the proportion of evening and weekend freight activity in the locations where these trips originate is likely to have increased substantially. The same is true of urban depots and fulfilment centres ('dark stores') from which vehicles are despatched to delivery groceries and non-food items ordered online to consumers' homes.

The importance of motorbikes, bicycles, cars and cargo cycles in freight activity is also likely to have increased since these all the freight surveys reviewed above were carried out due to these increases in online meal, grocery and non-food shopping and their last-mile deliveries from urban premises.

As discussed above, in recent years online shopping and associated last-mile deliveries have been growing strongly in the UK. At the same time, this and other factors have led to an increase in vacant retail property in urban areas. Both of these trends have been accelerated by consumer behaviour during the Covid-19 pandemic. While these trends are altering the logistics operations for some products, as well as increasing last-mile trip generation rates for some businesses and the final delivery locations for these products, it is important to recognise that this freight activity represents a relatively small proportion of total goods vehicle (van and HGV) activity in the UK (Piecyk et al., 2021). These last-mile deliveries, together with vacant urban retail space, offer new possibilities in how some goods deliveries could take place, such as using cargo cycles and on-foot porters from local logistics despatch points from which they can operate (McLeod, 2020; Steer, 2021).

This growth in online shopping for meals, groceries and parcels also has important implications for growth in deliveries taking place in residential streets and the kerbside parking space needed by those making these deliveries for their vehicles. Kerbs in residential streets in urban areas are often already busy with parked cars, so these delivery drivers often have to search for available stopping places, as well as parking illegally due to no legal stopping places being available (see **section 6.2** for further discussion of car parking in residential streets).

5.2 Servicing operations and the kerbside

As well as the delivery and collection of goods, freight transport also includes many servicing activities. These activities often use goods vehicles (vans and heavier) but the movement of goods is not their primary trip purpose, which is instead the provision of a service. Examples of such servicing activities include the work of engineers working for utility, telecommunications companies, plumbers, electricians, air conditioning and lighting engineers, carpenters, glaziers, roofers, builders, pest controllers, cleaners, security system providers, property maintenance personnel, surveyors, caterers, and gardeners. While those providing these services may carry goods as part of their work, they are also likely to carry tools and equipment that are necessary to the services they provide.

Some urban freight surveys carried out in the UK have investigated the number and frequency of service trips to business premises and have shown the importance of this activity in terms of vehicle trips. Service trips as a proportion of all freight trips to business premises were found to range from 11% in study in Norwich in 2001 to 63% in studies in Worthing and Winchester in 2005 and 2008 respectively. The number of service trips required by a business is very dependent on the type and size of business (Allen et al., 2008; Cherrett et al., 2012). It should be noted that not all service trips take place in motorised goods vehicles, with some provided by car, bicycle or on-foot.

In these service operations, the time spent by the person providing the service at the location at which it is provided is often substantially greater than the time spent solely making deliveries to buildings by goods vehicle. This is reflected in survey work of the dwell time of service vehicles. A 2001 survey in Winchester found average vehicle dwell time across all service activities to be approximately 35 minutes. However, some activities such as lift/escalator, air conditioning and computer maintenance and repairs, pest control, and floristry/plant care were found to often take longer (Cherrett et al., 2012). A study of service trips in American cities found that service vehicles typically account for 30-65% of total parked vehicle-hours per mile-day of all goods vehicles, while these trips only account for 6-25% of all motorised freight trips, reflecting their relatively long dwell times at the kerbside (Holguín-Veras et al., 2021).

In many urban areas, those using goods vehicles to provide services have to park at the kerbside as no off-street space is available or provided at the business or residential premises they are visiting. Requirements for off-street space for goods vehicles at major buildings vary by type of land use and planning authority. However, these major buildings with off-street loading space account for a small proportion of all the delivery and collection addresses visited by goods vehicles in urban areas and it is not always available on vehicle arrival where it does exist. As service activities do not involve continuous loading and unloading of goods from the vehicle, they are not treated in British traffic law as loading/unloading but are instead regarded as parking incidents. In addition, the substantial times that those providing these services can need to spend at the location served often exceed the time permitted for kerbside loading/unloading by highway authorities.

Service vehicle activity is therefore an important component in urban freight movements and kerbside use. A survey of 13 service providers servicing 438 clients in Winchester (Cherrett and Smyth, 2003) suggested that 38% of the vehicle activity involved parking on a public road near the premises with 31% parking off-street at the clients' premises. A study in Colchester, with a sample of 244 town centre establishments, found that 76% of service providers' vehicles were parked on a public road whilst the service was carried out (Allen et al., 2008). Given their frequency, relatively long vehicle dwell times and their high use of on-street parking, service visits can be responsible for the consumption of a substantial quantity of kerbside parking in urban areas. Finding kerb or off-street parking space together with the walking then necessary from vehicle to building can result in considerable time loss.

The tools and equipment needed to provide such services can be bulky and heavy. Therefore, some of those providing such services may need to park very close to the location at which the service is provided. If parking space is not available at an appropriate kerbside location close to the building served, it can be necessary for the tools, equipment and goods to be unloaded from the vehicle (which is treated in British traffic law as loading/unloading) and then for the service provider to move the vehicle to a kerbside location further away where the vehicle can be legally parked for the duration of the service and return to the building on foot. They then have to repeat this walking and vehicle relocation at the end of the servicing activity to collect their tools and equipment.

The number and frequency of vehicles trips for the purpose of servicing has increased substantially over time. This has been reflected in the number of vans in use in Britain which has risen by 98% between 1994 and 2020 (Department for Transport, 2021f). Despite the importance, growth and prevalence in these servicing activities and their related vehicle use, the requirements of these activities and vehicles have been overlooked in kerbside stopping regulations.

6. Provision of kerbside space for goods vehicles making deliveries and collections

6.1 Changes in kerbside space regulation and provision over time

On-street car parking and goods vehicle loading/loading was largely unrestricted in urban areas in the UK until the mid-twentieth century. However, as car ownership and use increased, cases of double and even triple car parking became increasingly common in busy urban locations, especially central London. Growing concerns about obstructions to traffic flow and road safety led to the growing introduction of parking management in towns and cities with regulations implemented concerning where kerbside parking was permitted and the times at which it could take place (Chartered Institution of Highways and Transportation, 2005). A 1947/8 study found that in a part of London without any parking controls road traffic collisions had increased over time, while in another location where parking controls had been introduced there had been a considerable reduction in road traffic collisions (quoted in London Assembly Transport Committee, 2005). Guidance and policies also gradually began to emerge in relation to parking standards for new residential and commercial developments.

From the introduction of motorised goods vehicles until the 1950s, kerbside loading and unloading in the UK was largely unrestricted, allowed to take place anywhere at any time. From the 1950s, single and double yellow lines began to be introduced at the kerbside to manage car parking. Kerbside loading was permitted on yellow lines as long as yellow kerbside pips were not displayed on the kerbstone with these pips denoting loading/unloading restrictions (either at certain times/days or at all times). While kerbside loading/unloading by goods vehicles has always been permitted to take place free of charge in the UK, parking meters (and charges) for car parking were first introduced in central London in 1958, with charging for car parking legislated for in the Road Traffic Regulation Act 1967 and expanded in the 1984 Act (Bates and Leibling, 2012).

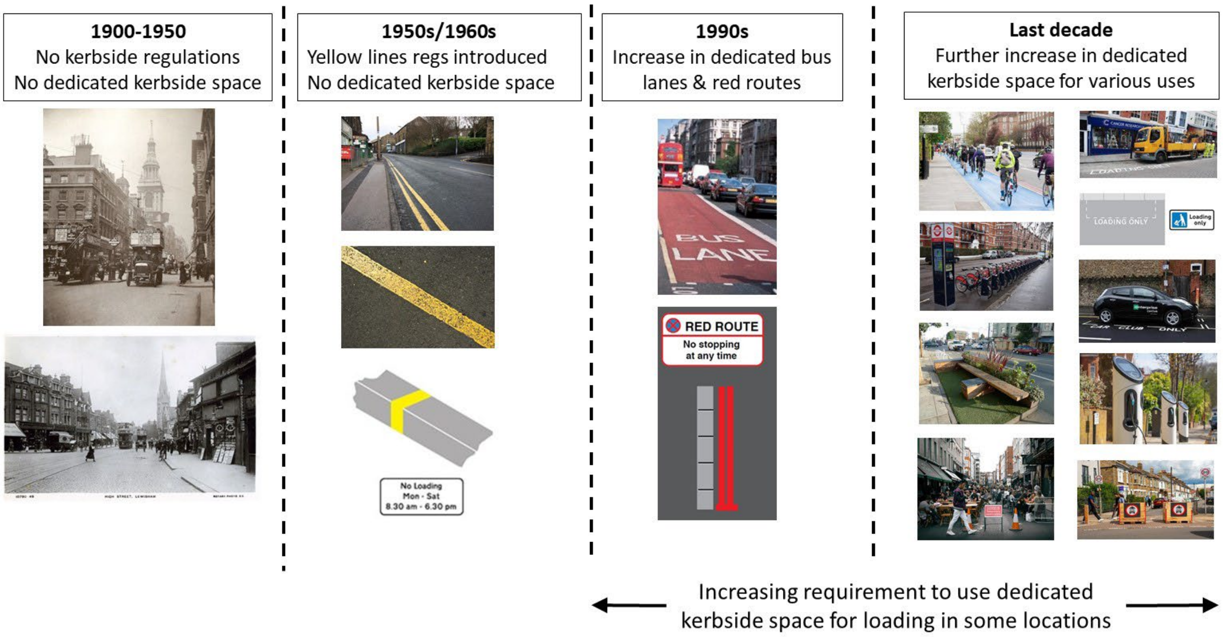
The UK Government has shifted its policy direction since the 1990s away from 'car-dependence' towards active travel and the importance of the place function of streets as a result of concerns about urban traffic congestion and its impact on the economy, public health and greenhouse gas emissions (see **section 3**). As previously discussed (see **section 4**), from the 1990s on, dedicated bus lanes and so-call 'red-routes' in London began to be introduced. Such schemes had the effect of preventing kerbside loading/loading taking place in these locations. On red-routes, kerbside loading/unloading had to take place either in dedicated loading bays when times permitted or on adjoining side-streets. Legislation introduced by the UK Government in the Road Traffic Act 1991 also permitted urban authorities to take control of on-street parking enforcement and to receive the revenue raised from parking charges (see **section 2** for further details).

Over the last decade, kerbside space has been reallocated to a growing number of other activities and purposes including bus and cycle lanes, car club parking bays, electric vehicle charging bays, parklets, cycle parking and hire bike and e-scooter docking stations, modal filters for LTNs, and, since Covid-19, for on-street dining (see **section 4** for further details). While the majority of kerbside loading/unloading still takes place on yellow lines and other unrestricted kerbside, there has been an increasing implementation of dedicated loading bays in busy urban streets with commercial activities. These dedicated loading bays either permit loading at any time or at specified days and times.

Since its implementation, car parking policy in the UK has therefore sought to meet various and at times conflicting objectives. As one researcher has noted UK parking policy, "is at best an opaque balance between a revenue raising activity for local authorities, a desire to avoid deterring visitors and therefore damaging urban vitality and a need to manage transport demand" (Marsden, 2006).

These developments in UK kerbside management and allocation are illustrated in **Figure 6.1.** Over time, especially in the last decade, an increasing proportion of kerbside space is becoming dedicated to specific uses.

Figure 6.1: Changes in kerbside regulation and allocation in the UK over time

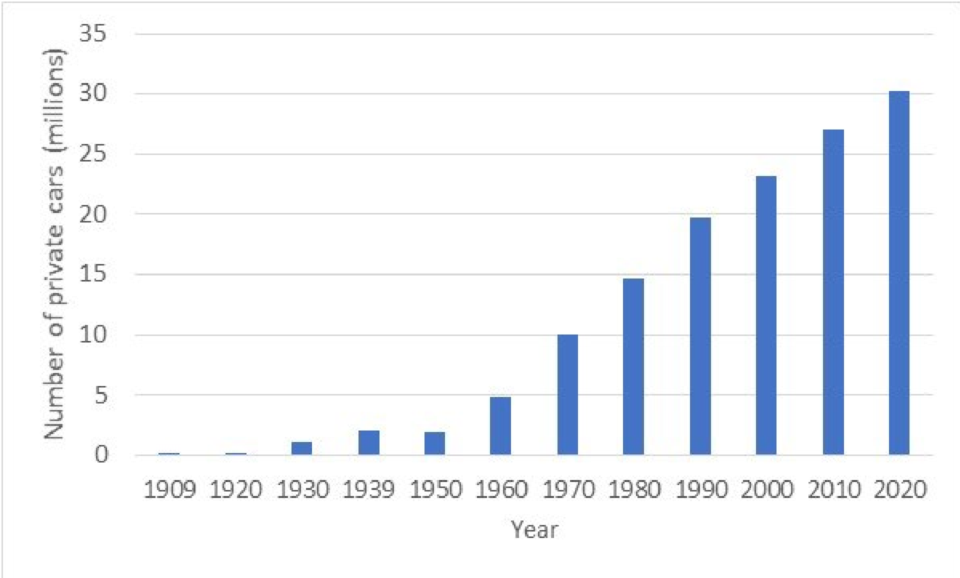


6.2 Car ownership and use

The total number of cars licensed in the UK has increased greatly since the 1950s (see **Figure 6.2**). So has the proportion of households with at least one car, increasing from 14% of English households in England in 1951, to 60% in 1981 and 76% in 2020. It continued to increase over this entire period (see **Figure 6.3**). Figure 6.4 shows the change in number of cars/vans per adult in England, with it rising from 0.42 cars/vans per adult in 1985/86, to 0.67 in 2020 (Department for Transport, 2021h). Research has shown that over the 24-year period from 1995/6 to 2018/19, on average, cars were driven for 4-5% of the time and parked for the other 95-96% (Nagler, 2021). In addition, 25-35% of UK households are estimated not to have off-street car parking facilities (and therefore parking these cars on-street - Cliff, 2020; Department for Transport, 2021g, Jennings et al., 2018; Nagler, 2021; Wills, 2020), with the proportion even higher in urban areas. Research shows that 35-40% of households in Manchester, Edinburgh and Cardiff and 45-50% of households in London have no off-street space for their cars (Jennings et al., 2018; Nagler, 2021).

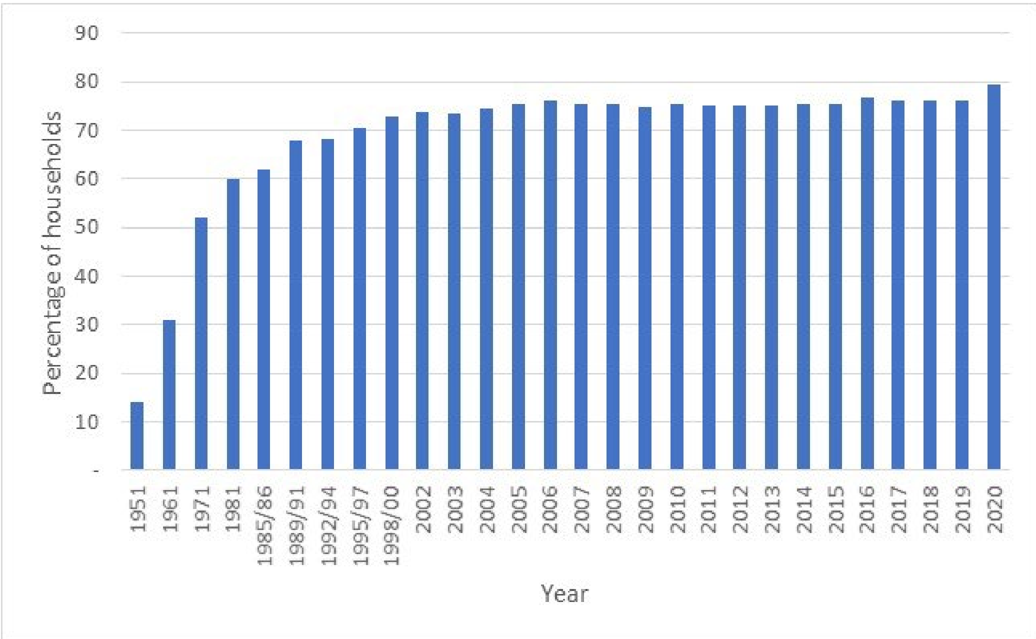
This growth in UK car ownership, together with the very high proportion of time that cars are parked for and the number of households without off-street car parking facilities has resulted in much kerbside space in urban areas, both in commercial streets and in residential streets (especially those with no off-street driveways), being taken up by parked cars.

Figure 6.2: Number of private cars licensed in Britain, 1909-2020



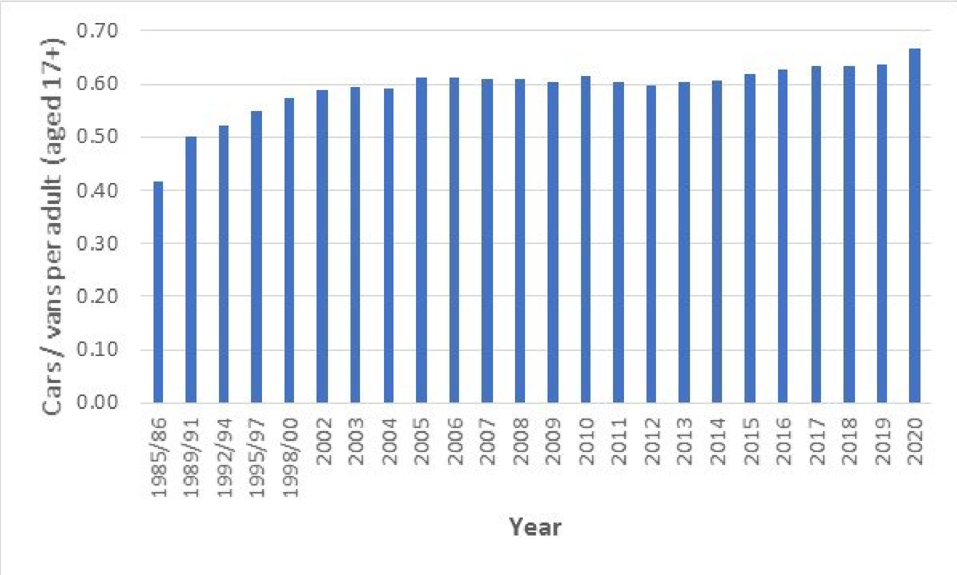
Source: Department for Transport, 2021h.

Figure 6.3: Proportion of English households with at least one car, 1951-2020



Source: Department for Transport, 2021i.

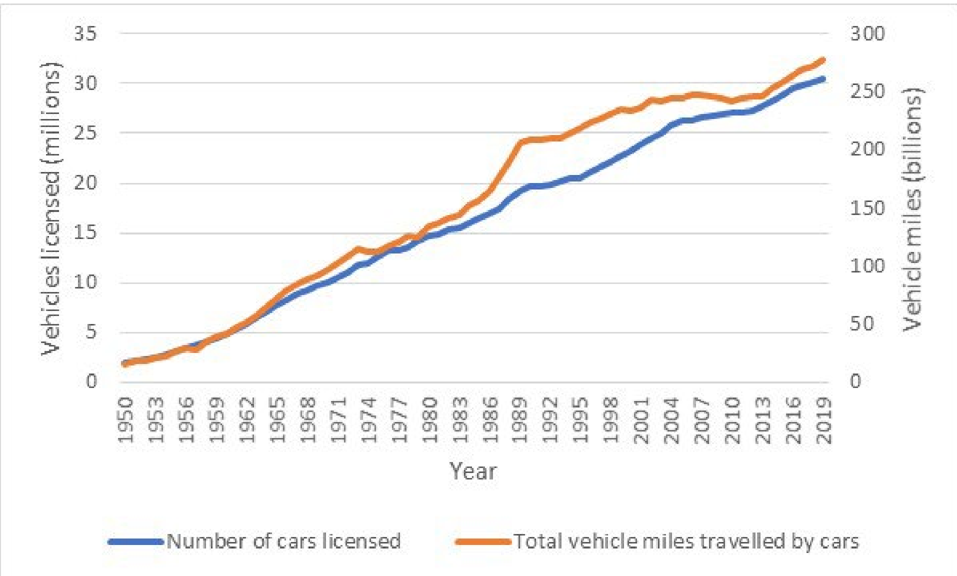
Figure 6.4: Cars/vans per adult in England, 1985/86-2020



Source: Department for Transport, 2021i.

Urban highway authorities provided for this demand for car parking by implementing kerbside parking bays and other schemes (such as Controlled Parking Zones) on street. Although kerbside loading is permitted to take place in kerbside car parking bays (but not in Controlled Parking Zones other than at times when the parking zone is not in force or in dedicated loading bays in the zone), as the number of cars licensed and their usage increased over time, this has made finding a kerbside space to unload increasingly difficult. **Figure 6.5** shows the number of cars licensed at a national level together with car usage in Britain since 1950. This illustrates the rate of growth in both the number of cars and their use, with strong growth in both over the decades. Growth in car usage rates outstripped growth in car numbers over the period 1980 to 1990.

Figure 6.5: Cars licensed and car usage in Britain, 1950-2019

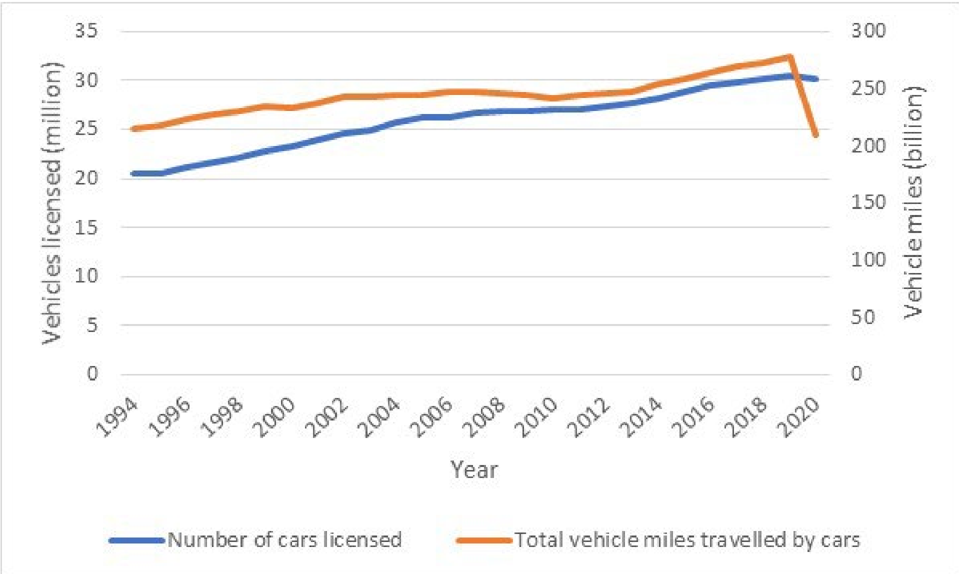


Source: Department for Transport, 2021j, 2021k.

Individuals are tending to make fewer car journeys over time and reduce the total distance that they travel. This is related to reductions in commuting due to more home-working and flexible working arrangements, as well as reductions in shopping journeys as people make greater use of online retailing services. However, overall car usage has increased due to population growth and is forecast to continue increasing (Department for Transport, 2019a). Government forecasts expect car traffic to grow between 11% and 43% nationally between 2015 and 2050 as a result of lower running costs, economic growth and population increases. Similar levels of traffic growth are forecast in London to 2050. Cars are forecast to continue to be the dominant mode of road transport – they accounted for 79% of road traffic activity nationally in 2015 and are forecast to account for 75% to 81% by 2050 (Department for Transport, 2018).

Figure 6.6 shows the number of cars licensed at a national level together with car usage between 1994 and 2020. This indicates the slowing rate of growth in car usage compared to car ownership between the mid-1990s and 2010 followed by a similar growth rate in both. It also illustrates the impact of the Covid-19 pandemic on car use in 2020, leading to a substantial reduction in car use in Britain. The number of cars licensed increased over this 25 year period, with the exception of 2020 when they fell by 1% compared with 2019 as a result of the Covid-19 pandemic.

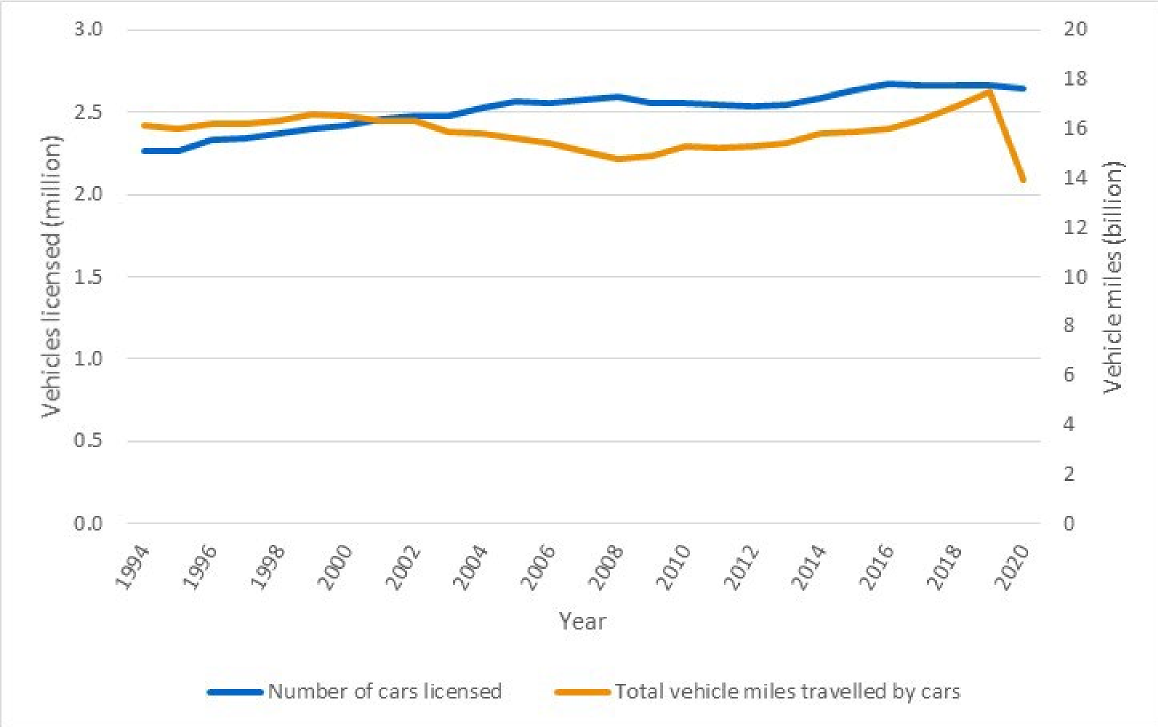
Figure 6.6: Cars licensed and car usage in Britain, 1994-2020



Source: Department for Transport, 2021j, 2021k.

Figure 6.7 shows the number of cars licensed and car usage in London over the same period, in order to provide a focus on an exclusively urban area. This indicates a reduction in car usage between 2003 and 2008, since when it began to gradually increase again, before falling considerably in 2020 due to the Covid-19 pandemic. The number of cars licensed has increased gradually over the period until 2015, since when it changed little.

Figure 6.7: Cars licensed and car usage in London, 1994-2020



Source: Department for Transport, 2021k, 2021l.

Figures 6.6 and 6.7 and **Table 6.1** indicate that at a national level, growth rates in the number of cars licensed outstripped car usage over the period 1994-2019. Growth in the number of cars licensed over this period was far stronger nationally than in London, but still increased by 17% in the capital. Similarly, car usage grew far less strongly in London than nationally between 1994-2019, even falling in some of the interim 5 year periods shown in **Table 6.1**. The Covid-19 pandemic can be seen to have contributed to substantial falls in car use both nationally and in London in in 2020, but the number of cars licensed remained virtually unchanged.

Table 6.1: Changes in cars licensed and car usage in Britain and London

Years	Number of cars licensed		Total vehicle miles travelled by cars	
	National	London	National	London
1994-1999	+11%	+6%	+9%	+3%
1999-2004	+13%	+5%	+4%	-5%
2004-2009	+4%	+1%	0%	-6%
2009-2014	+5%	+1%	+4%	+6%
2014-2019	+8%	+3%	+10%	+11%
2019-2020	-1%	0%	-25%	-21%
1994-2019	**+49%**	**+17%**	**+30%**	**+9%**

Source: Department for Transport, 2021h, 2021j, 2021k, 2021l.

Reasons for falling car usage in London between 1999 and 2009 include traffic congestion, the cost of car driving, increases in home working, and the promotion of active travel (use of public transport, walking and cycling). Car usage resumed its growth trend in London between 2009 and 2019.

Car ownership levels nationally and in London were, respectively, 49% and 17% higher in 2019 than in 1994. This has resulted in increased demand for car parking at the kerbside between these dates. The parking requirements of these cars at the kerbside, together with the other, more recent, reallocation of the kerbside for active travel and other uses, has led to a decreasing quantity of kerbside space for loading and unloading. Transport for London is of the view that “moving trips out of the car and on to these more space-efficient modes of transport will release road space for the freight and servicing trips” (Transport for London, 2019a, p.73).

Various national and city government policy documents expect car ownership levels to fall as more people switch to using public transport, cycling and walking. However, as discussed above, there is currently no evidence of car ownership levels declining at either a national or London level. Instead, the number of cars requiring kerbside parking in urban areas may even be continuing to rise at present as people decide to switch from public transport to private car transport in the midst of the Covid-19 pandemic, together with the continued development of multi-tenanted blocks of flats that have little or no off-street parking facilities.

6.3 Connected autonomous vehicles and kerb space

Government publications also foresee a future switch to connected and autonomous road vehicles (CAVs). The emergence of such vehicles would allow people to make use of bookable, autonomous ride-hailing services that would collect them from wherever they like and take them to their destinations without the need for them to own or park the vehicle. The charges for these services are expected to be lower than current taxi services, given the substantial proportion of operating cost accounted for by the driver. When CAV ride-hailing services will become commonly available and how sizeable the uptake of their use will be is uncertain, given the technology developments, safety approval and behaviour change that it requires.

If the use of ride-hailing CAVs becomes prevalent, rather than people choosing to own CAVs for their personal use this would be expected to substantially reduce the number of cars parked at the kerb and the total time that cars occupy kerb space for in both residential and city centre locations. This is because many personal cars are used relatively little, spending much of their life parked on- and off-street between uses. Therefore, greater use of CAV ride-hailing vehicles has the potential to vastly reduce the total car fleet in the UK, resulting in far more efficient vehicle utilisation. In addition, as the time taken to drop off and pick up people by car at the kerbside is so much less than parking the car at the kerb while carrying out activities at the journey destination, there would be substantial reductions in the total time this smaller car fleet spent at the kerb. This is reflected in the high street survey results in **Tables 5.6 and 5.7**, that show that although pick up and drop off accounted for 60-74% of total vehicle stops in these four surveys, the time spent by these vehicles at the kerb only accounted for 5-8% of total kerb time by all vehicles for all purposes. Similarly, vehicle waiting accounted for 6-9% of total vehicle stops at the kerb but only 1-5% of total vehicle time at the kerb. By comparison, parking accounted for 14-28% of total vehicle stops at the kerb, but 77-85% of total vehicle time at the kerb (Transport for London, 2015a, 2015b, 2015c, 2015d). A major switch from private car ownership and use to the use of ride-hailing CAVs would therefore free up substantial kerb space for other uses including freight transport loading/unloading.

Research has been carried out that has considered dynamic, flexible kerb allocation in the age of CAVs. Modelling their application to Cheapside in the City of London. In the simulation analysis carried out they foresaw no kerbside provision for the delivery and collection of goods either in the morning peak (between 07:00-09:00) or at lunchtime (between 12:00 and 14:00). Instead some kerb space was provided for loading/unloading between 19:00 to 21:00 but with greater kerb space allocated to this activity in the overnight period. The authors reported that, "the models show that FlexKerbs offer a wide range of benefits to all street users on a future CAV-enabled street. Comparing the No FlexKerbs and With FlexKerbs future scenarios, FlexKerbs offer dramatic reductions in vehicle delay, a safer and more comfortable experience for cyclists when and where they need it, a more efficient use of kerb space and an extra-wide footway to accommodate high pedestrian volumes" (Claris et al., 2018, p.45).

However, the discussion of the results provides no consideration of the impacts of such an approach on the provision of goods or on how realistic such an operating environment for freight transport would be likely to be. Such assumptions about the ability to retime all deliveries and collections of goods to the night is unlikely to be realistic in terms of how supply chains function, and the implementation of such a scheme by policy makers would be likely to result in increases in freight transport operating costs as well as possible difficulties in obtaining deliveries if some operators decline to provide delivery services in such situations, thereby putting pressure of the viability of local businesses.

If CAVs do results in a major decline in car ownership and usage this is however also likely to result in a major decline in the kerbside and off-street parking revenues generated by local highways authorities (which commenced in 1958 with the first parking meters installed in the City of Westminster – British Parking Association, 2021).

In 2020, work commenced to draft an international standard (ISO DTS 4448) to govern the use of automated vehicles on the carriageway and footway given that several companies were already running pilot projects using delivery robots for this purpose. This ISO standard was deemed necessary as the robots have no human operator, they operate on the same street environment as pedestrians some of whom are disabled and have sight problems, and other vehicles operated by humans, these robots require algorithms to determine the rules by which they operate, these robots will require reserved spaces to stop while delivery takes place, they will capture much data some of which will have implications for individual privacy (Bern, 2021). Part 4 of this ISO (DTS 4448-4) will specifically address the 'Kerb/Kerb loading / unloading for ground based robotic devices'. This part of the standard will provide "procedures and protocols for goods and passenger vehicles to reserve, queue, access, loading/unloading spaces at the kerb" (EU ICIP, 2022).

6.4 Residential development and car parking provision

Urban planning authorities have discouraged the inclusion of off-street car parking in new residential developments for the last two decades. Maximum car parking standards were first introduced in 2001 through national planning policy. For example, the first London Plan stated that car parking provision in new developments should be the 'minimum necessary' (Mayor of London, 2001, p.154). This guidance in London has become more nuanced over time to reflect the accessibility of a proposed development to public transport services. The 2021 London Plan states that, "Car-free development should be the starting point for all development proposals in places that are (or are planned to be) well-connected by public transport, with developments elsewhere designed to provide the minimum necessary parking ('car-lite')" (Mayor of London, 2021b, p.422).

Urban planning authorities take this approach to granting permission for off-street parking in housing developments in the hope that it will discourage new residents from buying cars and using them. For example, the London Plan explains that the current level of car use, "is a significant barrier to walking and cycling, reduces the appeal of streets as public places and has an impact on the reliability and journey times of bus services. Reduced parking provision can facilitate higher density development and support the creation of mixed and vibrant places that are designed for people rather than vehicles. As the population grows, a fixed road network cannot absorb the additional cars that would result from a continuation of current levels of car ownership and use" (Mayor of London, 2021b, p.423-4). In general, the greater the accessibility of new residential developments to local transport services, the lower the maximum permitted off-street parking facilities that are granted in planning permission. In London, for example, city centre developments are expected to be car-free, while those in inner London should permit a maximum of 0.25-0.75 car parking spaces per dwelling, depending on their public transport accessibility (Mayor of London, 2021b).

The data presented in **Figure 6.5** and **Table 6.1** indicates that these policies of discouraging off-street parking in new developments and setting maximum off-street parking standards have had little impact on car ownership levels in London. However, due to a lack of off-street parking space at their homes, many residents instead have to park their cars on-street at the kerbside, thereby consuming this valuable resource.

6.5 Provision of loading/unloading space at the kerbside

Providing evidence to a House of Commons Transport Committee inquiry in parking enforcement, the freight transport operator TNT stated that, "In our experience, the provision of loading and unloading facilities in many commercial centres is substantially inadequate. It is our view that it is important to ensure that the demand for loading and delivery activity is not ignored as it can create congestion, harm road network performance and reduce the effectiveness of traffic engineering schemes. Facilitating kerbside loading at the right place and time, through a combination of appropriate physical infrastructure and TRO's, smooths the traffic flow and benefits the local economy. As internet shopping and home delivery continues to increase exponentially, more places to legally stop for deliveries outside or near shop fronts and residences becomes an ever-more essential requirement. A review of the existing provision for loading and unloading, particularly in PCN Hot Spots, could enable delivery activities to be integrated more successfully into a street's day-to-day operation" (TNT Express Services, 2013).

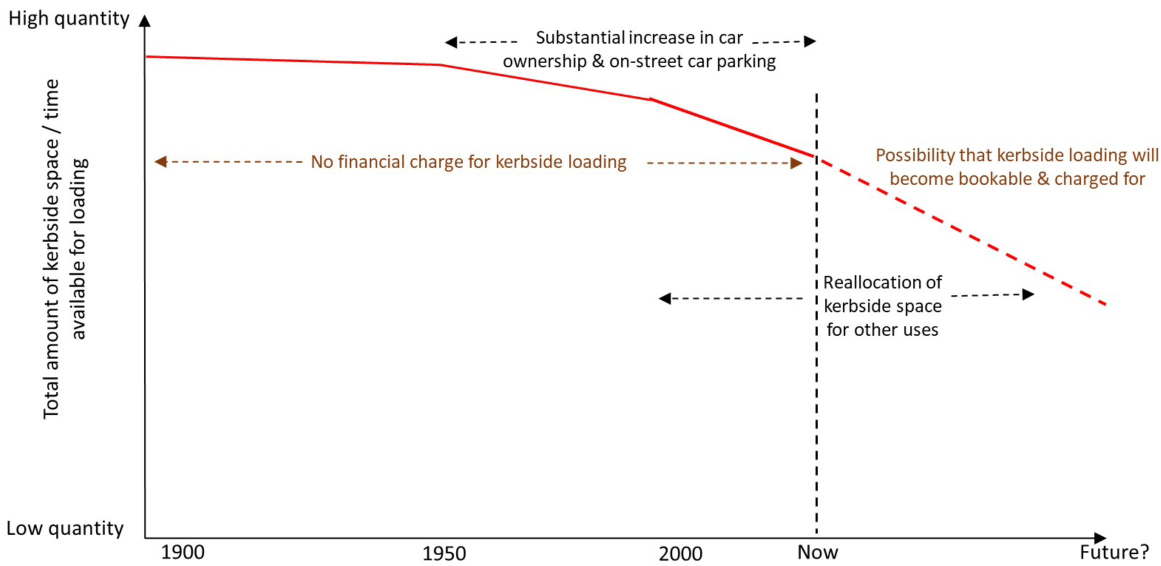
In the evidence submitted to the House of Commons Transport Committee inquiry into Parking Policy and Enforcement, the Freight Transport Association shared survey work it had carried out amongst its members. This showed that the majority of the top five reasons for freight transport operators receiving Penalty Charge Notices (PCNs) were concerned with the provision of loading/unloading: kerbside parking restrictions in force, inflexibility of parking enforcement officers, lack of kerbside loading/unloading provision at delivery location where vehicle needed to stop, delivery being made on a Red Route, and the kerbside loading space already being occupied (by cars or other goods vehicles) (Freight Transport Association, 2005).

As well as the amount of space provided for loading/unloading at the kerbside, it is also necessary for urban authorities to take account of the times at which this space is made available for use. Time restrictions may be applied for safety and traffic flow reasons. If the times at which loading/unloading at the kerbside is too short to deliver or collect substantial loads and/or does not match with the delivery and collection times requested by their customers, then freight transport operators may have to operate additional vehicles to such a location in order to comply. This results in additional vehicle travel and its related energy use and other impacts.

Figure 6.6 provides indicative insight into the change in available kerbside loading space and time in urban areas in the UK over recent decades. This reflects the fall in kerbside loading space and time available over the years, first due to increases in car ownership and on-street car parking (especially since the 1950s) and then the reallocation of kerbside space for other uses since the early 1990s (initially with bus lanes and Red Routes, and their use of dedicated loading bays rather than a yellow line loading/unloading regime, and more recently with the implementation of a range of other kerbside infrastructure including segregated cycle lanes, cycle and e-scooter hire scheme docking stations, cycle parking, car club bays, electric vehicle charging points, parklets and on-street dining).

Such reallocation may well continue at a similar space to recent years in future, leading to ever-diminishing kerbside space and time for loading/unloading. Technology is permitting the digitisation of the kerbside and the implementation of innovative kerbside car parking schemes in which spaces can be pre-booked and paid for remotely. Similar pre-booking schemes are currently being developed by specialist technology providers for kerbside loading/unloading (see **section 9.1**). Whether such technology will be applied to kerbside loading will depend on the willingness of highway authorities to adopt it and work in partnership with these technology providers. Also, as discussed above, until now, unlike car parking, no charging has been levied for kerbside loading/unloading by highway authorities in the UK. However, given the perilous state of local authority finances, the demand for kerbside space and the provision of technology that facilitates it, whether kerbside loading/unloading will remain financially free to use in future is uncertain.

Figure 6.6: Indicative change in available kerbside loading space / time in urban areas in the UK



It is also worth noting that although some shops, restaurants, pubs and other businesses may have been receiving fewer goods per delivery during Covid-19 as a result of a reduction in shoppers and personnel working from home, these premises still require vehicle deliveries and collections to take place at the same frequency that they did previously. It is only the quantity of goods delivered or collected per vehicle visit that will have changed, not the kerbside stopping space required by freight operators serving these businesses.

6.6 Charging for kerbside loading/unloading space

Both the availability of car parking spaces (near people's home and the destinations they travel to) and parking charges influence people's choices about whether to drive or use another mode of transport, the times at which to drive, and even whether to own a car. These tools (car parking spaces and pricing) are used by policymakers to manage demand for car use and car parking.

Charging is being encouraged by some commentators and parking technology providers as a means of making freight transport operators' use of kerbside loading/unloading space more efficient and thereby reducing the extent freight transport activity. The application of charging to kerbside loading/unloading activities would be unlikely to have the same effect on the use of this space as it does for car parking. First, no suitable alternatives exist to the vast majority of this goods collection and delivery work in urban areas being performed by goods vehicles using the road network and kerbside and none are likely to emerge anytime soon (Jaller et al., 2013). Second, the demand for freight transport services is derived from the need to collect and deliver goods to and from businesses and private individuals, and therefore the freight companies providing these services are contractually obliged to make these goods deliveries and collections. Drivers of goods vehicles only make journeys to fulfil the deliveries and collections of goods requested by businesses and individuals. They carry out these loading/unloading stops at the kerbside as quickly as possible, so that they can continue to their next location to perform the next job.

Charging for the space and time used at the kerbside where loading/unloading activities take place is unlikely to have much effect on the total level of goods vehicles using them given the inelastic demand for freight transport services with respect to price (due to the lack of modal alternatives and that freight transport services represent a small proportion of the total cost of many goods. In addition, the level of competition between freight transport operators results in them often not being able to pass on such cost increases to their customers. As a result, any increases in kerbside stopping costs are unlikely to have much of an effect on the total demand for those goods or their delivery, unlike the effect of such price signals on car users. Therefore charging for goods vehicle kerb space acts rather as a means of revenue raising (Holguín-Veras et al., 2020). Instead, such kerbside pricing for loading/unloading would result in higher freight transport operating costs that some operators may be able to pass on but many others not, depending on the size and influence of the company and the nature of the contracts it has with its customers. However, depending on the scale of such kerbside loading/unloading charges and the types of goods involved, these could result in price increases for those goods for which freight transport costs represent a sizeable proportion of total costs.

Reducing the kerb space and time for loading/unloading would also potentially lead to greater levels of freight transport activity in which loading rules and restrictions are breached, resulting in less safe operations and impacts on traffic flow. It could also result in difficulties in some businesses obtaining deliveries if some companies were to refuse to provide their services in certain locations, thereby adversely affecting the liveability and economically sustainability of such places.

Pricing of the kerbside for freight use has been implemented in some busy, central streets in New York and other American cities (see **section 9.4**). This has come about in cities that have made use of dedicated loading bays in busy, central locations. This contrasts with the UK where traditionally all and, still today, most loading/unloading in central locations takes place on yellow lines with no loading restrictions which cannot be used for car parking. In this yellow line regime, urban authorities have no mechanism for charging operators for loading/unloading even if they wanted to. However, over time in the UK, some kerbsides where demand for the space is especially high and new streetspace schemes, Red Routes, or other priority traffic schemes have been introduced, urban authorities are redesigning kerb access so that loading/unloading is only permitted in dedicated loading bays or bays shared with disabled parking (see **sections 4.10 and 4.11**). While use of such these dedicated loading bays is not currently charged for in the UK, the existence of dedicated bays provides urban authorities with the opportunity to charge for their use.

In New York and some other American cities, another challenge that has been faced that does not exist in the UK, arises from goods vehicles having commercial number plates whether carrying out loading/unloading or servicing activities (see for example, New York City Department of Transportation, 2020). This has led to dedicated loading bays in dense, urban locations being made available to all goods vehicles regardless of whether their activity is loading/unloading or servicing, which have very different vehicle dwell times. This approach provides as easy means by which the use of these bays can be enforced (as vehicles without commercial plates can be easily observed) but has resulted in service vehicles that need to park rather than load/unload goods occupying these bays for long periods of time while engineers carry out tasks inside buildings. This results in a lack of turnover of the bay space and goods vehicles needing to make collections and deliveries being unable to find a bay space to do so. This is not the case in the UK, where in British law, goods vehicles used to provide servicing activities are treated as parking rather than loading/unloading unless continuous loading/unloading to and from them is taking place.

6.7 Public attitudes towards the impacts of transport in general and freight transport operations

In 2020, the Department for Transport's National Travel Attitudes Survey asked respondents in England in 2020 about their concerns regarding transport impacts on air quality and climate change. This showed that 56% of respondents either agreed or strongly agreed that they were concerned about the impact on their health of traffic fumes. Seventy-six percent of respondents either agreed or strongly agreed that, for the sake of the environment, everyone should reduce how much they use their cars. However, only 39% of respondents either agreed or strongly agreed that they were personally willing to reduce the amount that they travelled by car to help reduce the impact of climate change (see **Table 6.2**).

Table 6.2: Respondents views on vehicle exhaust emissions and car use, England, 2020

Topic	Agree strongly	Agree	Neither agree nor disagree	Disagree	Disagree strongly	Total
I am concerned about damage to my personal health from exhaust fumes	20%	36%	28%	15%	2%	100%
For the sake of the environment, everyone should reduce how much they use their cars	24%	52%	15%	7%	2%	100%
I am willing to reduce the amount I travel by car, to help reduce the impact of climate change	8%	31%	23%	18%	8%	100%

Source: Department for Transport, 2019c, 2020f.

When asked how concerned they were about air quality in their immediate area, 12% of respondents said that they were very concerned, 36% that they were fairly concerned, 38% not very concerned, and 14% not at all concerned (Wave 3) These views on air quality varied by the size of settlement in which the respondent lived, with concern being greater the larger the size of settlement (see **Table 6.3**).

Table 6.3: Whether or not respondents were concerned about air quality in their immediate area by the size of settlement in which they live, England 2020.

	Responses	
Size of settlement	**Concerned**	**Not concerned**
Urban conurbation	59%	41%
Urban City and Town	46%	54%
Rural Town and Fringe	36%	64%
Rural Village, Hamlet and Isolated Dwelling	25%	75%
England as a whole	**48%**	**52%**

Notes:
Urban Conurbation: An extended urban area, typically consisting of several towns merging with the suburbs of a central city.
Urban City and Town: A built up area with population exceeding 10,000 individuals within the settlement.
Rural Town and Fringe: Fewer than 10,000 within a settlement which consists of more than 35 dwellings within 800m radius.
Rural Village and Hamlet: Fewer than 10,000 within a settlement, consisting of fewer than 35 dwellings within 800m radius.
Source: Department for Transport, 2020g.

Cars (82%), lorries and vans (73%), buses (57%) and motorbikes (43%) were most frequently mentioned by respondents when asked about the causes of their concerns in relation to poor air quality in their immediate area (see **Table 6.4**).

Table 6.4: In your immediate area, which of the following, if any, cause you concern in relation to poor air quality? (England, 2020)

Source of air pollution	Yes	No
Cars	82%	18%
Lorries or Vans	73%	27%
Buses	57%	43%
Motorbikes	43%	57%
Aeroplanes	19%	81%
Household sources, such as BBQs or bonfires	16%	84%
Industry, such as manufacturing, construction or power stations	22%	78%
Trains	9%	91%
Boats or ferries	3%	97%
Light rail (trams or underground)	3%	97%

Source: Department for Transport, 2020g.

Table 6.5 shows respondents' views on the types of transport that have the greatest overall impact on climate change. This shows that respondents believed that vans and lorries have a greater impact on climate change than car use.

Table 6.5: Respondents views on which types of transport have the most overall impact on climate change, England, 2020 (proportion of respondents stating each)

Vans and lorries	Cars	Aeroplanes	Buses and coaches	Ships and ferries	Motorbikes	Trains
29%	24%	21%	15%	6%	3%	2%

Note: Respondents were asked to select up to three transport modes for this question.
Source: Department for Transport, 2019c.

In this same survey work, when asked how concerned they were about noise pollution in their immediate area, 13% of respondents said that they were very concerned, 27% that they were fairly concerned, 44% not very concerned, and 16% not at all concerned (Wave 3). As with air pollution, cars (74%), lorries and vans (61%), motorbikes (54%) and buses (38%) were most frequently mentioned by respondents as sources of concern in relation to noise pollution (see **Table 6.6**).

Table 6.6: In your immediate area, which of the following, if any, cause you concern in relation to noise pollution?

Source of air pollution	**Yes**	**No**
Cars	74%	26%
Lorries or Vans	61%	39%
Motorbikes	54%	46%
Buses	38%	62%
Aeroplanes	19%	81%
Industry, such as manufacturing, construction or power stations	15%	85%
Trains	12%	88%
Hotels, restaurants, pubs and other places of entertainment	8%	92%
Light rail (trams or underground)	3%	97%
Boats or ferries	2%	98%

Source: Department for Transport, 2020g.

Thirty-six percent of respondents agreed with the statement that "vehicles making deliveries cause congestion in my local area", while 34% disagreed and 29% thought neither was true. Responses varied by the size of settlement in which respondents lived with those living in rural areas more likely to disagree that delivery drivers cause congestion in the local area than those living in urban areas. However, there is little difference in the proportion of respondents who agree with the statement, regardless of the size of settlement in which they live (see **Table 6.7**).

Table 6.7: Proportion of respondents who think that delivery drivers cause congestion in the local area by settlement type, England, 2020 (proportion of respondents)

	Responses		
Size of settlement	**Agree**	**Neither**	**Disagree**
Urban conurbation	37%	33%	29%
Urban City and Town	36%	29%	35%
Rural Town and Fringe	36%	23%	38%
Rural Village, Hamlet and Isolated Dwelling	34%	22%	44%
England as a whole	**36%**	**29%**	**34%**

Notes:
Urban Conurbation: An extended urban area, typically consisting of several towns merging with the suburbs of a central city.
Urban City and Town: A built up area with population exceeding 10,000 individuals within the settlement.
Rural Town and Fringe: Fewer than 10,000 within a settlement which consists of more than 35 dwellings within 800m radius.
Rural Village and Hamlet: Fewer than 10,000 within a settlement, consisting of fewer than 35 dwellings within 800m radius.
Source: Department for Transport, 2020f.

Respondents in another Department for Transport survey in England in 2020 were asked the extent to which, if at all, they thought that various transport issues were a problem either on their residential street or in your local high street. The four areas that were considered the most serious problems in residential and high streets were: vehicles going too fast (30% residential, 26% high street), not enough car parking spaces (27% residential, 26% high street), heavy traffic (20% residential, 23% high street) and traffic fumes (20% residential, 24% high street). By comparison, fewer respondents thought that a lot of lorries were a problem. Fifteen percent of respondents felt that a lot of lorries were a problem on their residential street, while 17% thought so on their local high street (Kantar, 2020). This survey only referred to lorries and not vans, unlike the questions posed in the above questions which either referred to ‘lorries and vans’ or ‘delivery drivers’ regardless of the vehicle type they used.

Qualitative and quantitative survey work carried out on behalf of the UK Government between September and November 2020 investigated the current behaviours and attitudes towards sharing the road of various categories of road user. Categories of road users included in the work included: drivers (of cars, motorcycles, LGVs, HGVs and other vehicles), cyclists, pedestrians and horse riders. The quantitative survey had a sample of 2000 respondents, of whom 64% were vehicle drivers, 88% were pedestrians, 27% were cyclists and 12% were horse riders, with many respondents being in more than one of these road user categories. 98 respondents were LGV, HGV or bus drivers (Logan et al., 2021).

The report summarises the views of those taking part in the work towards the vulnerability of categories of road users as follows: “Vulnerability was primarily associated with road users’ risk of physical injury, which was heavily associated with users not having a designated area of the road, and to a lesser extent with the likelihood of causing an accident. Cyclists were perceived as most vulnerable and voiced the most concern for their own personal safety, with drivers not leaving enough space when overtaking being their biggest concern. Drivers were also more likely to be worried for themselves and for others when directly sharing the road, especially due to cyclists’ perceived poor visibility and unpredictable behaviour. Linked to this, drivers often saw cyclists as inconsiderate road users, contributing to tension between these two groups and drivers’ broader views towards road sharing” (Logan et al., 2021).

The report summarises views the views of participants on road sharing and road priority as follows: “Three quarters thought roads are and should be shared equally, with stronger agreement among cyclists and pedestrians compared to drivers. Perceptions of how considerate cyclists are towards others was a key driver of whether participants supported equal road sharing. The research indicated a misunderstanding of the equal rights of all road users under current law, with almost two thirds of adults perceiving motor vehicles to currently have priority on the road, particularly horse riders and cyclists. A significantly lower proportion, although still the majority of those surveyed, thought cars should take priority suggesting the current norm is largely accepted although there is some appetite for this to change. The overwhelming majority believed all types of road users have equal responsibility for keeping others safe on the road” (Logan et al., 2021).

Responses to several questions were produced by road user category and show results for LGV, HGV and bus drivers as a separate category. These are summarised below and indicate that the concerns about road user safety, road sharing, road user priority and road users having equal responsibility for keeping others safe on the road among LGV, HGV and bus drivers are similar to all other categories of road user.

Table 6.8 indicates cyclists’ greater levels of concern about keeping themselves safe on the roads than other road users with 75% of cyclists being either fairly or very concerned).

Table 6.8: Respondents’ level of concern about keeping themselves safe on the road

	Road user category of respondent				
Level of concern	**Pedestrians**	**Cyclists**	**Horse riders**	**Car drivers**	**LGV, HGV and bus drivers**
Very concerned	21%	35%	36%	20%	27%
Fairly concerned	37%	40%	34%	36%	30%
Not very concerned	29%	17%	19%	29%	27%
Not at all concerned	11%	7%	5%	14%	14%
Don’t know	1%	2%	6%	1%	3%
Total	100%	100%	100%	100%	100%

Note: Number of respondents - Pedestrians: 1764; Cyclists: 537; Horse riders: 247; Car drivers: 1285; LGV, HGV and bus drivers: 98.
Source: Logan et al., 2021.

Table 6.9 shows that a higher proportion of LGV, HGV and bus drivers were ‘very concerned’ about keeping other road users safe than in any other road user category. However, those who were either ‘not very’ or ‘not at all’ concerned about keeping other road users safe were worryingly high across all road user categories.

Table 6.9: Respondents' level of concern about safety of other road users

	Road user category of respondent				
Level of concern	**Pedestrians**	**Cyclists**	**Horse riders**	**Car drivers**	**LGV, HGV and bus drivers**
Very concerned	21%	29%	34%	28%	37%
Fairly concerned	34%	40%	33%	39%	27%
Not very concerned	28%	22%	17%	22%	20%
Not at all concerned	14%	6%	9%	9%	13%
Don't know	2%	3%	7%	1%	3%
Total	100%	100%	100%	100%	100%

Note: Number of respondents - Pedestrians: 1764; Cyclists: 537; Horse riders: 247; Car drivers: 1285; LGV, HGV and bus drivers: 98.
Source: Logan et al., 2021.

Table 6.10 shows that a similar proportion of respondents in each road user category (74-77%) agreed that "roads are for all road users to share equally", while a similar proportion of respondents in each road user category (20-23%) disagreed with this statement.

Table 6.10: Respondents' agreement with the statement that "roads are for all road users to share equally"

	Road user category of respondent				
Opinion	**Pedestrians**	**Cyclists**	**Horse riders**	**Car drivers**	**LGV, HGV and bus drivers**
Agree strongly	32%	36%	34%	29%	35%
Tend to agree	42%	39%	37%	44%	42%
Tend to disagree	18%	19%	18%	19%	16%
Disagree strongly	3%	2%	4%	4%	4%
Don't know	5%	4%	7%	4%	3%
Total	100%	100%	100%	100%	100%

Note: Number of respondents - Pedestrians: 1764; Cyclists: 537; Horse riders: 247; Car drivers: 1285; LGV, HGV and bus drivers: 98.
Source: Logan et al., 2021.

Although all road users have equal rights in law, a sizeable proportion of respondents agreed with the statement, "motor vehicles currently have priority on the road", indicating that they may not be aware of this. Cyclists were most likely to state that motor vehicles have priority (with 72% agreeing) compared with 67% of LGV, HGV and bus drivers and 62% of car drivers (see **Table 6.11**).

Table 6.11: Respondents' agreement with the statement that "motor vehicles currently have priority on the road"

	Road user category of respondent				
Opinion	**Pedestrians**	**Cyclists**	**Horse riders**	**Car drivers**	**LGV, HGV and bus drivers**
Agree strongly	21%	27%	28%	18%	24%
Tend to agree	44%	45%	42%	44%	43%
Tend to disagree	20%	17%	16%	24%	20%
Disagree strongly	6%	6%	7%	7%	6%
Don't know	9%	5%	6%	8%	6%
Total	100%	100%	100%	100%	100%

Note: Number of respondents - Pedestrians: 1764; Cyclists: 537; Horse riders: 247; Car drivers: 1285; LGV, HGV and bus drivers: 98.
Source: Logan et al., 2021.

The vast majority of respondents in all road user categories (and 87% of all respondents) agreed with the statement, "all types of road users have equal responsibility for keeping others safe on the road" (see **Table 6.12**).

Table 6.12: Respondents' agreement with the statement that "all types of road users have equal responsibility for keeping others safe on the road"

	Road user category of respondent				
Opinion	**Pedestrians**	**Cyclists**	**Horse riders**	**Car drivers**	**LGV, HGV and bus drivers**
Agree strongly	46%	44%	37%	48%	52%
Tend to agree	41%	38%	36%	40%	34%
Tend to disagree	7%	12%	18%	6%	6%
Disagree strongly	2%	3%	3%	2%	5%
Don't know	4%	3%	6%	4%	3%
Total	100%	100%	100%	100%	100%

Note: Number of respondents - Pedestrians: 1764; Cyclists: 537; Horse riders: 247; Car drivers: 1285; LGV, HGV and bus drivers: 98.
Source: Logan et al., 2021.

7. Policy maker views on the need for greater efficiency in freight operations

As previously noted, as part of the Mayor of London's Transport Strategy of 2018, kerbside space will be reallocated to achieve the target of 80 per cent of personal trips to be made on foot, by cycling or using public transport and that this will significantly change the operating environment for freight and servicing vehicles. The Mayor acknowledged that London's economy depends on reliable deliveries and servicing, but that, in future, freight and servicing will have to comply with the Healthy Streets Approach and impose, "minimal impact on the street environment and other road users" (Transport for London, 2019a, p.73). The report acknowledges that discussion with the industry had indicated, "some concern that this will reduce the space available for freight and servicing trips, and risks worsening the impacts of congestion" (Transport for London, 2019a, p.73).

In response to these concerns, Transport for London committed to, "work with all partners to ensure businesses are able to receive the goods and services they need, and that there is a clear and joined-up approach" ((Transport for London, 2019a, p.121). Steps to achieving this include: i) reviewing kerbside management on the Transport for London road network to ensure "a strategic, effective and joined-up approach", ii) Transport for London working with boroughs to review and update access and loading regulations and restrictions, and ensuring adequate loading space is provided in all TfL-funded schemes, and iii) making available Transport for London data "to provide clear information and guidance on existing and planned restrictions and regulations across London" to operators and software developers ((Transport for London, 2019a, p.121-4).

The UK Government's daughter document to its 1998 Transport White Paper considered how 'sustainable distribution' was to be achieved in urban areas. In addition to the use of cleaner, quieter goods vehicles and the introduction of Low Emission Zones, it identified the retiming of deliveries away from peak hours and better consolidation of the loads carried by goods vehicles (either by transhipment of goods at urban consolidation centres into smaller, quieter and less polluting vehicles as options or by using information systems to achieve 'virtual' consolidation) (Department of the Environment, Transport and the Regions, 1998, 1999). Over the intervening twenty plus years, subsequent national and urban government policy documents about urban freight transport operations contain similar views about the need for these operations to increase their efficiency and thereby reduce their activity and kerbside space requirements in peak hours (Department for Transport, 2019a; 2020c; 2020d, National Infrastructure Commission, 2019; Transport for London, 2019a). None of these publications provide evidence of the stated inefficiency of freight transport operations and its use of the kerb for loading/unloading. The means by which policy makers expect this to be achieved can be summarised into the following approaches:

- Consolidation of loads carried
- Retiming of deliveries
- Increased use of cargo cycles

7.1 Freight consolidation

The UK Government's National Infrastructure Commission has made specific suggestions regarding the use of Urban Consolidation Centres (UCCs). It advises that, where there is a business case for UCCs, this case can be made stronger by building incentives for operators to make use of them, through planning restrictions on new build properties, and by giving consolidated services preferential regulatory treatment such as reduced loading restrictions at the kerbside" (National Infrastructure Commission, 2019, p.51).
The consolidation of goods transport improves vehicle load utilisation and can thereby reduce goods vehicle movements and the total distance travelled. Governmental policy documents

urge greater levels of goods consolidation either within these existing supply chains, or through the use of UCCs.

Several UCCs exist in London including one that serves the House of Commons, another that delivers to retailers on Regent Street, one that serves Guys Hospital, one servicing retail outlets in Heathrow airport, one run by the London Borough of Camden for its and other public sector building deliveries, and several construction consolidation centres serving major construction sites. The City of London Corporation intends to develop and tender for a logistics provider to run a large UCC serving businesses located within its jurisdiction. Two of these UCCs are located in counties outside of Greater London. The City of London Corporation intends to develop and tender for a logistics provider to run a large UCC serving businesses located within its jurisdiction. There are two sectors in which the concept of urban consolidation centres has been most often applied in recent years. One is the construction industry with the use of a consolidation centre made a requirement of a planning condition imposed on a major development as part of planning permission for the site. However, even in this industry, use of such consolidation centres is not the norm for the majority of construction sites. The other is for public sector buildings, with the public body resident in the building taking the decision to use a consolidation centre as part of its sustainability or security strategy.

The UK Government's cycling and walking strategy notes that it intends to pilot compulsory physical urban consolidation schemes in one or two small historic city centres that would be used for all goods except perishables and items requiring specialist carriage (Department for Transport, 2020d). These historic pilot cities would incorporate substantial bike lanes, a zero emission bus fleet, a ban on nearly all petrol and diesel vehicles, and deliveries made to consolidation hubs with the last-mile delivery made by cargo bike or electric van (Department for Transport, 2021d). The UK Government made this commitment to such pilot schemes despite evidence from two research projects commissioned by Transport for London that physical consolidation centres serving central urban areas should not be considered as a preferable option for improving freight vehicle load consolidation and that other means of increasing load consolidation were likely to be successful and a more effective use of resources (Peter Brett Associates and WYG, 2019; Steer, 2019; Transport for London, 2019a). Physical urban consolidation centre schemes typically require substantial public sector investment for capital costs of the scheme, and many such trials and area-wide schemes that have operated on a voluntary basis have tended to fail due to issues including lack of goods throughput, lack of popularity among user groups and the misallocation of costs and benefits between supply chain partners, such as freight transport companies experiencing lower operating costs but receivers being charged for using the service (Allen et al., 2012; Paddeu, 2018; Paddeu et al., 2018).

UK policy makers have been encouraging the transhipment and consolidation of goods for approximately fifty years, commencing with support for studies and trials of dedicated transhipment (UCC) schemes to reduce the number of large goods vehicles that would need to enter towns and cities, to calls in the last twenty years for physical UCCs at which goods can be combined to achieve high levels of vehicle loading using clean goods vehicles and/or providing the opportunity to use cargo cycles for final delivery (Allen et al., 2012; McKinnon, 1998).

It is important to note that much vehicle load consolidation already takes place within many retailers' and manufacturers' own supply chains and by parcel operators on behalf of their business customers.

Other methods of achieving the consolidation of goods vehicle deliveries without the need for the establishment of a dedicated UCC include 'preferred supplier' schemes (also known as 'joint procurement' schemes) by businesses in a given geographical area to reduce freight vehicle activity in that locality, the use of 'nominated carrier' schemes, the holding of more stock in urban buildings to reduce the need for small, frequent goods deliveries and the use of locker banks and collections points by consumers for their online orders (see section 9.4 for further details of research and trials into these methods). However, it should be noted that While offering means by which goods vehicle collections and deliveries can be reduced, hence reducing demand for kerbside space and time, it is important to note that none of these three approaches are currently widespread in terms of their adoption by businesses and public sector organisations receiving goods in their urban buildings. Reluctance to do so often involves concerns regarding data sharing, the need for senior management to support such changes, and the set-up costs that can be involved, with uncertain overall financial savings or other operating advantages once the scheme is up and running (Steer, 2019).

The sharing of vehicle capacity to transport more than one freight carrier's goods (often referred to as 'horizontal collaboration') can also help to improve load consolidation, and thereby the efficiency and costs of freight transport operations. It can result in reductions in the total distance travelled, reductions in carbon emissions and local air pollution, as well as the total time spent at the kerbside to deliver a specified quantity of goods in an urban area. Such a last-mile parcel delivery system, co-ordinated and managed by a neutral consolidator currently exists in the Scottish Highlands and Islands. Via this collaborative operation, Menzies Distribution carries out deliveries on behalf of other carriers including many national parcel carriers (McLeod et al., 2019). A case study carried out as part of the FTC 2050 project of next-day parcel operations indicated that the merging of the parcel flows from three London depots into a single delivery operation could lead to a 14% reduction in total distance travelled on delivery operations in the urban area. Given that this case study only included three depots, which represented a small proportion of the total next-day parcel delivery market, and did not consider altering vehicle size used, there is clearly great scope for traffic reduction and related environmental benefits from such collaborative working (Piecyk et al., 2021).

However, achieving successful horizontal collaboration between freight operators requires a well-specified and organised operational model that functions to the mutual benefit of the participants, addressing all of their concerns about data confidentiality and security and privacy, no preferential treatment, fair and transparent pricing, and a data handling system that can be integrated with the existing IT systems of the carriers involved. Given these concerns from carriers, together with prevailing competition law, it is often most satisfactory for such a collaborative delivery system to function via a neutral logistics provider (Lietner et al., 2011; White et al., 2017). The UK Government seemed committed to collaboration between companies as a means to achieve improved vehicle load consolidation at the time of its 2017 Freight Carbon Review but this means of goods consolidation seems to have been replaced by the notion of compulsory, physical urban consolidation centres in more recent publications (Department for Transport, 2017; 2021d; 2021m).

7.2 Cargo cycles

The UK Government has stated that it will promote cycling for the carriage of freight (i.e. cargo cycles) and has already provided funding for electric cargo bikes trials and schemes (Department for Transport, 2021d). Experiments and trials of cargo bikes have also been organised and provided by some urban authorities. Cargo cycles can help to reduce motorised goods vehicle traffic, CO_2 and air pollution emissions, and delivery vehicle noise (Browne et al., 2011; Element Energy and WSP, 2018; Element Energy, 2019). A trial in central London found that the kerbside space and time requirements of cargo cycles used to deliver stationery to businesses were 10% less than those of vans. However, the use of cargo cycles resulted in increases in the distance travelled per unit of goods transported due to vehicle capacity (Browne et al., 2011). A simulation study found that the use of cargo cycles rather than goods vehicles for parcel delivery in urban areas achieved greatest relative time and distance savings when the density of deliveries exceeds 150 deliveries per km^2 (Dalla Chiara et al, 2020).

Various studies have reached differing conclusions about how much freight transport could be shifted to cargo bikes. One study estimated that 51% of motorised freight journeys in European urban areas (including consumer shopping trips) could be made by bicycle or cargo bike (Cyclelogistics, 2014). In another, survey results suggested that about 25% of goods transported in European urban areas could by transported by cargo cycle (Lenz and Riehle, 2013). Research commissioned by Transport for London in 2017 estimated that, "up to 14 per cent of vans could be replaced by cycle freight by 2025 in areas where LGVs (i.e. vans) contribute to more than 60 per cent of traffic" (Transport for London, 2019a, p.98; Element Energy and WSP, 2017). A simulation study in Porto, Portugal of replacing diesel vans with electrically assisted cargo cycles indicated that cargo bikes have the potential to replace van activity when the vans are engaged in journeys with a maximum linear distance of approximately 2 kilometres, and that this equated to about 10% of the current goods work carried out by vans (Melo and Baptiste, 2017). Meanwhile, a project estimated that approximately 10-15% of commercial goods vehicle trips in urban areas have potential for shift to light electric freight vehicles (bike, cargo bike, moped and small vans with payloads up to 750 kg) in sectors including food, construction, services, non-food retail and post/parcel deliveries Ploos van Amstel et al, 2018). Some of these estimates seems to be rather optimistic given that parcel deliveries, one of the key sectors from which goods could be shifted to cargo cycle, is likely to only represent approximately 10% of all van activity in the UK at present (Braithwaite, 2017; Cross River Partnership and Future City Logistics, 2020; Freight Transport Association, 2016; Transport for London, 2016). Therefore, estimates of up to 10% of van activity that could potentially be carried by cargo cycles in dense urban areas seem more plausible.

Cargo cycles are likely to be most applicable in environment and operational terms to specific sectors such as shop deliveries (of, for instance, parcels, small grocery orders, meal orders and floristry in dense, busy central urban areas (Allen et al., 2018b). Therefore, although cargo cycles can play a useful role in urban deliveries in some sectors and settings, their implementation is likely to be somewhat limited. Care also needs to be exercised as cargo cycles are often associated with instant delivery services for online orders, which have the effect of increasing consumer ordering and delivery frequency, thereby resulting in a proliferation of vehicle journeys. Additionally using cargo cycles rather than vans results in a reduction in the loads carried per vehicle thereby worsening load consolidation and increasing the number of journeys and distance travelled, albeit by a different vehicle type.

The National infrastructure Commission has noted that electric cargo cycle operations can be made use for deliveries in dense urban areas but recognises that, due to their smaller payloads, are not as efficient as LGVs in many operations and that acquiring the land needed for logistics hubs to facilitate their use is difficult given the high land values and low profit margins in logistics operations (National Infrastructure Commission, 2019).

7.3 Retiming of deliveries

Retiming of deliveries can reduce delivery activity in peak daytime hours, thereby reducing demand for road and kerbside space. The National Infrastructure Commission has stated that urban highway authorities should, "consider tightening existing (freight transport) kerbside restrictions during peaks to incentivise more efficient activity when the roads are busy (National Infrastructure Commission, 2019, p.53).

In 2004, the Cabinet Office worked with the freight transport industry to investigate the planning and environmental health conditions that prevented the retiming of deliveries to evenings and early mornings at certain large stores. This resulted in the publication of guides for local authorities and industry about actions that could be taken to help facilitate retiming. In 2009, the Department for Transport commissioned a project that trialled quiet delivery demonstrations at selected retail premises across England, to investigate and demonstrate the potential benefits of relaxing delivery curfews. This project involved a close working partnership between the Department, local authorities and retailers (TTR, 2011). Subsequently, the Department for Transport also produced guidance documents on quiet deliveries for local authorities, freight operators, retailers, construction logistics, and community and resident groups (Department for Transport, 2014a, 2014b, 2014c, 2014d, 2015).

In the run-up to the London Olympic and Paralympic Games held in 2012 Transport for London worked with freight operators, businesses receiving and shipping goods, local authorities and other partners to temporarily retime goods collections and deliveries in parts of London impacted by the Olympic Route Network. In terms of traffic levels as a whole across London, a greater proportion of road traffic took place in the overnight hours compared to normal during the London 2012 Olympics. In central London there was 13 per cent more traffic in the period from midnight to 07:00, and in outer London there was 16 per cent more. Morning peak (07:00-10:00) traffic in central London during the Olympics was 13 per cent below the non-Games baseline, with inter-peak traffic 12 per cent down and evening peak traffic down by 11 per cent (Transport for London, 2012). Large scale telephone surveys with businesses and freight operators were carried out before and during the 2012 Games to establish its impact on business activity, the effectiveness of their plans to minimise disruption, and any long term impacts. Results showed that approximately 50 per cent of respondent companies put retiming initiatives in place during the 2012 London Olympics (Transport for London, 2012). HGVs were shown to have done the most time shifting during the Olympics period, in terms of increases in journeys made in the evening, night and early morning, together with reductions in the proportion of HGV traffic across the working day. The changes in the time of goods vehicle operations during the 2012 Olympics were even more marked in central London, than in London as a whole for both LGVs and HGVs, with greater relative use during the evening, night and early morning, and less relative use during the day than in 2011 (Browne et al., 2014a).

As part of its as part of its Olympic legacy planning following the London 2012 Games, Transport for London established a 'Retiming Deliveries' programme to promote retiming and assist companies on a voluntary basis in their efforts to alter their times of goods deliveries to outside of peak road traffic hours on a permanent basis. This programme consists of several elements including: establishing a 'Retiming Deliveries' Consortium, investigating quiet vehicle and delivery technologies, carrying out retiming trials and associated noise assessments, working closely with businesses that were interested in retiming that needed help to ensure they were not contravening any existing time restrictions on their premises and to implement these retiming schemes, and producing guidance and tools. The help that Transport for London provided to initiate delivery retiming was freely available to businesses and local authorities. This retiming programme ran from 2014 and 2017 and during this time Transport for London worked directly with businesses that receive goods to retime deliveries at approximately 500 London premises (Transport for London, 2019a). This work also led to the publication of various guides and case studies intended to help local authorities, businesses and fleet operators participate in the opportunities that retiming deliveries can offer, outlining the benefits and key issues to consider when planning to change deliveries (Transport for London, 2017b; 2021e). However, this voluntary scheme and others like it require substantial labour efforts and financial resourcing by those promoting and setting up retiming arrangements.

Despite all the research and trials that have taken place and guidance that has been issued into retiming goods delivery and collection retiming schemes over the last twenty years involving the UK Government and Transport for London, achieving such retiming has encountered various barriers. This can be due to a reluctance among some businesses receiving goods to alter the time at which this takes place. This can be caused by factors including staff having to be present to receive deliveries resulting in more labour costs for the receiver, security concerns about providing freight transport operators with door access codes or keys for their drivers to be able to access empty buildings, and receivers not wanting to have their goods delivered to lockers outside their buildings when their staff are not present (Browne et al., 2006). Also, when a freight operator does provide deliveries outside of peak hours (before the morning traffic peak or after the evening peak) there is the risk that if not all the addresses they deliver to are willing or able to accept these retimed deliveries that the operator will have to operate both peak and off-peak vehicle operations, resulting in inferior vehicle load consolidation and an increase in vehicle journeys, distance travelled, environmental and social impacts and operating costs.

Existing planning and environmental conditions imposed on specific buildings by local planning authorities either as part of planning conditions or later by environmental health officers due to noise disturbance can also prevent goods delivery and collection retiming (Browne et al., 2006). Local planning authorities can carry out reviews of such delivery and collection time restrictions that have been imposed on buildings in their jurisdiction due to the disturbance that such activity can cause to residents living in close proximity. While such restrictions may still be valid and warranted, they may have been put in place many years ago when buildings had other uses and/or which do not take account of improvements in vehicle technologies and logistics equipment and practices. In such cases, local planning authorities can modify or remove such delivery time restrictions and thereby facilitate these trips to take place outside peak hours, taking pressure off the road network and off-street and kerbside parking space. However, despite the work carried out by central Government, Transport for London, trade associations and researchers over the years, this has led to relatively few reviews of, or changes to, existing delivery and collection time restrictions imposed on building by local planning authorities.

Therefore, achieving efficiency gains in freight transport through delivery retiming (and thereby reducing traffic and kerbside demand for loading and unloading during peak hours) is rather difficult to achieve in practice due to various real-world barriers and constraints. Reluctance among local residents and local planning authorities to amend existing time restrictions on a building is often to linked to the inability to easily and quickly revoke this permission if the operations is conducted in a manner that leads to noise disturbance. It therefore seems likely that a new approach is required that would grant such permission to a specific building on a temporary basis that can easily be cancelled should the need arise due to undue disturbance. Investment by freight operators and receivers of goods is likely to be necessary in aspects that can include staff training, vehicle adaptations, manual handling equipment and loading bay/ building entrance noise reduction technologies, and locker banks.

7.4 Other methods of reducing the demand for goods vehicle space and time at the kerbside

Other measures exist to reduce the demand for motorised goods vehicle space and time at the kerbside in addition to consolidation, the use of cargo cycles and retiming discussed above – see sections 7.1 to 7.4). These measures can involve: (i) the provision of physical infrastructure at buildings receiving goods and services that is included at the time of constructing/developing the building, and (ii) the implementation of logistics operational measures once the building has been occupied and become operational.

Physical infrastructure that can be designed into buildings includes:

- off-street loading/unloading and parking space for vehicles providing deliveries/collections and services to occupiers of the building
- suitably designed off-street loading bays and other entrance points for goods and servicing activities
- waste storage space and equipment

- adequate ingress and egress to and from the public road and these off-street parking spaces
- the provision of sufficient goods lifts within the building
- the provision of sufficient stockholding space within the building
- the provision of locker banks

Logistics operational measures to make delivery/collection/servicing trips to these buildings as efficient as possible can include:

- ensuring that efficient use is made of physical logistics infrastructure at the building (e.g. that off-street vehicle parking space is made available to visiting goods and service vehicles)
- the use of booking systems for goods delivery and collection vehicle arrivals to prevent vehicle queuing for either kerbside or off-street parking space
- the provision of internal logistics operations within the building (using concierge or loading bay personnel who work at the building to prevent goods vehicle drivers having to make deliveries within large, multi-floored buildings and thereby reduce vehicle dwell times)
- providing accurate delivery point geographical data for use by freight transport operators and servicing personnel visiting buildings by vehicle (to avoid unnecessary local driving and repositioning of vehicles when the registered address of the building is not to entry point for goods and services)

These infrastructure and logistics operations measures can achieve several objectives including to:

- reduce the total number of delivery/collection/servicing trips made to the building
- reduce demand for kerbside parking by those making delivery/collection/servicing trips to the building
- reduce goods vehicle dwell time at the building/kerbside
- Prevent freight vehicle queueing from occurring either at the building or at the kerbside outside it
- reduce goods vehicle kilometres travelled (searching for suitable stopping spaces)
- ensure that vehicles making delivery/collection/servicing trips to the building take place outside of peak hours
- Improve the welfare of personnel making delivery/collection/servicing trips to the building
- Change the types of vehicles used to make delivery/collection/servicing trips to the building from motorised goods vehicles to smaller, cleaner vehicles and methods (such as cargo cycles)

In thinking about these physical infrastructure and logistics operational measures that can be taken in relation to the buildings that receive delivery, collection and servicing trips in order to improve their efficiency and reduce their impacts it is necessary to think about:

- the primary stakeholder/s that need to act in relation to the measure
- whether the measures apply to all such trips or only a subset of them
- the impact of the measures on logistics costs (as if a measure increases logistics costs businesses are unlikely to voluntarily adopt it and it could therefore require compulsion through planning conditions or obligations by local planning authorities)

The best starting place for good building/site design and operation from a logistics perspective is ensuring that the goods vehicle trip forecasts for the building/development at the planning application stage are as accurate as possible estimates. Underestimation of goods vehicle trips using TRICS or other methods for new developments is likely to lead to planning authorities not requiring the same scale of mitigation measures that would have been required if the number of these trips had been accurately predicted (Allen and Piecyk, 2022).

Together with cargo cycles, research has also been conducted into using on-foot porters to make the final delivery of parcels in central urban areas. This approach removes the need for vans to park at the kerbside while drivers carry out deliveries, resulting in substantial reductions in their kerbside space and time use (given that, in this alternative system, these vans need only be used to supply porters with bags of parcels and to deliver large and bulky items not suitable for porters) (see **section 9.1** for further details of research into the use of on-foot porters). Rather than porters having to rendezvous with vans to be resupplied with bags of parcels, these bags can be pre-delivered to holding locations. Such locations include former carparks and vacant retail properties which could be repurposed as micro delivery depots from which on-foot porters (and cargo cycle riders). While the number of available former car parks in central urban areas may be limited, the high vacancy rate in shops in the UK provides a potential source of such logistics space. In the first quarter of 2022, the overall retail vacancy rate (including high street shops, retail parks and shopping centres) stood at 14%, ranging from 11% in London to 19% in the North East) (Local Data Company, 2022). The announcement in the background notes to the Queen’s Speech in May 2022 that the Government intends in the forthcoming Parliament to unlock “new powers for local authorities to bring empty premises back into use and instigate rental auctions of vacant commercial properties in town centres and on high streets” may help make vacant retail space available for such purposes (Prime Minister’s Office, 2022).

Horizontal collaboration between freight transport operators can also lead to reductions in the total number of goods vehicle deliveries required and hence the kerbside space and time. However, such practices are not commonly practiced by these operators in urban areas due to their concerns about data sharing with competitors, the benefits they would derive from doing so and competition law.

Findings of research into these other methods of reducing the kerb space and time demands of goods and servicing vehicles can be found it **section 9.1**.

8. Public sector views, planning and joint working on provision of loading/unloading at the kerbside

8.1 Public sector views of loading/unloading at the kerbside

Policy makers have a somewhat Jekyll and Hyde position with respect to the provision of loading/unloading space at the kerbside. As discussed in **section 2**, many transport policy and strategy documents and design guides focused on roads and/or urban areas make little or no reference to the subject. However, at the same time policy makers typically acknowledge the importance of freight transport operations to the national and urban economy.

In the inquiry into parking and its enforcement in 2005/6, the House of Commons Transport Committee heard evidence from several trade associations representing the freight transport industry about the insufficient kerbside loading space in urban areas, especially in central London. The Brewery Logistics Group explained how drivers delivering beer are governed by Health and Safety at Work, and that being able to stop and unload directly outside receivers' buildings is not always provided for in kerbside stopping arrangements of streets. They explained that this had been exacerbated by no planning consideration having been given to safe kerbside parking provision by local authorities when granting planning permission for new pubs and bars, which were converted from other uses (AICES, 2005; Brewery Logistics Group, 2005; Freight Transport Association, 2005).

The Committee noted that, "owing to a combination of planning and traffic management decisions some commercial drivers must frequently deal with intractable problems". It went on, "traffic management is difficult where space is constrained and deliveries must be made. The demands of vehicles arriving to load and unload, the pressing need to keep the traffic flowing freely, guarding the quality of life for local residents, and the overriding objective of maintaining a safe environment for all road users, can seem daunting. Planning decisions should reflect a redoubled effort to ensure that the decisions on parking are able to be as realistic as possible. Adequate time must be given for vehicles to load and unload where this is essential. At the same time, those who abuse realistic rules by overstaying or delivering at prohibited times should be penalised heavily. Development control decisions on planning applications must be consistent with decisions taken on traffic and kerbside management. Local authorities should anticipate how planning policies will affect transport policies, and vice versa" (House of Commons Transport Committee, 2006a, p.60-1).

In giving evidence to the Committee, the then Director of Transport and Environment at London Councils said, "I do not think there is the space to put them [more kerbside space for loading and parking purposes in central London] …every city has limited kerb space and it is (particularly in London) not possible to meet all the competing demands for kerb space which are there" (Lester, 2005). Similarly, in its response to the Committee's report, the UK Government stated that, "the ever increasing demand for kerb space means that for many local authorities it is not possible to meet all the many and varying needs of the public, including shops and businesses" (House of Commons Transport Committee, 2006b, p.25). Written evidence provided by London Councils to a later House of Commons parking inquiry in 2013 reiterated this view: "a large number of deliveries continue to be made across the kerb. As mentioned above, where parking demands exceed local supply councils must balance off competing demands, and where deliveries are made, these needs are taken into account along with all the other needs of the area" (London Councils, 2013). These statements indicate that freight transport receives no greater, and possibly less, consideration, in the provision of kerbside than car parking and any other requirements for kerbside space.

Joint working between policy makers and the road freight transport industry has an important role to play the provision of loading/unloading space at the kerbside and this is discussed in **section 8.2**.

8.2 Joint working on freight transport needs at the kerbside

Conversations and joint working between policy makers and the road freight transport industry can play an important role in ensuring the design of the kerbside meets loading/unloading needs and that reallocation of the kerbside for new uses disrupts freight transport operations as little as possible. The importance of such partnerships in addressing freight transport issues has been noted on by various UK governmental bodies including the House of Commons Select Committee, who said that "progress in balancing road capacity and business needs can be made when councils work with delivery companies to find acceptable solutions….Such a cooperative approach is especially useful where there are severe physical constraints on what can be done to accommodate delivery vehicles….Strong communications and a partnership approach to loading problems between businesses, local authorities, residents and other users, has been shown to be helpful in resolving loading disputes. Not every problem can be resolved neatly; but more can be done to integrate vehicle deliveries better into the street environment" (House of Commons Transport Committee, 2006a, p.60).

The Committee recommended that the Department for Transport's guidance should, "encourage consultation and constructive relationships between different road users, residents, and local authorities in arriving at loading policies to suit local needs" (House of Commons Transport Committee, 2006a, p.60). However, the UK Government did not implement this recommendation, saying in response that, "The ever increasing demand for kerb space means that for many local authorities it is not possible to meet all the many and varying needs of the public, including shops and businesses. The draft statutory guidance advises local authorities to review all their parking policies, CPE regimes and associated regulatory framework when reviewing their Local Transport Plan (House of Commons Transport Committee, 2006a, p.25).

This guidance concerning dialogue between local authorities and the freight transport industry to resolve delivery problems and the need to regularly review the kerbside environment for loading/unloading was, however, subsequently included in the Department for Transport's 2008 parking enforcement guidance. This document also included guidance that loading/unloading includes taking goods into buildings, waiting for them to be checked and getting documents signed, as well as noting that goods vehicle can legitimately be locked during some of these stages to ensure vehicle and load security (Department for Transport, 2008c). However, these inclusions appear to have been omitted from the current version of this Government guidance document (Department for Transport, 2020h).

The UK Government's daughter document to its 1998 Transport White Paper, which considered how 'sustainable distribution' was to be achieved referred to the notion of so-called 'Freight Quality Partnerships' regular meetings on urban distribution issues between representatives of local authorities, the freight transport industry, the business community, residents and other relevant stakeholders (Department of the Environment, Transport and the Regions, 1998, 1999).

Initial designs for major streetspace schemes in London, such as those in Oxford Street, Tottenham Court Road and the City of London (see **section 4.9**) had major implications for kerbside loading. Each of these schemes involved formal consultation processes. In addition, meetings were organised by the Central London Freight Quality Partnership (CLFQP). This is one of the longest-running Freight Quality Partnerships in the UK, including stakeholders from the public and private sectors, that has met on a regular basis since 2005 to discuss and attempt to resolve freight transport issues in central London (Browne et al., 2014b). The plans and designs for these three major streetscape schemes were presented and then discussed by members of the CLFQP. Freight industry representatives were able to identify various aspects of the proposed schemes would lead to difficulties in making kerbside deliveries and meeting their customer's requirements. These meetings helped to identify oversights in terms of freight kerbside needs, especially in relation to the delivery of heavy and bulky loads and their loading/unloading needs. These CLFQP discussions together with responses to the formal consultation exercises led to the planners and designers of these schemes incorporating changes where possible to accommodate freight needs to ensure efficient and reliable kerbside deliveries.

The longest strategic cycle lanes implemented by the Mayor of London since 2010, the East-West and North-South cycle routes (then referred to as 'Cycle Superhighways') were the subject of major consultation exercises (Mayor and London and Transport for London, 2015a, 2015b). Approximately 1% of responses to these consultations came from local businesses, road freight operators and trade associations representing the industry expressing concerns about the impacts of these cycle lanes on their ability to carry out kerbside loading and unloading operations safely and efficiently, especially in relation to fully segregated lanes. While providing support in principle for the proposed lanes, the Freight Transport Association indicated the impact that fully segregated cycle lanes and a reduction in loading bays would have on delivery operations and costs (Freight Transport Association, 2014). The Road Haulage Association, John Lewis Partnership and several major parcel operators and bodies representing them also raised concerns about negative impacts on delivery operations (Mayor and London and Transport for London, 2015a; 2015b).

The Brewery Logistics Group (BLG) and the British Beer & Pub Association (BBPA) submitted a joint response in which they highlighted the effect that the proposed lanes and the related loss in kerbside access and relocation of loading bays would have on their members' operations given their need to make kerbside deliveries adjacent to receiver's businesses based on HSE guidance. They also raised concerns about the potential safety implications and conflicts that would arise between delivery personnel, cyclists and pedestrians as they crossed these cycle lanes with kegs to reach receivers' businesses, and had to move kegs across raised kerbs. They also highlighted the impact that this would have on the time taken to make deliveries and hence delivery costs (Brewery Logistics Group and British Beer & Pub Association, 2014). As a result of issues raised by the road freight industry, designs for these cycle lanes were adapted to include longer delivery bays and revisions to kerb designs. In addition, meetings were held between Transport for London, BLG, BBPA, HSE and the Freight Transport Association and a 'Code of Practice' was agreed which granted permission for beer delivery personnel to temporarily close these cycle lanes while crossing them with kegs, communicating this with to cyclists and pedestrians with Transport for London signage (Mayor and London and Transport for London, 2015a; British Beer & Pub Association, Brewery Logistics Group and Freight Transport Association, 2015). However, despite the success of this joint working, the Brewery Logistics Group has noted that deliveries where cycle lanes are present can take up to 50% longer to carry out (Crosk, 2021).

Westminster City Council developed a collaborative working approach with the freight transport industry about loading activities to help ensure that the industry is aware of how and where to stop when making deliveries and collections. This involved establishing a 'Commercial Deliveries Group', holding seminars, producing relevant guides, working with the Freight Transport Association and the Brewery Logistics Industry to develop pragmatic solutions to delivering to specific bars and restaurants in congested areas where there was a history of many PCNs being issued, and also being available to other companies to inform them and help them understand. A change was made to how businesses were consulted about alterations to kerbside stopping outside of their property, prompting them to consider how deliveries are made to them and any changes to this kerbside provision that would be desirable (Westminster City Council, 2013). This 'Commercial Deliveries Group' ceased after the London Olympic Games in 2012 but efforts are being made to re-establish it in 2022.

Following meetings with the freight transport industry Westminster City Council also introduced changes to the kerbside loading/unloading regime, allowing additional time and longer observation periods (40 minutes stopping time for heavy goods vehicles on single yellow and double yellow lines between 11:00 and 18:30 where permitted). This approach led to a reduction in the number of PCNs issued to goods vehicles of about 80% (Westminster City Council, 2013).

8.3 Planning for loading/unloading at the kerbside

In 2009, Transport for London published a Kerbside Loading Guide which was an exception to the general overlooking of the kerbside needs of freight in national street design guidance and strategy described in **section 3**. A second edition of this guide was published in 2017. This guide, which was produced with input and feedback from representatives of the freight transport industry, sought to provide guidance to planners and urban designers about the specific kerbside needs of various sectors of the freight transport industry and the businesses and customers they serve. This work included consideration of sectors with specific kerbside needs including brewery logistics, cash and valuables in transit (CVIT), as well as the range of manual handling devices that need to be used to convey goods from vehicles to delivery addresses. This work discusses the competing requirements of streetscape users, including pedestrians, cyclists, motorcyclists, bus passengers, private vehicle owners and freight vehicle operators. It also includes an explanation of the freight survey work of commercial streets required to gain insight into freight trip generation, vehicle stopping patterns and kerbside provisions for this activity, as well as streetspace design considerations to improve these freight transport operations. It also explains how kerbside loading facilities can be provided in locations with limited space including the use of inset bays, on-footway loading and half-on, half-off facilities, as well as the amount of kerb length required for dedicated loading bays (Transport for London, 2009a, 2017a, 2019b). However, this guide provides no discussion of how any conflicts surrounding kerbside space provision between freight loading / unloading needs and other potential needs such as active-travel and place-based goals should be approached and addressed by planners and designers. The extent to which this Transport for London loading guidance for kerbside loading has been adopted by local authorities in London is uncertain and debateable. In addition, it is unclear whether certain aspects of this guidance will be altered by more recent policy developments introduced by the Mayor of London to promote and increase active personal travel (i.e. cycling, walking and public transport) together with the promotion of the use of electric vehicles which require recharging facilities, and other developments in response to the Covid-19 pandemic.

In 2014/15, Atkins developed a detailed methodology for analysing kerbside freight transport activity as part of Transport for London's High Street Freight Project. The methodology was intended to provide a consistent approach to analysing and understanding freight kerbside behaviour on any given high street. It comprised the following components: analysis of existing background information (including Traffic Regulation Order analysis, Penalty Charge Notice analysis, planning considerations including Delivery and Service Plans and Construction Logistics Plans in force, and other information such as pedestrian footfall, road traffic data and collision data), a land use and street kerbside audit (including waiting and loading restrictions, facilities for buses, cyclists and pedestrians, and data on the floorspace of businesses), video surveys and business and driver questionnaires, and analysis of results. This methodology was applied to four London high streets (see **section 5.1** - Atkins, 2015). A summary of this methodology is provided to interested parties in the second edition of Transport for London's Kerbside Loading Guidance (Transport for London, 2019b).

In the UK, TRL has developed a software tool called “streetaudit”, which is intended to help policy makers review existing streetspace allocation. It contains three modules: PERS - audit of pedestrian environment, CERS - audit of cycling environment, FERS - audit of freight environment. FERS is used to assess the quality and sustainability of freight activity, including kerbside space and time use in street environments in terms of loading capacity, signage, infrastructure provision, access routes, and safety (TRL, 2018, 2021). FERS involves audits of each of these factors by personnel with the required training. Whilst it identifies freight-related issues associated with the findings of these audits, it does not provide recommendations for the resolution of these issues. This is due to the existence of “very little policy for freight”, and that different local authorities applying FERS will have different policies and approaches. Therefore these authorities and their planning and design personnel have to generate and determine suitable solutions to the issues that FERS identifies (Greenshields et al., 2009, p.117). The FERS methodology comprises desk-based research to gather data that cannot easily be gathered on-street during the FERS audit (this can include land use data, road traffic data, PCN data, data on kerbside loading restrictions, and questionnaires of local businesses to find out about the extent of control they have over their deliveries and other local issues), followed by a street audit in which personnel gather data using several audit forms. These include a ‘place’ audit (which assesses the street area that goods vehicle moves about in including traffic congestion from loading activities, safety from moving freight vehicles, infrastructure damage, and access routes to an area), a ‘space’ audit (which captures details of the space where a goods vehicle stops to load/unload including details of kerbside loading size and time provision, and assessment of the suitability of loading space and timing, loading signage, physical barriers between vehicles and delivery points, footway user conflicts, and driver health and safety issues), a ‘specialist industries’ audit (which assess loading space for brewery and cash-in-transit operations), and a ‘premises’ audit (which collects data about business that generate substantial freight vehicle activity in terms of the freight activity it generates - vehicle types, timings, and vehicle dwell times) (Greenshields et al., 2009).

A methodology for analysing kerb occupancy by all vehicles has also been developed by the University of Washington. The survey approach was designed to provide accurate results at a reasonable cost, to be replicable in other urban areas, and governed by quality-control measures. It was applied in a case study in central parts of Seattle, with the study area being five locations with a three-by-three city block grid being surveyed in each case. A team of seven data collectors were trained and then collected data worked over three days in each of five study locations, working in 4-5 hour shifts so that each locations was continuously observed during daytime hours. An inventory of observed kerbside provision and regulations was compared with Seattle Department of Transportation’s kerb space GIS database to develop a customised kerb map and data collection form for each study area. Data collectors were assigned up to four strategic positions on the blocks in each area to maximise their view along the kerb and the range of types of kerb parking space. The methodology has been made available for us by others (Urban Freight Lab, 2019a).

While these methodologies are helpful for analysing delivering and collection operations and the use of the kerbside for them in order to assess the suitability of existing kerbside provision for freight transport, it should be noted that they are relatively labour intensive and expensive to carry out. Given the resourcing requirements of these freight transport kerbside assessments and the recent UK and local government decisions concerning the need to reallocate kerbside capacity for active travel, few urban freight surveys applying these methods have been carried out in recent years. This is reflected in the surveys reviewed in **Table 5.1** (see **section 5.1**), the most recent of which took place in 2015.

9. Research, trials and schemes in innovative kerbside use for freight operations

9.1 Digitising the kerbside and loading management systems

Digital data has been becoming an increasingly important consideration in the policy-making and management of the kerbside in the UK. In 2019, the Department for Transport announced new national parking data standards with the ambition, "for all parking data released by local councils and companies across the country to use the same language, supporting the development of apps to make parking easier for drivers." The Government explained that these data standards would help make it, "easier for drivers to find a suitable parking place, the standards could ultimately free up crucial space, easing congested cities and boosting British high streets." The intention of this standard was to "make it easier for local authorities and private companies to exchange data" thereby helping drivers and vehicles find available parking space based on the price, quality and safety of the space (Department for Transport, 2019d). This together with other initiatives by Government are intended to bring about improved transport information and operations and better use of transport infrastructure capacity through improved traffic management systems, route optimisation, provision of data about parking and vehicle charging locations, and enabling active travel and Mobility as a service (MaaS) (Geospatial Commission, 2021).

The Department for Transport has also carried out a study into the processes by which Traffic Regulation Orders (TROs) are made, and how TRO data is made available and used across the country, with the intention of helping local authorities aware of how they can utilise digital technology to support the TRO process within the limits of current legislation (Department for Transport et al., 2019; British Parking Association, 2019).

In terms of the use of the kerbside for loading and unloading by freight transport operators, kerbside loading regulations have traditionally been communicated to goods vehicle drivers by yellow pips painted on the kerbside and traffic signs that specify the times at which loading is permitted, while enforcement of these regulations has been achieved through the deployment of parking attendants. The advent of computer-based systems and the internet are providing the opportunity for digital systems to be developed to facilitate prebooking of kerbside space for loading/unloading activities. As well as providing a guaranteed loading space on the arrival of the vehicle, the aims of such a system can include to discourage undesirable driver behaviour associated with loading/unloading including double parking, parking on the pavement and causing obstructions to pedestrians and other road users, and reducing vehicles circulating seeking an available kerbside space, which adds to traffic levels as well as vehicle emissions.

In 2009, an online kerbside loading bay booking system was trialled in Earl's Court in London as part of the EU-funded CVIS project. The trial collected data for a 3-month period, during which the loading bay was made available to ten goods vehicles operator by eight freight transport companies. In-vehicle and roadside hardware included a roadside cabinet and CCTV cameras were installed for the trial. The loading bay was marked and signed to make it clear that it was only available for registered users. Enforcement action was carried out by a service provider who received digital communication if an approved or unapproved vehicle used the loading bay without having made a booking (CVIS, 2010).

The company Grid Smarter Cities carried out a 'Virtual Loading Bays' (VLB) project for Westminster City Council in 2011 to investigate a real-time dynamic approach to allocating kerbside space to goods vehicle which was intended to facilitate local authorities to better utilise the kerb. The concept was that freight companies would be able to reserve space in advance of the vehicle's arrival, thereby potentially improving traffic management and the use of the kerbside. The project in Westminster was the first attempt at a proof of concept. The modelling and analysis carried out by Grid suggested that, "the introduction of a VLB system in Westminster would not only provide a solution to managing congestion and smoothing traffic flows, but could also provide substantial economic benefits of around £1.7m a year." Grid's calculations of these benefits were based on assumed reductions in operating costs for freight transport companies whose drivers would be able to find loading places at the kerbside more quickly, saving fuel by not having to drive further than needed searching for a kerbside space and reduced PCNs. At the same time, it was argued, these distance savings would result in reductions in traffic and vehicle emissions (Institution of Engineering and Technology, 2018). Since this project, Grid has continued to engage, "with local authorities, freight operators and local businesses to identify penalty charge notice (PCN) 'hotspots' and 'difficult to deliver' locations (Institution of Engineering and Technology, 2018).

This approach to kerb management for goods vehicles is based on charging for the use of this space and time, with the technology provider sharing the revenue with the local authority. Grid has developed three products that can be applied to goods vehicles at the kerbside: i) Kerb Control (which "provides intelligent kerbside management for kerbside owners such as local highway authorities. The system uses or creates one or more vehicle bay types – dedicated bookable, loading, virtual bays - and can incorporate smart signs, for controlled management and usage. The system can be implemented across a single bay, multiple bays or area wide and be variable by time of day, vehicle type and location requirements"), ii) Kerb Delivery (which "provides guaranteed kerbside delivery access using one or more vehicle bay types i.e. bookable loading or virtual bays. It incorporates a web app for the delivery company, a mobile app for drivers and connects directly to the Kerb Control product") and iii) Kerb Construction (which "coordinates last mile vehicle movements to and from a construction site via a series of 'Virtual Holding Bays'. It incorporates a web app for site management and haulier, and a mobile app for drivers and traffic marshals" (Stantec, 2021). The types of loading bay that can be offered with the Kerb Control product are: i) Loading Bay: "Digital platform for booking and allocating time slots in existing on-street parking and loading bays", ii) Virtual Loading Bay: "A nearby digital alternative location for delivery vehicles when the Permit Loading Bay is blocked or unavailable (or in advance when a user has an agreed parking / loading dispensation)", iii) Loading extension: "Permit to extend the typical 20 mins LGV, and 40 mins HGV loading/unloading time limits in designated loading and unloading zones", and iv) Zonal permit: Daily access permit allowing access to restricted kerbside (whilst observing certain protocols) within a permit restricted or geographical zone" (Stantec, 2021).

Similarly, another company, AppyWay, is also seeking to provide its computer software for digital, pre-bookable vehicle parking and loading solution to urban highway authorities in the UK. Initially, the company compiled local authority paper-based TRO restriction information into a digitised, standardised, map-based dataset. It has also been digitising kerbside space in UK urban areas by capturing, "high resolution 360˚ panoramic imagery of streets, converting them to structured data to provide in-depth insights on Britain's parking". In addition, AppyWay's "team of GIS experts analyse every street data collected, ensuring rigorous accuracy. They also manually map streets where it's difficult to survey". The company has now mapped the kerbside data for over 450 UK towns and cities (AppyWay, 2021a; Tomkins, 2020). AppyWay is involved in the Department for Transport's Traffic Regulation Order (TRO) Data Model Alpha Project to explore how a standardised data publication and distribution system could be put in place to replace existing paper-based TRO systems thereby improving information quality and accessibility and enabling new services such as digital mapping (Tomkins, 2021).

In 2019, AppyWay launched its first live parking scheme in Harrogate, Yorkshire. It involved the, "installation of 2,156 smart sensors and the consolidation of digitised parking data, parking sensors, parking payments, ANPR barriers and linear pricing into a single solution for the two authorities that enabled a totally seamless experience for users of our mobile app." Vehicle drivers can find kerbside or off-street parking with real-time availability and pay for this through the app. The local authorities are, "able to see how their (parking) assets are consumed through our web-hosted analytics platform which exposes parking utilisation data for all on and off-street parking spaces thanks to our smart parking sensors" (AppyWay, 2021b). AppyWay is considering ways in which to apply its digital parking approach to freight loading/unloading at the kerbside.

Similar efforts by companies to make the kerbside pre-bookable and chargeable for freight are being developed and tested in other countries. For example, in America, the kerb (curb) software management company Coord (renamed as Pebble in 2022) is working with 15 cities and managing 4.9 million kerbside parking spaces. Its tools provide urban authorities with the ability to digitally price, allocate and manage kerbside parking. In 2020, Coord established its first kerbside loading space trials for freight vehicles, partnering with four urban authorities. It is doing the same with other cities in 2021 to test: variable pricing at different times of day and/or in different locations, automated booking systems to automatically allocate drivers to the best available loading space near their destinations, making use of loading space in other locations such as alleyways as well as the kerbside (Coord, 2021).

One of the four cities in the 2020 trials run by Coord signed up for the scheme with the intention of reducing kerbside space for freight loading/unloading, and thereby support the city's safety and sustainability goals. City growth, together with increasing active travel and growing freight trip generation linked to online meal ordering and shopping, was putting ever greater demands on finite kerbside space. Faye DiMassimo, the Mayor's Senior Advisor for Transportation and Infrastructure said that, "By partnering with Coord to pilot Smart Zones downtown, we hope to increase compliance with loading regulations, improve traffic flow and safety, accommodate rising curb-access needs, collect quality data, and ultimately capture the true cost of Metro-provided services to reframe and re-value private use of public space" (DiMassimo, F. quoted in International Parking and Mobility Institute, 2020).

In the American city of Columbus, the city authority carried out a six-month pilot of pre-bookable kerbside loading space with the company curbFlow. It ran from November 2019 to March 2020 and involved converting eight high-traffic areas into 'loading management zones' where drivers of goods vehicles, other commercial vehicles, and ride-hail services could use the curbFlow Driver App to reserve kerbside space. Approximately 2,400 drivers signed up to use the pilot scheme and used it for about 19,000 bookings. The city intends to continue developing this concept with technology providers (City of Columbus, 2021; curbFlow, 2021).

The company PARKUNLOAD has been running schemes in parts of Barcelona and Madrid that allow drivers to locate available loading bays in their vicinity and then to register their use of these via a mobile phone app (Hayes and Rodriguez, 2019).

A consultancy report commissioned by Grid has suggested that the use of their kerb products for freight transport would result in benefits to local authorities (kerbside owners) and freight operators (kerb users). The benefits to local authorities cited include: income generation (approximately £25,000 per annum per loading bay), reduced need for and cost of Civil Enforcement Officers of this equipped kerb space, reduced traffic delay, reduce goods vehicle kilometres, associated reductions in greenhouse gas emissions and air pollutants, and fewer traffic collisions and casualties involving goods vehicles. The benefits to freight transport operators cited include time savings that permit more deliveries/collections per vehicle per day, greater journey time reliability, and reduced Penalty Charge Notices (PCNs). An example is provided in which it is stated that the use of these Grid products for a single bay, "could lead to the delivery operator being able to make nine more deliveries per day, annual savings of £100,000 in PCN costs per bay and a 20%+ increase in reliability. The overall financial impact to delivery operators of the Kerb products is estimated to range from a benefit of £100k pa for a single bay to c£2m across a zone" (Stantec, 2021). In this report it is estimated that the benefits of implementing the Kerb products across all of Greater London would result in, potential annual revenue for local authorities of £139 million, enable freight operators to make

21% more deliveries than at present, reduce the distance travelled by goods vehicle per year by 20.2 million kilometres, reduce CO_2 emissions by 15,500 tonnes (Stantec, 2021).

However, these quantified findings provided in the report are based on many assumptions, some of which are provided and others of which are not. Even when assumptions are provided they tend not to be supported by research evidence that justifies them. For instance, assumptions made about how traffic conditions would alter with the introduction of such a bookable kerb management system. The lack of explanation of assumptions made and their justification makes the validity of any quantified analysis extremely uncertain. Such assumptions required in the analysis contained in the report include i) those made about the difference in time spent waiting for kerb space in a bookable and non-bookable (i.e. current) kerb management system, ii) the distance travelled by these vehicles circulating searching for a space, iii) how any time savings that may arise with a bookable system would translate into additional stops by goods vehicles (and the dwell time assumptions and demand for kerb space in different locations this depends on), iv) the extra revenue that freight operators could earn doing extra work from any time savings (as this depends on an operators ability to gain and carry out extra work with such time savings which will vary depending on company and sector), v) goods vehicle operating costs (which vary by type of vehicle used and the nature of the work carried out rather than being constant for all freight operations as assumed in the report), vi) the administrative costs to freight operators of having to prebook kerb space (which will be especially burdensome in the case of multi-stop delivery and collection work), vii) the change in PCNs issued and its effect on local authority parking revenue compared with bookable system revenue (the analysis assumes that there is no change in PCN revenue), and viii) the price charged for a bookable loading bay and the split of this revenue between local authority and technology provider (the analysis refers to a single bay price of £3 with no consideration of the effects of other prices or splits in revenue).

The use of sensitivity analysis would help to address some of this uncertainty in such a comparison between a bookable, charged for kerb space system and the current kerb arrangements in which no booking is required or any price charged. It would indicate the situations under which net benefits or costs may arise. However, no use of such sensitivity analysis has been made us of in the work carried out in the report. In addition, qualitative methods of assessment have been applied to many of the impacts considered in the analysis presented in the report including the effect on noise and vibration, air quality, community severance, transport network reliability, journey quality, biodiversity, security, landscape, townscape, heritage, employment and land values. The report states that these were based on, “using professional judgement and relevant guidance” but does not elaborate on this qualitative methodology used. There is therefore a need for more research into the comparison of a bookable, charged for kerb management system for loading/unloading and the current system.

If different technology providers were granted contracts to operate bookable systems in various UK towns and cities each of which makes use of different apps and with different rules this would add to the already considerable administrative burden that a bookable system will place on freight operators that make many deliveries/collections per day. If bookable systems are implemented in urban areas in the UK for the purpose of loading/unloading space it would be desirable for all these systems to operate via a single technology platform and conform to the same rules and regulations. This would prevent the problem of an operator whose vehicles visit several urban areas during the course of their work having to be familiar with and conform to various regulatory regimes. Achieving a single bookable system platform and rules protocol would require national Government to oversee this process and to regulate its implementation rather than leaving this to individual urban governments.

Charging freight operators for use of the kerb space is likely to have little if any impact on their demand for this space given the need for them to make deliveries and collections when and where required by their customers, the relatively small proportion of the costs of many products accounted for by freight transport and the inability of many operators, especially smaller ones, to pass these costs onto their customers given the extremely competitive nature of the industry (see **section 6.6** for further discussion).

Table 9.1 shows the possible impacts of bookable kerb space on freight transport operators and local authorities.

Table 9.1: Possible impacts of bookable kerb space on freight transport operators and local authorities

Possible impacts	Comments
Improvement in traffic flow, journey times, journey time reliability, kerb utilisation and associated reductions in vehicle kilometres travelled, greenhouse gas and air pollutant emissions, traffic collisions and casualties, noise and vibration	Asserted by bookable system technology providers based on reduced vehicle queuing and circulating while waiting for kerb space – current lack of evidence to demonstrate if this is correct and, if so, scale of improvement
Worsening in traffic flow, journey times, journey time reliability, kerb utilisation and associated reductions in vehicle kilometres travelled, greenhouse gas and air pollutant emissions, traffic collisions and casualties, noise and vibration	In contrast to above view of technology providers, goods vehicles may arrive at bay prior to their pre-booked time resulting in them queuing or circulating. They may also arrive late, resulting in poor utilisation of the prebooked space and then queuing, circulating or illegal loading as they try to make the delivery/collection. This would be especially likely to occur in busy urban areas due to journey time unreliability. Vehicles making multi-stops in different locations would be most prone to these problems
Reduction in total kerbside space provided for loading/unloading	Would arise if local authorities chose not to convert all existing kerbside space and time where loading/unloading is permissible into dedicated loading bays with sensors
Less flexible vehicle access to kerb space	Dedicated loading bays provide less choice for stopping locations than yellow line regime where loading is permitted. More difficult to change vehicle operations at short notice to accommodate customer requests in a booked system.
Enforcement issues	Whilst a prebooked system using technology may be capable of issuing fines to those using bays who have not booked the space, this will cause vehicle queuing and circulating. Bookable system providers claim that these will not require Civil Enforcement Officers – however, without these present illegal users of bays will not be moved on
Easier for freight operators making regular deliveries / collections of large and/or bulky loads to obtain space adjacent to building served	Depends on the location of loading bays in a bookable regime (and whether this is different to current situation)
Easier for one-off deliveries/ collections of large and/or bulky to obtain dispensations to stop where needed and/or exceed normal loading time restrictions	Depends on whether the system used provided such a facility
Administrative work for freight operators	As space has to be prebooked this will require an additional task for freight operators. The burden of this prebooked will be greatest in freight operations involving multi-stops. This has to be contrasted with work involved in challenging PCNs
Complexity for freight operators if different urban areas use different bookable space platforms and rules	This will complicate the use of kerbside space for freight operators, especially those whose vehicles move between different urban areas and will potentially result in more reduced vehicle efficiency and more PCNs
Revenue for local authorities	Bookable system promoted by technology providers involves charging freight operators for kerb space that is currently free to use - but net effect on local authority revenues depends on loss of PCN revenue, technology capital costs and proportion of revenue taken by technology providers
Impact on goods vehicle operating costs	Impact on operating costs depends on level of charge to use the kerb together with related reductions in number of PCNs received and associated administration costs of dealing with them

Key:

(green)	Possible improvement	(amber)	Uncertain	(red)	Possible worsening

9.2 Innovative freight transport trials with implications for kerbside use

Research studies and trials into novel methods for urban freight operations that have implications for freight vehicle demand for kerbside space and time have been carried out in recent years. The findings of this work indicate that such approaches can have implications for various aspects of urban freight operations (including total distance travelled, time spent and space required at the kerbside, CO_2 and air pollutant emissions, and operating costs). Some of these initiatives have the effect of reducing the time spent at the kerbside while others increase it while providing other benefits. These research studies and trials are reviewed below. These studies and trials are in addition to consolidation, retiming and cargo cycle operations already discussed in **section 7**.

In 2018, the Freight Traffic Control (FTC) 2050 project trialled the use of on-foot porters to make the final delivery of parcels, rather than delivery drivers as currently happens in most parcel operations. Porters were provided with wheeled bag loads of parcels by drivers at the kerbside. This approach demonstrated considerable promise in terms of reducing vehicle kerbside stopping durations as normally the driver has to leave their vehicle at the kerbside while they carry out the deliveries, resulting in these vehicles being parked at kerbsides for approximately 60% of the working day while drivers walk up to 10 km. The results of this trial and additional analysis of its wider implementation across London's Central Activities Zone (CAZ) indicate that parcel portering could result in reductions in vehicle parking time at kerbside of approximately 50-65%, vehicle driving time and distance travelled (of approximately 25-35%) and CO_2 and air pollutant emissions compared to current parcel operations. The trial also demonstrated potential financial viability from a business perspective and the need for public policy makers to review freight vehicle kerbside stopping regulations to encourage portering (Allen et al., 2021b). Ford Europe and the parcel carrier Hermes are carrying out further trials of this on-foot portering approach to parcel delivery in urban areas (Ford Europe, 2021). Such portering solutions could also be used in future in conjunction with autonomous vehicles when these become available for general use in urban areas.

The trials carried out in the FTC 2050 project have also shown that in delivering to consignees, parcel delivery drivers often have to ascend and descend staircases and lifts. This can be the case for both commercial consignees, especially those in multi-tenanted office blocks, and residential consignees in block of flats. This results in drivers spending substantial periods of time inside buildings (e.g. waiting for lifts to different floors, climbing and descending stairs), thus increasing vehicle kerbside dwell time and total working time taken. Research in the City of London suggests that parcel delivery workers had to travel vertically to reach approximately 15-20% of consignees whilst carrying out their delivery rounds (Allen et al., 2021b). In the case of large and multi-tenanted buildings, providing the facility for drivers to deliver tenants' items to a single mail room, reception desk or loading bay can reduce the time that vehicles are parked at the kerbside while such deliveries take place and the total number of vehicle trips required daily to carry out this parcel delivery work. Reductions in the vehicle dwell time at the kerbside, can also lead to other vehicles finding kerbside parking space more quickly and easily resulting in less vehicle queueing (which causes additional traffic and other impacts).

Another study investigated two identical seven-floor multi-tenanted office blocks in central London, one of which had building personnel who made internal deliveries within the building on behalf of the drivers and the other which did not (with the drivers having to wait for and ascend lifts to make deliveries to tenants). The former was found to have vehicle delivery dwell times that were 20% shorter than the latter (Browne et al., 2016). The provision of a concierge or loading bay personnel service (who can make internal deliveries on behalf of the driver) or a locker bank facility in a ground floor location in which the driver can deposit all deliveries for receivers helps to considerably speed up goods deliveries, especially of small items including parcels. This therefore reduces vehicle dwell time in kerbside parking space, freeing it up for use by others (Allen and Browne, 2016).

In addition, multi-drop parcel delivery drivers have to decide how to group deliveries together in walking tours. All of these tasks are highly challenging and the latter is an under-researched optimisation task which the FTC 2050 project research team investigated. Results for the next-day parcel delivery sector indicated that the total time taken to carry out delivery work in dense, busy urban areas could be reduced by making fewer vehicle stops than at present and the driver then making a greater number of deliveries and collections on-foot each time the vehicle is parked. Such a solution was calculated to be capable of reducing the total round time by approximately 25% and the total driving time (and distance) in the delivery area by approximately 50% but with a 20% increase in time spent at kerbside by vehicles and an up to 50% increase in walking time and distance (Allen et al., 2018b).

Those making goods deliveries and collections can struggle to find the entry point to the building to make these deliveries and collections when this is not the front door or address registered (which it often is not), especially if they are new to the new job or have not previously visited the building. The delivery details provided to the freight transport operator and hence the driver, typically only provides the registered address of the business rather than the address of the entrance it uses for goods. This can result in the driver having to park the vehicle and only subsequently discover this, before having to return to the vehicle and reposition/repark it, resulting in lost time, additional driving distance and extra parking time. A trial conducted by a provider of a precise geographical location tool worked with a carrier to test the benefits of using their tool in a situation in which the precise delivery point location had been logged using their tool. Two couriers were despatched to carry out exactly the same delivery round involving visiting 20 addresses in London. One of the couriers used the tool, called what3words, to immediately locate the precise delivery point, whereas the other courier was issued with only the street address of the building. Both couriers successfully completed their delivery rounds but the first driver using the tool was 30% faster than the other, which equated to approximately 6 minutes on average per building delivered to and therefore two hours in terms of total time savings over the course of the entire 20 deliveries (what3words, 2017).

Research in the parcel delivery sector has also indicated that there are major differences in operational performance between drivers of with differing levels of experience working on the same next-day multi-drop delivery round on different days. In one such case, an experienced driver was found to drive 44% less distance per parcel, spend 35% less total time per parcel, and 39% less parking time per parcel than the inexperienced driver. The variation in effectiveness of the couriers related to better route planning and exploitation of accumulated knowledge (Bates et al., 2018). Providing drivers, especially novice ones, with computer-based tools to assist vehicle routing, vehicle parking and driver walking strategies, and locating the building entry point for deliveries/collections can improve their efficiency. Providing inexperienced couriers with training programmes can also assist in raising operational performance as well as road safety.

In the EU-funded Straightsol project, the parcel carrier TNT Express was part of a 3-month pilot scheme in 2013 in which a mobile depot (a goods vehicle trailer equipped with a loading dock, warehousing facilities and an office where labelling and data entry could be carried out) was used as a mobile central city base in Brussels from where last-mile deliveries and first-mile pick-ups were carried out using electrically assisted freight cycles. The mobile depot was also used to transport parcel shipments to and from a peripheral depot in the evenings and early mornings. The central Brussels location at which the trailer was based during the working day while deliveries took place was off-street but it could have made use of the kerbside if such space was made available by a local authority. The mobile trailer and cargo cycle pilot resulted in a decrease in diesel vehicle kilometres driven and a 24% reduction in CO_2 emissions and 59% reduction in PM2.5 compared with the business-as-usual case (Verlinde et al., 2014). UPS demonstrated a similar mobile trailer and cargo cycle pilot for parcel delivery in Dublin city centre in 2018. However, in this scheme the city authority made kerbside space available for the parking of the trailer during the working day (UPS, 2018).

The sharing of vehicle capacity to transport more than one carrier's goods (often referred to as 'horizontal collaboration') can help to improve load consolidation, and thereby the efficiency and costs of freight transport operations. It can result in reductions in the total distance travelled, reductions in carbon emissions and local air pollution, as well as the total time spent at the kerbside to deliver a specified quantity of goods in an urban area. These benefits would result from the fact that other logistics providers (i.e. freight transport operators) would no longer have to provide delivery services in all locations in the urban area, resulting in a reduction in the current extent of service duplication (for instance, all major next-day parcel carriers making deliveries to the same streets and buildings every day). A case study carried out in the FTC 2050 project of next-day parcel operations indicated that the merging of the parcel flows of three such London depots into a single delivery operation could lead to a 14% reduction in total distance travelled on delivery operations in the urban area. Given that this case study only included three depots, which represented a small proportion of the total next-day parcel delivery market, there is clearly scope for traffic reduction and related environmental benefits from such collaborative working (Allen et al., 2018a). Such a last-mile parcel delivery system, co-ordinated and managed by a neutral consolidator (sometimes referred to as a 'carriers' carrier' approach) currently exists in the Scottish Highlands and Islands. Via this collaborative operation, Menzies Distribution carries out deliveries on behalf of other carriers including many national parcel carriers (McLeod et al., 2019). Research in Seoul, South Korea, indicated that the consolidation of the parcel flows of nine parcel carriers destined for a major high-rise housing complex, with the last-mile delivery handled by a single carrier, would reduce the distance travelled by vehicles by approximately 70%, and the time taken for vertical delivery within buildings by approximately 35%, as well as total vehicle dwell time at the kerbside. This collaborative consolidated delivery of parcels was calculated to be financially feasible for 10-20% of all apartments in the city (Park et al., 2016).

However, achieving successful horizontal collaboration between logistics providers (i.e. freight transport operators) requires a well-specified and organised operational model that functions to the mutual benefit of the participants, addressing all of their concerns about data confidentiality and security and privacy, no preferential treatment, fair and transparent pricing, and a data handling system that can be integrated with the existing IT systems of the carriers involved. Given these concerns from carriers, together with prevailing competition law, it is often most satisfactory for such a collaborative delivery system to function via a neutral logistics provider (Lietner et al., 2011).

In 2017, Ocado ran a two-week trial of an autonomous grocery delivery van, which was referred to as a CargoPod, in Woolwich, south-east London. The van was developed by Oxbotica. The customer The customer receives notification when the vehicle is within a mile of their home and then again when it arrives at the kerbside outside their home. The customer comes out to the vehicle to unlock their box on the vehicle and collect their shopping. Two human supervisors accompanied the CargoPod throughout the trial (Burgess, 2017; Oxbotica, 2017). In 2021 Ocado made a £10 million investment in Oxbotica to further their collaboration on autonomous mobility solutions for online grocery operations at fulfilment centres, delivery vehicles and kerb-to-kitchen robots (Ocado, 2021; Oxbotica, 2021).

Collection points and locker banks for consumer purchases made online can help to reduce goods vehicle deliveries in residential areas. While some click and collect collection points and locker bank networks are entirely dedicated to specific retailers and carriers (such as Amazon, Royal Mail, DPD, DHL and Hermes collection points and locker banks, and many retailers' with in-house collection services in their shops), some collaboration exists in those click and collect facilities that provide so-called 'agnostics' services with more than one retailer or carrier able to use these facilities (such as the third-party collection point service provider Collect +

and InPost locker banks). Some retailers such as Asda also allow other specified retailers to make use of their facilities for customer parcel collections and returns. Such sharing of click and collect facilities and services helps to consolidate the flow of products through fewer points of collection, and thereby offers the potential for better vehicle utilisation on goods vehicles and for customers to collect several orders from a single location. Transport for London has been investigating how it could collaborate with industry to provide a network of agnostic locker banks and collection points across London situated at suitable locations to facilitate consumers to use them as part of their commuting and other public transport journeys, and thereby limit the extent to which consumers travel to these facilities by car (Barrie, 2020; Transport for London, 2019d).

Trials are taking place with aerial drones and pavement droids for the delivery of items such as meals and parcels. While the use of these vehicle types would remove the need for kerbside space when making such deliveries, they are unlikely to become legal or commonplace in busy, urban environments in the near future as there are many safety, security, technological, operational, attitudinal and infrastructural challenges that they first need to overcome (Buldeo Rai et al., 2021; Kapser and Abdelrahman, 2020).

In 2010, Greater Lyon in France was involved in an experiment about the “loading bay of the future” in which operators could reserve an on-street loading bay 24 hours in advance. This led to more efficient vehicle trips and routes in the city. The results showed a 40% reduction in double parking for delivery vehicles, reduced congestion and pollution in the city centre, and an improved environment for city users and other road users. Following the experiment, the intention was to improve the scheme to make this a dynamic booking system thereby allowing for changes to schedules and optimisation of the allocation of loading ‘slots’ (Browne et al., 2012; Patier et al., 2015).

An initiative in the Marunouchi Central Business District of Tokyo which commenced in 2002 involved two key elements of co-operative urban freight. First, a common depot and stockholding point was set up approximately 500 metres from major office buildings in the CBD. Companies with goods destined for these buildings in the CBD, delivered goods to this depot instead of direct to the receivers. The goods were then delivered from the depot to the buildings in the CBD by designated delivery vehicles based at the depot. The intention was to reduce delivery trips in the CBD. Second, two workers were stationed at the loading bay in each of the major buildings in the initiative. These workers unloaded the required goods from the delivery vehicles on arrival and were then responsible for internal delivery of the goods within the buildings (i.e. common internal logistics). This approach was deemed especially useful for Marunouchi given the number of skyscrapers and major office developments it comprises. The experiment was organised by the Tokyo Metropolitan Government (Sinarimbo et al., 2004; Takahashi et al., 2004). The results of this initiative showed that the time taken for delivery trips, parking and unloading and delivery within the buildings was reduced by approximately 70 per cent (Takahashi et al., 2004).

In several French cities, a system called ‘nearby delivery areas’ (Espace de livraison de proximité - ELP) has been established to provide goods vehicle drivers with assistance unloading and delivering goods to nearby retailers and businesses using on-street space. The ELP approach comprises the installation of an urban transhipment platform at which dedicated ELP staff provide assistance with the delivering of consignments for the last leg of the delivery in the city centre. Goods are unloaded from incoming vehicles, and can be loaded onto trolleys, carts, electric vehicles and bicycles for the final distribution leg to shops and offices in the surrounding area. The first ELP was set up in Bordeaux in 2003, with a second ELP established in Bordeaux in 2005. The ELP is intended to make the delivery of goods to the city centre easier and reduce traffic congestion, noise and pollution associated with deliveries. It is a collaboration between freight transport companies, the Chamber of Commerce of Bordeaux and the Bordeaux metropolitan authority; these parties set up and co-finance the

ELP system. A dedicated area of street space is allocated for the ELP for goods vehicle loading and unloading with this space able to accommodate up to six delivery vehicles at once (about 30 metres wide, and a total area of approximately 75 m^2). The ELP also requires a small cabin of about 15-20m^2 for use by the staff, road markings, and handling equipment. The ELP in Bordeaux operates from Monday to Friday between 09.00 and 17.00 and on Saturday between 09.00 and 11.00. An impact assessment in 2005 showed that the ELP scheme prevented the need for 9,400 goods vehicles to enter the inner-city area in Bordeaux, with an average of 1.4 km saved per vehicle trip. Receiver and carrier satisfaction with the scheme was high. ELP was subsequently replicated in Rouen, Paris, Lyon, Clermont Ferrand, and Montpellier. Most of these projects were initiated by the private sector but the role of the city authority was important because of the need to use public space for the ELP itself (e.g. a car park or other public space). The city typically rents the space at a price that does not necessarily reflect the true market value – thereby assisting logistics activities in the heart of the city (Allen et al., 2007; Browne et al., 2012; Huschebeck, 2012; SUGAR, 2011).

9.3 Research and trials in goods vehicle consolidation through procurement practices

Rather than achieving goods consolidation and reduction in the number of goods vehicle delivery and collection trips (and hence their demand for kerbside space) through the adoption and use of an Urban Consolidation Centre (UCC) other 'virtual' methods of consolidation also exist that have been the subject of research and trials.

The first procurement approach available includes those staff placing orders within a specific building or several buildings in a local area choosing to use the same suppliers (which is often referred to as 'preferred supplier' or 'joint procurement' schemes for their selection of goods and service supplies) Results of trials of such schemes are provided below.

A pilot scheme carried out at one of Transport for London's main offices in central London investigated the potential benefits of reviewing procurement practices. This resulted in a 20% reduction in the total number of delivery journeys to the site. Stationery supplies to the site were reduced from twice daily to three visits a week, and daily paper records deliveries were also reduced from daily to three times per week. Catering deliveries were also reduced by 40 per cent (Transport for London, 2009b).

Another study indicated the potential for changes in procurement practices in large, public sector organisations as a means to reduce freight vehicle activity (Balm et al., 2015). This work showed that in one UK university there are 466 so-called "expert" buyers (who purchase of behalf of a department), and 1058 additional individual buyers who are also able to raise orders. At two universities in the Netherlands, a survey of 278 suppliers found that they were responsible for approximately 35,000 deliveries to the universities over the previous 12 months. Meanwhile, survey work at the Municipality of Rotterdam showed that 245 suppliers were responsible for 37,600 deliveries in 2013 (Aditjandra and Zunder, 2015; Balm et al., 2015).

Research into procurement was also carried out at the University of Westminster. It was found that there were over 2,000 registered suppliers and contractors to meet the needs of the various faculties, with products ranging from stationery to instrumentation and capital equipment for engineering studies. Stationery was ordered by a wide range of university employees with no minimum spend limits on individual orders or central storage and supply activity. In 2009/10 the University received over 400 invoices from its principal stationery supplier a year, with an average value of £30 per delivery. It was decided that this was inefficient, as the cost of processing each invoice in the University's accounts department was about £20. On the assumption that each invoice represented a vehicle delivery to one of the sites within the University, approximately 2 stationery deliveries per day were being made during the academic year. Changes to procurement arrangements were made so that each school had responsibility and accountability for its procurement (rather than this taking place at a higher campus level – which was further removed from the actual demand for stationery products). A new computer-based procurement system was also introduced that increased the ability of schools to coordinate their procurement needs and reduce the number of individuals able to place stationery orders with suppliers. As a result, the University was able to increase the average order value from £30 to approximately £300. This significantly reduced the administrative costs associated with invoice processing. On the basis that each delivery became ten times larger, there were ten times fewer invoices to process; therefore approximately £180 was saved per delivery. The number of stationery deliveries were estimated to have been reduced from 400 to 70 per year (approximately an 80 per cent reduction) and, as well as reducing delivery costs in the supply chain and goods reception and accounts administrative costs at the University, also helped to reduce vehicle activity on the road network, together with fossil fuel consumption and vehicle emissions (AEA, 2010).

Two identical seven-floor multi-tenanted office blocks in central London were found to employ different procurement practices, with occupiers in one using the same preferred suppliers and the other not. This resulted in 50% fewer goods vehicle deliveries at the block with these joint procurement practices in place (Browne et al., 2016).

An 18-month pilot project at a multi-tenanted publicly-owned building in central London to encourage occupiers to use preferred suppliers resulted in a 12% reduction in the goods vehicle and servicing vehicle trips. This project highlighted the importance of the role played by the landlord in encouraging tenant businesses to participate in the demonstrator and change their procurement behaviour when the scheme is a voluntary one (Steer, 2019).

Another central London demonstrator project in the West End of central London sought to encourage businesses to make use of a preferred supplier scheme for waste and recycling collection services in order to reduce the number of private waste company vehicles operating in the area. Businesses that volunteered to participate in the project received the benefits of reduced waste collection costs through their joint procurement power. However, uptake among businesses of the preferred waste contractor scheme was limited; the scheme took approximately three months to set up and 321 businesses had signed up after six months. It resulted in a 94% reduction in the number of waste vehicles operating within the target area and a 17% reduction in the number of daily vehicle stops made by these vehicles. A preferred supplier scheme for goods purchasing was also set up as part of the demonstrator but only 13 businesses were participating in it after six months (Steer, 2019).

A second method for achieving more consolidated goods deliveries to a building involves those placing orders for goods request that they are made to a nominated freight operator's depot rather than direct to building, thereby allowing these goods to be consolidated by the freight operator and delivered in a single vehicle load. This approach is most suitable for smaller items such as parcels and packages and prevents the need for all major parcel carriers to make deliveries direct to the building as would otherwise happen.

A property company with a head office in central London set up a pilot scheme to consolidate personal deliveries ordered by staff that were being delivered to this workplace, as well as the stationery required for business purposes. These goods deliveries were instead sent to a nominated delivery company's depot in east London and then delivered each day to the head office by a single electric vehicle. This pilot scheme led to a reduction in goods vehicle deliveries to the head office from an average of 21 per day before the scheme to just one per day from the nominated freight operator's depot as a result. Efforts were made by the property company to extend the nominated delivery company scheme to tenants of its buildings, using tenancy agreements to mandate sign-ups. However, most lawyers and property agents reviewing these agreements insisted on such clauses being removed, casting doubt on the viability of this approach to compelling tenants to use nominated delivery addresses (Steer, 2019).

The City of London Corporation, the local planning authority for the traditional central business district of London, has imposed planning conditions on several new, very large multi-tenanted office blocks granted planning permission. This requires that rather than their tenants receiving direct deliveries from their goods suppliers, instead these deliveries have to be sent to a nominated freight operator's depot where they can be consolidated before being delivered to the building, thereby reducing goods vehicle trips. By the end of 2019, the Corporation had put in place seven signed section 106 agreements of this type with developers of major new office schemes. These were forecast by the Corporation to reduce goods vehicle deliveries at each site by at least 40-66%, with a forecast total reduction of at least 51% across the seven sites combined. The Corporation intends to work with the developers and occupiers of these sites to monitor actual reductions in delivery vehicle numbers and will use the monitoring work "as a basis for putting more stringent restrictions on developments in future". The Corporation is also working with existing tenants in offices within the City of London to voluntarily engage in similar schemes to use a nominated freight operator depot or a dedicated UCC to consolidate goods flows and vehicle movements to and from their buildings. Since November 2018, the Corporation has made used of a nominated freight operator's depot for the delivery of its own goods to its head office and encouraging other tenants in the building to also do so (City of London Corporation, 2019b).

A third method for achieving consolidation of goods deliveries to buildings requires that staff responsible for placing orders review how frequently the goods ordered need to be delivered (for instance having the goods delivered one per week rather than daily or several times per week) and holding more stock within the building to facilitate this.

Several examples of this approach are available from procurement practices operated by companies during the London 2012 Olympic and Paralympic Games. These examples included the 'Living Room' a national chain of restaurants and bars, with a central London branch just off Regent Street. Given the delivery restrictions imposed during the 2012 Games the Living Room arranged with its suppliers to pre-order up to twice the normal amount of certain goods and stockpile them to reduce deliveries during the busiest periods. Non-perishable and long-shelf-life stock, such as soft drink concentrate, draft and bottled beers, and dry food stuffs, were particularly suitable (Transport for London, 2011a). Bike Dock Solutions, a London-based company selling bicycle parking products including cycle racks, shelters and lockers, also put in place a plan to order key products in bulk and arrange extra storage facilities during the 2012 Games (Transport for London, 2011b). The Brewery, a shopping and entertainment centre with approximately 30 shops, attractions and restaurants in Romford, close to the Olympic Park put in place a plan to encourage businesses to pre-order goods, where possible, to reduce the number of deliveries needed during the 2012 Games. To help facilitate this, the management team provided large containers for businesses to use temporary stockrooms (Transport for London, 2011c).

The procurement process can also be used to influence the type of vehicles used by operators – this has been achieved through contractual requirements by Transport for London and other public sector purchasers of freight services in the UK, especially in relation to improving the safety of vehicles used to supply materials for construction and building projects.

While offering means by which goods vehicle collections and deliveries can be reduced, hence reducing demand for kerbside space and time, it is important to note that none of these three approaches are currently widespread in terms of their adoption by businesses and public sector organisations receiving goods in their urban buildings. Research among businesses where such initiatives have been promoted by the landlord have shown that commercial tenants can be reluctant to share supply chain data and to exhibit the necessary motivation and interest to engage with such schemes, while identifying a 'champion' in schools who is prepared to implement such an approach can be challenging. Clear communication and promotion of such schemes to businesses and their staff is required with direct, personal communication proving more successful than mailouts and poster campaigns, and the support of senior personnel can prove important. There can be costs involved in setting up such schemes that need to be met, even if there may be financial savings or other operating advantages once the scheme is up and running (Steer, 2019).

9.4 Research into kerbside loading/unloading

Research projects in several countries have studied various aspects of kerbside loading/unloading in recent years. Those studies with greatest relevance to this report are summarised below. Several studies in cities in America, Canada, Spain, Italy and Portugal have identified poorly located and insufficient total available kerbside space for freight vehicles loading and unloading operations. Illegal on-street parking at the kerbside can contribute to traffic congestion, safety implications for other road users, and an increase in freight transport operating costs and hence the cost of goods and services.

A study in New York using freight trip generation rates for various business types and assuming three deliveries per vehicle stop and an average goods vehicle stopping space length of 33 feet found that there were about 54,000 stopping spaces to accommodate about 25,000 goods vehicles during the two-hour weekday morning peak period. This morning peak represents about 12.5% of the total daily freight vehicle activity. This implies a ratio of supply of loading space to demand for loading space of about 2:1. However disaggregated analysis of smaller areas within the city by zip code found that demand far exceeded supply in some locations. The results indicated that about 10 out of 41 zip codes studied (25%) had an occupancy rate that that exceeded the supply of loading space. Therefore, during the morning two-hour peak period, there were no kerbside stopping spaces available for about 11% of all goods vehicles that required them (Jaller et al., 2013).

A study of an area 800 metres by 800 metres in Toronto's Central Business District using parking ticket data, parking supply data, passenger trip data and employment data found that 80% of freight vehicle parking fines were issued to vehicles stopping during restricted time periods, with most of these restrictions applying during peak periods. Modelling indicated that restricted availability of kerbside loading space and high numbers of businesses located adjacent to a single kerbside location tend to increase the incidence of illegal freight vehicle stopping (Wenneman et al., 2015). Analysis of illegal on-street goods vehicle parking in city of Chicago, USA found that rather than happening in the vicinity of industrial and transportation businesses and was instead occurring in newly developed, mixed-use neighbourhoods, indicating the role that the provision of parking space and street design in these new developments that generate many goods deliveries. This reflects the importance of land use planning and street designing addressing illegal goods vehicle parking (Kawamura et al., 2014).

A study of last-mile deliveries of online shopping orders to residents in the Manhattan district of New York found little kerbside loading space availability in residential areas. The analysis comparing parking demand and parking availability in residential areas found that streets with have little, if any, dedicated space for goods vehicles and high levels of car parking with very low turnover of this vehicle parking. Therefore, goods vehicles making last-mile deliveries to residents rarely have access to legal kerbside parking on street (Chen et al., 2017).

A study of loading bays in four streets in the Spanish city of Santander (which are prohibited for car parking) found that, by street, between 21% to 49% of all vehicles using these loading bays were cars. Overall, approximately 30% of loading bay space and time was illegally used by cars. This illegal car parking led to some goods vehicles making deliveries either double parking, parking on the pavement or parking in other kerbside locations where they should not. In addition, a considerable number of vehicles that were permitted to use the loadings bays stopped for longer than they were permitted to. The authors concluded that a loading bay should have a maximum size capacity of five medium-sized goods vehicles stopped at the same time and that greater enforcement of loading bays was required (Ezquerro et al., 2020).

A study of the suitability of the location and total capacity of dedicated loading bays in the city centre of Bologna in Italy using freight traffic data, business profiles and loading bay location and size data found that many bays were poorly located to serve the businesses where deliveries and collections are made. Many of the existing bays were found to be too close to each other and while there were other areas where loading/unloading needed to take place that had insufficient loading bay provision. In addition, the analysis found that there were too few bays in total to meet busy hours when the demand for loading and unloading space was greatest. The research therefore concluded that both a relocation of existing loading bays as well as a substantial increase in total loading bays capacity was required. Greater enforcement was also urged to prevent non-freight vehicles from parking in these loading bays (Dezi et al., 2010).

A study in Lisbon, Portugal used microsimulation to investigate the extent to which double parking by goods vehicles could be improved by changes in the size and location of dedicated loading bays as well as greater enforcement of illegal parking by non-freight vehicles in these bays. The modelling work made use of loading bay location, size and use data, survey work of businesses receiving deliveries, land use data, and road traffic data. The analysis indicated that many of the bays were poorly located for making deliveries to businesses served. The results found that relocating some loading bays, replacing some larger bays with more smaller ones that were better distributed to serve businesses and greater enforcement of car parking offences would lead to less goods vehicle double parking and improved traffic flow (Alho et al., 2018).

Research in the American city of Seattle investigated the extent to which goods vehicles need to driver further than necessary in the driver's search for a suitable kerbside loading space, thereby contributing to traffic levels and vehicle emissions. GPS data was used from a sample of 2900 goods vehicle trips performed by parcel operator. The analysis indicated an average estimated 2.3 minutes per trip spent driving looking for a loading space. This accounted, on average, for 28% of total trip time on these relatively short distance parcel trips. The study also found that driving distance and time searching for a suitable loading space was greater in locations where more kerbside space was allocated to bus lanes and lower in locations where more kerbside space was allocated to loading/unloading, and where more off-street parking space was available at receiver's businesses (Dalla Chiara and Goodchild, 2020). Another subsequent study in Seattle has corroborated this finding of the average time per trip spent driving looking for a kerbside loading space in parcel operations (Dalla Chiara et al., 2021).

Another study in Seattle focused on vehicle kerbside parking behaviour in a three-by-three city block grid around a hotel, a high-rise office building, a historical building, retail centres, and a residential tower block. Key findings included that 52% of all vehicle parking in loading bays were illegally parked passenger vehicles, while 26% of goods vehicles were parked in car parking bays. Goods vehicles used to provide services rather than load/unload goods made up 36% of the total goods vehicles using the kerbside. These vehicles tended to stop at the kerbside for far longer than goods making deliveries and collections, with 44% of them parked for more than 30 minutes, and 27% of them parked for more than one hour. Overall, 41% of goods vehicles parked in unauthorised locations, with this being as high as 65% near the retail centres (Urban Freight Lab, 2019b).

Modelling of road freight transport in the historic centres of the Brazilian city of Sao Joao Del Rei has indicated that there was insufficient kerbside stopping space for the level of goods vehicle journeys. Only 18% of the stopping spaces that have been calculated to be required in peak delivery periods existed. The results also indicated that additional stopping spaces for loading/unloading needed to be located in closer proximity to the establishments that generate the greatest number of deliveries than was currently the case. This would assist in reducing the time taken to convey goods between vehicles and delivery points and thereby vehicle kerbside dwell times (Silva et al., 2020).

Research in Seattle has investigated the use of alleys behind buildings for loading and unloading activity by goods vehicles, an activity for which they are not currently used. The research found that 40% of the city centre blocks have an alley, 90% of which are sufficiently wide to accommodate only a single lane for goods vehicles. Given the shortage of kerbside space for freight loading/unloading in the city, the authors propose the use of suitable alleys for this purpose (Machado-León, 2020).

Research in New York City has identified that since the expansion of the cycle route network there has been a growing problem concerning interactions between goods vehicles parked on-street (either legally or illegally) and cyclists. Management strategies are identified as necessary in commercial and retail areas as well as in residential areas to provide adequate solutions, including a better understanding of the parking decision-making of goods vehicle drivers (Conway et al., 2016).

A range of factors influence the design of on-street loading bays. These include: the length and width of vehicles intended to use them, the width needed to align the vehicle with the kerbside, the roadside width needed by a driver to safety alight from the cab/driver's seat without endangering themselves or cyclists and other road users, the width required on the carriageway and footway if vehicles are side- rather than rear-unloaded (such as curtain-sided vehicles and side-opening vans, the length needed to operate rear tail lifts, and the length of bay required for vehicles to ingress and egress to/from the kerbside based on the turning ability of goods vehicles. A loading bay and the roadway and kerbside surrounding it should be designed to have sufficient space vehicle to manoeuvre safely, preferably without having to reverse in busy locations with pedestrians and other hazards that could present themselves in drivers' blind spots (Transport for London, 2017). If the length of loading bays is insufficient for the types of vehicles that stop at the kerbside to use this can result in freight operators having to use smaller vehicles instead, leading to an increase in the total number of journeys.

The width of kerbside loading bays in America has been the subject of research to study situations in which they are insufficiently wide to prevent drivers from having to walk in and use traffic lanes, cycle lanes and pedestrian footways when moving around the outside of and unloading their vehicles. This places drivers and other road and pavement users at risk. The space required by drivers to carry out these procedures while reduce the risk of such conflicts with other road users was calculated. A simulator experiment was used to investigate bicycle and goods vehicle interactions with a variety of loading bay designs (McCormack et al., 2020). Research has indicated that many urban locations in America do not provide on-street loading and unloading zones, resulting in large goods vehicle parking in locations that can obstruct roadway infrastructure provided for pedestrians and cyclists. A bicycle simulation experiment was designed to evaluate the impact of on-street loading/unloading activities on the safety and efficiency of bicycle operations on a shared urban road. Results of this work indicated that the size of the loading zone size has the greatest effect on the extent to which a cyclist diverges from their intended route. When a goods vehicle driver walks alongside their vehicle this was found to impact substantially on a cyclist's speed. When no commercial vehicle loading zone was present and the goods vehicle was parked on the cycle lane, cyclists had to choose between using the roadway without cycle lane or the pavement. Approximately one-third of cyclists opted to use the pavement. Current American guides for traffic engineers and planners designing kerbside goods vehicle parking space provide guidelines concerning the parking space needed but not the additional envelope around these vehicles to ensure loading/unloading is safe and prevents impacts on cyclists. Further research is required to determine the minimum space required to permit this (Jashmani et al., 2020).

Modelling of pre-bookable kerbside loading space in Winchester identified potential benefits to freight companies in terms of reductions in the time taken make deliveries. However, the potential problem of drivers arriving early or late for the slots they have booked which could result in on-street queuing and impacts on traffic flow (in the case of arriving early) and poor utilisation of the kerbside space (in the case of arriving late) (McLeod and Cherrett, 2011).

Analysis carried out in Seoul, South Korea, indicated that the consolidation of the parcel flows of nine parcel carriers destined for a major high-rise housing complex, with the last-mile delivery handled by a single carrier, would reduce the distance travelled by goods vehicles by approximately 70%, and the time taken for vertical delivery within buildings by approximately 35%. This would thereby result in less total time being spent at kerbside by goods vehicles. This collaborative consolidated delivery of parcels was calculated to be financially feasible for 10%-20% of all apartments in the city (Park et al., 2016).

In assessing the effects on urban freight transportation of implementing Bus Rapid Transit (BRT) systems in the Colombian city of Cali, a study has, among other things, examined the impacts on kerbside loading/unloading space. Interviews carried out with various experts working in urban authorities, businesses and freight transport companies has identified that kerbside loading bays and access ramps to commercial establishments close to BRT corridors that have been implemented were reduced significantly in number. Freight operators report that this has led to more goods vehicles circulating to find kerbside loading space, double parking and illegal parking and fines for companies (Cruz-Daraviñ, 2021)

An American project has investigated the ways that urban authorities and technology companies are responding in policy and technology terms to the growing demand for kerbside space in cities. Interviews with policy makers in 14 cities, three and three regional metropolitan planning organisations and 10 technology companies were carried out (Diehl et al., 2021).

American research has identified how inadequate planning requirements for off-street delivery facilities at major commercial and residential developments in central urban areas has led to the majority of vehicle stops to carry out deliveries to these buildings having to take place on-street. The additional mismatch between the demand for and supply of on-street stopping space for goods vehicles compounds this problem. This on-street shortfall is due to inadequate planning together with lack of enforcement of goods vehicle loading zones by other vehicles. This can result in illegal on-street parking by goods vehicle drivers which contributes to traffic congestion, safety problems, and pollution impacts (McDonald and Yuan, 2021).

Research into next-day parcel deliveries in central London has quantified the proportion of vehicle time spent driving and parked at kerbside while making deliveries, distance walked and time taken by drivers making deliveries while the vehicle is parked (Allen et al., 2018a). Research has been carried out into the spatial concentration and trip patterns of last-mile meal deliveries in north London using an operational dataset from a meal delivery provider. It quantifies the transport characteristics and environmental impacts of these meal deliveries in London, sets these deliveries in context with other forms of urban freight transport, and discusses the negative impacts associated with these meal deliveries (Allen et al., 2021a). (See **section 5.2** for further details of these two London studies.

Several studies have considered the effect of charging for kerbside loading space on road freight transport operations. A stated preference and simulation study focused on Rome's limited traffic zone (LTZ - a 5 km^2 area in the city centre) in which freight operators had to pay an annual fee of approximately 600 euros which was increased to 2000 euros per vehicle in 2014 to enter at the time of the study. Unsurprisingly, this had led to much discord among freight operators. The study evaluated freight operators' sensitivities to various fees to enter and the availability of loading bays inside the Rome LTZ using stated preference techniques (Marcucci et al., 2015).

The feasibility of a goods vehicle parking permit with an annual fee was studied in downtown Toronto, Canada as a means by which to overcome the existing practice of illegal parking by goods vehicle drivers and the issuing of parking fines. Modelling reflected the decision process of goods vehicle drivers and showed a trade-off between walking time, parking costs, and risk aversion to parking tickets. The introduction of a permit system was found to reduce the frequency of parking fines being issued as well as alleviating driver frustration caused by having to search for legal loading spaces. As well as incentivising legal parking and the traffic benefits that may be associated with that, a permit scheme also generates revenue for the city. However, a relationship exists between widespread adoption of the permit scheme and its price, indicating a trade-off between the benefits of traffic improvements from widespread uptake and revenue generated for the city authority (Rosenfield et al., 2016).

A study focusing on shopping centres in two Singaporean urban areas applied a discrete choice model for goods vehicle parking choice based on real-world data on goods vehicle parking to investigate how a driver's choice between legal parking and illegal parking is affected by parking cost, parking fines, and parking availability, as well as the implication of drivers' parking behaviour on environmental and economic impacts. It found that, as would be expected, higher parking costs disincentivize vehicle drivers parking in off-street parking facilities. It also found that goods vehicle drivers are generally law-abiding, with one dollar paid for parking in an off-street facility carrying less disutility than one dollar paid in parking fines. Goods vehicles drivers were found to use their local knowledge so are more willing to join longer queues for loading/unloading areas that have larger parking capacities, and HGV drivers were found to be more prone to park illegally than LGV drivers. Excessive freight parking demand was found to generate traffic congestion, with drivers queuing for spaces, and thereby increasing air pollution, and worsening traffic safety (Dalla Chiara et al., 2020).

9.5 International innovation by urban authorities in kerbside loading arrangements

The double parking of goods vehicles was becoming a major problem in New York, in terms cars and long stays by goods vehicles. To improve traffic flow and increase the efficiency of urban freight transport, the highway authority implemented several kerbside management strategies. This included providing additional dedicated kerbside spaces for commercial vehicles, reducing the amount of time these spaces can be occupied, and increasing enforcement. An added complication in New York is that commercial vehicles (those with commercial number plates and only front seats) include both vehicles delivering and collecting goods and therefore using the kerb to load and unload as well as those providing servicing activities that require parking space and often have far longer dwell times than loading/unloading operations. In the newly designated commercial vehicle loading zones, single-space parking meters were replaced with ticket dispensers that allowed commercial vehicle drivers to purchase prepaid parking tickets for up to three hours. By using a pricing structure that escalated with duration of stay it was possible to a substantially reduce commercial vehicle dwell times in these spaces, discouraging the drivers of commercial vehicles used for providing services that often have far longer dwell times than loading/unloading operations. In 2018, this space was priced at $4 for the first hour, $5 for the second hour, and $6 for the third hour. The program was initially implemented between 43rd and 59th streets and Fifth Avenue and Seventh Avenue. However, its success led to the scheme being expanded to other streets. Evaluation of the scheme showed that the percentage of occupied kerb space reduced from an average of 140 percent (i.e. all spaces were occupied, with double parking occurring at 40 percent of these locations) to 95 percent, and average dwell times reduced from 160 minutes to 45 minutes, with only approximately 25 percent of goods vehicles occupying spaces for more than one hour. However, double parking of goods vehicles while making deliveries is still allowed in situations where there is no available kerbside space for 100 feet on either side of the vehicle's destination (New York City Department of Transportation, 2020; New York State Energy Research and Development Authority, 2017, 2018; Rhodes et al., 2012; Smart Freight Centre, 2017; USDOT-FHA, 2014).

Currently, New York City has an estimated 28,600 goods vehicle kerbside stopping spaces, 11,300 of which are metered. Most of these kerbside spaces are designated for commercial vehicles for only a specified period of the day, often then converting to passenger vehicle spaces after the peak period for commercial vehicle activity end. In 2018, approximately 2,300 kerbside spaces for commercial vehicles were added in the city. Metered commercial vehicle parking was first introduced in Midtown Manhattan but has now been deployed in other busy locations in the city to encourage more efficient use of this kerbside space by commercial vehicles. In addition, there is also an Off-Hour Deliveries (OHD) Program in New York that encourages goods deliveries during the off-peak hours of 19:00 to 06:00 with the intention of helping to reduce traffic levels and goods vehicle emissions. It is especially focused on areas with high pedestrian volumes and limited kerb space. Following a pilot scheme, the OHD Program was officially launched in 2019. It is anticipated that the number of businesses participating in the OHD Program will triple from 500 to 1500 by the end of 2021. Further loading bays are being introduced in residential areas (referred to as 'Neighborhood Loading Zones - NLZs) to reduce the extent of double parking by goods vehicles making deliveries in areas where no kerbside space is available due to high levels of car parking (New York City Department of Transportation, 2021).

In the French capital of Paris, prior to 2004 there was a problem with cars parking in the 10,000 kerbside loading bays, and them therefore being unavailable for goods vehicles. The City of Paris therefore took steps to address this problem. This included: (i) developing a method to quantify the required number of delivery bays for given types of street based on the businesses located there. A guide was produced that imposed a minimum standard of one delivery bay every 100 meters in the city's streets with each bay being at least 10 meters long, (ii) imposing a maximum loading/unloading time of 30 minutes per vehicle, and (iii) making this loading space shared-use with cars – in 2010, 80 per cent of the loading bays were made available for car parking from 20:00 to 07:00 to increase utilisation of the kerbside. The remaining 20% of loading bays were retained only for use by goods vehicles as they were assessed to be used in these off-peak evening and early morning hours for deliveries and collections), (iv) increasing the enforcement of these regulations – 1% of illegal kerbside stops received fines in 2004 compared with 13% in 2008 (Dablanc, 2013; Giuliano et al., 2013). In Toulouse in France a scheme was installed in which a section of on-street space reserved for car parking vehicles was altered so that at particular times of day it was only for use by goods vehicles making deliveries (Giuliano et al. 2013).

In Sendai in Japan a 2005-6 project identified that there was insufficient on-street loading space for goods vehicles. It was found that loading activities accounted for approximately 40 per cent of kerbside space use, and only 20 per cent of receivers had off-street loading facilities. A consultation process was established which led to the city authority converting more kerbside space into loading bays, and in some cases sharing this space with taxi bays at specified times (PIARC, 2012). Similar efforts to improve the provision of on-street loading space and reduce the illegal use of kerb space by cars were also implemented in Tokyo City in 2000 and in the Shibuya district of Tokyo in 2002-3 (PIARC, 2012). A scheme in Musashino in Japan in 2005 addressed the issue of illegal parking and loading in the vicinity of Kichijoji station through a stricter enforcement regime as this was impacting on passengers and pedestrians shopping and affecting (PIARC, 2012).

An example of an innovative street use management solution which involves the idea of multi-use lanes was introduced in the commercial centre of Barcelona in Spain in order to reduce the impact of increasing traffic in the area. The lanes were linked to VMS (variable message signs) technology which informed drivers who was allowed to use them according to the time of the day (e.g. bus or general traffic, freight operators making deliveries or residents parking their cars). During peak hours the lanes were bus lanes, during off-peak hours freight drivers could use them for loading and unloading, thereby removing the double parking of goods vehicles. The multi-use lane approach also helped to eliminate illegal car parking. Although expensive to implement, the multi-use lanes were a success, reducing travel time along the section by between 12 to 15 per cent (NICHES, 2005; Hayes, 2007). The Barcelona approach of using road space for different purposes by time of day has also been implemented in Bilbao. The left hand lane varies in use between: i) loading and unloading for goods vehicles (08.00 to 12.00), ii) moving traffic (12.00 to 21:00), and iii) car parking (21.00 to 08.00) (BESTFACT, 2013).

In Barcelona, in 2015 kerbside loading/unloading areas were introduced (called Distribució Urbana de Mercaderies (DUM) areas). These 9,000 kerbside spaces are intended to improve loading/unloading management. They require drivers to use a mobile phone based app to register their use of the loading space. The app includes a system to assist the driver in finding an available space when they are in the vicinity. Vehicles receive 30 minutes free loading. Exceeding the time booked for results in fines. Approximately 45,000 loading activities are carried out in these spaces each day (Barcelona City Council, 2015; 2020).

On-street goods vehicle stopping on the footway (i.e. on the pavement rather than on the carriageway – sometimes referred to as a footway loading bay), in a void space at the nearside of the carriageway (sometimes referred to as an inset loading bay) and in a loading bay that is half in the carriageway and half on the footway (sometimes referred to as a half-on, half-off loading bay) is allowed in marked bays in urban areas in some countries including France, Portugal and the UK. This can either be permitted at certain times of day or at any time, with this depending on the particular circumstances in the locality. This footway loading bay reduces the need for providing a kerbside loading bay and is potentially especially useful in streets in which moving vehicle flows are high and pedestrian footfall and demand for loading facilities are low, and in which kerbside parking would unduly narrow the carriageway. Care has to be taken in providing this solution in determining suitable vehicle weights for footway parking so as to not damage the footway, as well as ensuring that such an approach will not unduly place pedestrians at greater risk. Street furniture and kerbstones may have to be removed to permit this approach and/or retractable bollards used. These solutions are often seen as a last resort to providing loading space in constrained situations (Anciaes, 2022; Transport for London, 2017).

9.6 International studies of off-street loading facilities

The provision of off-street parking space for goods vehicle deliveries and collections and servicing activity at buildings when they are designed and constructed can reduce the demand for kerbside space and time by freight vehicles. However good design of such parking space and access routes to and from it are important to ensure it does not result in impacts on traffic flow or the safety of carriageway and footway users. Inadequate design of off-street vehicle facilities (parking spaces and loading bays) can also result in having to use smaller goods vehicles than would otherwise have been used and hence generate additional vehicle movements (Environment Canterbury, 2007; Rhodes et al., 2012).

A study was carried out in New York in 1997 into the adequacy of off-street freight handling facilities at office blocks in the central business district. This work considered the size and design of the off-street loading space, the extent to which of-street facilities are used by goods vehicle drivers, the location and number of goods lifts, and the times at which delivery and collection activity was permitted by the building managers. Although based on a limited sample size the work concluded that inadequate off-street freight facilities were adding to cost, reliability and time taken for freight transport (Morris and Kornhauser, 2000).

Local planning authorities should regularly review and update their policies for off-street goods and servicing vehicle facilities to make them more appropriate to current urban traffic and environmental problems. For instance, rules can be put in place or amended that specify standards for the presence, quantity and design of loading bays, and for off-street loading and parking space to help to reduce the need for goods vehicles servicing these buildings to have to stop on-street to carry out loading and unloading activities (Giuliano et al., 2013; Holguín-Veras, et al, 2015).

In Tokyo, the 2002 off-street parking ordinance requires new department stores, offices, or warehouses of over 2,000 square metres to provide off-street loading facilities. Planning authorities in European cities often require such loading facilities for buildings with floor areas as low as 400 to 1,000 square metres. The City of New York regulations also specify the size, design, and location of the loading bays required (Giuliano et al., 2013).

In Barcelona, in addition to common practice of specifying the number of loading bays required based on the size of the development, the city-wide rules imposed by the planning authority also require that new bars and restaurants must accommodate a storage area of at least 5 m^2 for drinks. This is intended to reduce the frequency of delivery needed by these businesses (which otherwise, is usually daily) (Giuliano et al., 2013).

Various trade associations and public authority bodies have produced guides and advice to assist in off-street site design for freight activities providing goods and servicing activities to buildings including on-site design standards, templates and scale drawings for designing layouts for goods vehicles of various sizes and configurations and for carrying out swept path analysis for designing turning circles (see for example Freight Transport Association, 2006; Environment Canterbury, 2007).

Most urban authorities have little, if any, information about off-street loading facilities at major buildings. The Seattle Department of Transport has worked with the Urban Freight Lab at the University of Washington, to document such facilities at large commercial and residential buildings in the city centre including off-street loading bays, goods delivery policies at these sites and delivery operations within the buildings including concierge systems, lift availability etc. and producing process maps to explain the delivery procedures for each building studied. This has helped Seattle DoT to establish a database detailed all these off-street delivery and collection facilities and procedures (Urban Freight Lab and Seattle Department for Transport, 2018).

10. International perspectives on kerb space allocation and street design

10.1 International research into kerb space allocation

As the international research and actions taken by policy makers in other countries reviewed in the previous sections indicates, kerbside parking and loading/unloading operations have become increasingly scrutinised and contested in other countries in addition to the UK in recent years.

International documentation also reflects the more general increase in competition for kerbside space beyond car parking and goods vehicle loading as policy makers seek to promote active travel by bus, bicycle and on-foot as well as for other leisure and social uses in urban areas outside the UK, mirroring what is taking place in this country. A report by the International Transport Forum (ITF) reflects the increase in demand for the kerbside, and how the use of kerb is changing internationally, noting that it is, “an increasingly contested piece of urban real estate” (ITF, 2018, p.11). It goes on to note that, “Where motorisation rates are high, the curb often serves to store vehicles that are not in circulation, sometimes for minutes, oftentimes for hours. Where motorisation rates are lower, curb space may encompass many other activities, including commerce and socialising. In many contexts, especially where car use is rising rapidly, all of these uses are concurrent. Moves to re-allocate, reduce or price these uses are often contentious, especially where implied losses for incumbent users are tangible and where benefits from changing curb use will flow to as-yet unclear, unorganised or diffuse beneficiaries” (ITF, 2018, p.11).

This ITF report considers the extent to which the so called ‘ride-hailing’ services that have emerged in cities around the world in recent years (e.g. Uber, Lyft etc.) will affect future demand for car ownership and use, cycling, walking and bus services. If demand for these ride-hailing services grows strongly this may result in changes from a ‘parking’ city world to a ‘pick-up/drop-off’ city world, and would make the kerbside parking of cars in dense urban areas increasingly less tenable (ITF, 2018). Another more recent ITF report into street space allocation for transport considers how street space has traditionally been allocated in the past, considers suitable metrics to use when considering street space allocation. However, the report completely omits any consideration of the street and kerb space requirements for freight transport, instead only considering passenger transport (ITF, 2022).

Interviews with policy makers in 14 cities, three and three regional metropolitan planning organisations and 10 technology companies in America identified the top five major challenges in kerb management. These were: i) communication and enforcement of kerb rules that can in some cities change dynamically by week, day, or hour. Violations of kerb regulations were high in all cities interviewed either due to misunderstanding or their not meeting user needs, ii) confusion and lack of co-ordination between urban authorities and agencies about who is responsible for kerb management across the entire urban area and a lack of suitable structures for dealing with it, iii) concerns about losing urban authority revenues if parking meters and replaced with loading zones or other such infrastructure that yields less income, iv) political inertia due especially to concerns about residents’ reactions to the removal of free kerbside parking space and the reallocation of kerb space to other uses, and v) lack of data and knowledge about kerb use in urban authorities (Diehl et al., 2021).

Another American study in which public sector planners and engineers were interviewed has also identified the ad hoc approach to the provision of kerbside loading space, with action often taken in response to requests from local businesses. Several interviewees noted the changing needs for kerbside loading space as business close down and new ones open, but that many kerbsides were originally planned and space allocated long ago without a regular mechanism for reviewing its use. This is further complicated by the use of the kerbside for car parking and other transport operations. The provision of kerbside loading spaces can require the liaison and joint working of many departments in a city authority in America, including public works teams, design teams, transport consultation and regulatory teams, planning teams and the police department. This leads to substantial complexity and delay in action (McDonald and Yuan, 2021).

Research has indicated that knowledge of kerbside space, its use and the restrictions imposed on it is generally poor among policy makers and local authorities, with them having inadequate data collection and metrics to understand how well it is used and how its allocation could be changed to improve its efficient use (ITF, 2018). A study that involved interviews with senior representatives of kerb space management in ten American cities found that all respondents wanted to have more detailed kerb-related data to be able to manage the kerb (Butrina et al., 2020). Instead, specialist private companies often have better data and knowledge of kerbside space, restrictions and use than policy makers in urban authorities through the digital mapping and remote sensing technologies they have deployed (ITF, 2018).

10.2 Road space allocation considerations

Over recent decades, national and urban governments in other developed countries in addition to the UK have also shifted their focus away from a ‘car-oriented city’ to a ‘sustainable mobility city’ (based on active travel and the road space reallocation associated with it) and a ‘city of place’ in which the importance of public realm and the functions of streets not associated with vehicle movement are promoted. This change has come about due to policy maker objectives concerning air quality, greenhouse gas emissions, road safety, health and fitness, noise disturbance and the attractiveness and competitiveness of place. This shift in policy away from a car-oriented city towards a sustainable city (based on active travel) and the importance of the place functions of streets has tended to initially focus on dense city centre locations with high density development, high quality public spaces, good public transport services and provision of concentrated walking and cycling infrastructure and where car driving is therefore less attractive. Then, over time, it spreads out to the inner city (which also typically has high density of buildings and good public transport and non-car mode choices) and eventually the outer city (which typically has lower density development and fewer public transport services and is subject to a greater proportion of car trips) (Jones, 2018).

In considering the allocation of road space (i.e. carriageway, kerbside and footway space) between different road users, various user groups argue for ‘fairer’ distribution of this space. Those supporting different user groups have used different ways of calculating how this space should be allocated including modal split, total distance travelled by each mode/type of road user. One study has applied each of these allocation methods to cars, cyclists and pedestrians in Amsterdam to illustrate how there is no satisfactory method for doing so, and how a technical solution does not exist (Nello-Deakin, 2019). This analysis showed that, in Amsterdam, in terms of total road space (i.e. carriageway, kerbside and footway) and modal share, cars and pedestrians receive far greater space allocation than their modal share, while cyclists receive far less. This could lead to the argument that, on this basis of total space allocation, cars should receive considerably less space than they currently do and cyclists considerably more. The author notes that such an argument is typically used by sustainable transport advocates in selective cases where modal share of cycling or walking is greater than the relative amount of road space they occupy. However, in the case of Amsterdam such an argument would also suggest that pedestrians should receive considerably less which does not seem sensible or likely to be prove popular.

Another study using GIS data and on-street surveys, also considered the road, kerb and pavement area dedicated to various road users (cars, bicycles and pedestrians) in four distinctly different city quarters in Freiburg, Germany. These results shown in **Table 10.1** demonstrate considerable differences in the allocation of transport infrastructure between different road users in these four districts, which were built in different time periods from the

1900s on and which have varying population densities. However, in all four districts cases, the greatest proportion of transport space is allocated to cars for road use and kerbside parking, followed by space allocated to pedestrians, public transport and cycling.

Table 10.1: Allocation of space by transport mode in city quarters in Freiburg, Germany

	Area (m^2) as % of total street area			
	Wiehre	**Weingarten**	**Herdern**	**Vauban**
Road	46.5%	52.1%	55.6%	40.3%
Public parking	11.9%	6.6%	3.8%	3.9%
Pedestrian area	29.8%	15.0%	33.0%	21.4%
Bicycle & walking	3.1%	16.8%	1.0%	12.2%
Public transport	2.9%	5.3%	1.4%	16.3%
Bicycle lane	1.3%	1.4%	4.1%	2.9%
Pedestrian area & road	0.8%	1.0%	0.2%	0.9%
Bicycle lane & road	0.4%	0.9%	0.2%	0.7%
Road & public transport	3.0%	0.4%	0.7%	0.9%
Pedestrian area & public transport	0.2%	0.2%	0.1%	0.4%
TOTAL	**100%**	**100%**	**100%**	**100%**

Source: Gössling et al., 2016

Some have argued that the total distance travelled by each type of road user provide a better indicator of overall transport volumes than modal share as it takes into account journey distance, and is therefore a better measure to use in allocating road space. The analysis of kilometres travelled per person per day in Amsterdam showed that cars had a far lower allocation of space that the relative importance of the distance they travel, while pedestrians and cyclist have an overallocation of road space according to the distance travelled by these methods. The allocation method based on distance travelled by road user group values longer journeys over shorter ones, and motorised vehicles over active travel by walking or cycling (Nello-Deakin, 2019).

Different types of road users take up varying quantities of space, with for instance, a car having far larger physical dimensions and requiring far more space for safety reasons from another car than is true of cyclists or pedestrians. Analysis of the road space required by each road user, based on the physical size and its spacing requirements from others and modal share, and allocating road space of this basis would result in cars being given nearly all road space in Amsterdam and cyclists and pedestrians a combined total of 4% (Nello-Deakin, 2019). But clearly allocating road space on the basis of the space that different means of travel occupy and require and their current level of usage would not be a sensible approach.

The comparison of the results of these three different approaches to road space allocation for cars, cyclists and pedestrians together with the road space they currently have in Amsterdam are shown in **Table 10.2**. Such means of measurement overlooks the intrinsic characteristics of each, such as the spatial efficiency of cycling, the flexibility and purpose of walking, and the distance and speed attributes of cars. Similarly, if goods vehicles were considered, their carrying attributes in terms of their volume and weight capacity, is superior to other means of conveying goods by road or by foot and is the only method possible for large and bulky products. In addition, such an analysis concentrates exclusively on the movement function of streets rather than their place functions and overlooks the sharing of space between uses.

Table 10.2: Comparison of road space distribution, modal share, travel per person per day and weighted mode share x space scores in Amsterdam

	Current road space distribution	Modal share	Km travelled per person per day	Weighted mode share x space score
Cars	51%	32%	71%	96%
Pedestrians	40%	18%	8%	1%
Cyclists	7%	27%	21%	3%

Source: Nello-Deakin, 2019.

Efforts to carry out comparative analysis of types of road use for transport using quantified metrics such as those discussed above is unlikely to provide sensible solutions to road space allocation and nor is it likely to satisfy the different groups who require road space for various transport and place functions. Some approaches to kerb space management recommend that, in addition to a framework for designating street kerbside use according to the surrounding land use, a more flexible, dynamic approach to kerb space allocation is required based on the use of technology systems and pricing mechanisms underpinned by data from vehicle operators and other sources that permits the monitoring of kerb use (International Transportation Forum, 2018).

The allocation of road space depends on the roles played by (Jones, 2014): i) transport planners (who have typically been educated in traffic engineering, urban planning and urban design), ii) governance (such as Acts of Parliament) that help establish parameters for which authority is responsible for what portion of road space, iii) organisational conventions (i.e. the formal professional conventions, techniques and methods that provide guidance on road space allocation, and iv) infrastructure which places requirements on road space (which includes both technology (e.g. traffic lights) and artefacts (e.g. cars).

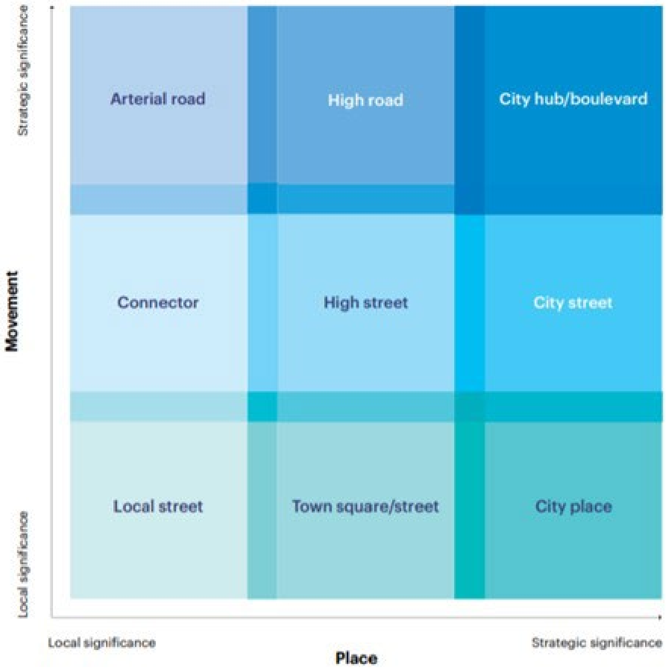
There are no simple, or purely technical/engineering-based methods by which to make satisfactory decisions about the allocation of road space. Instead, such allocation decisions have to take into account a range of political, economic, technical, social, environmental, historical and land use factors, and include the views, opinions and needs of different stakeholder groups to identify pragmatic solutions.

10.3 Examples of approaches street typologies and hierarchies in cities

As a result of their lack of knowledge about the kerb, many urban authorities often allocate the kerbside among uses in a piecemeal fashion, and few have developed a strategy of how best to manage the kerbside and street space, taking account of both movement and place functions and the safety, accessibility, efficiency, health, and other environmental and social factors involved, or consulted on this (ITF, 2018). The senior kerb management respondents from a study of ten America cities explained that the methods they used for prioritising and allocating kerb space are generally ad hoc and based on professional judgement, with two describing their approach as “more of an art than a science,” and “not a lot of science” (Butrina et al., 2020). However, several urban authorities have developed street typologies by consideration of their movement and place functions and used this to consider a hierarchy of kerb space use.

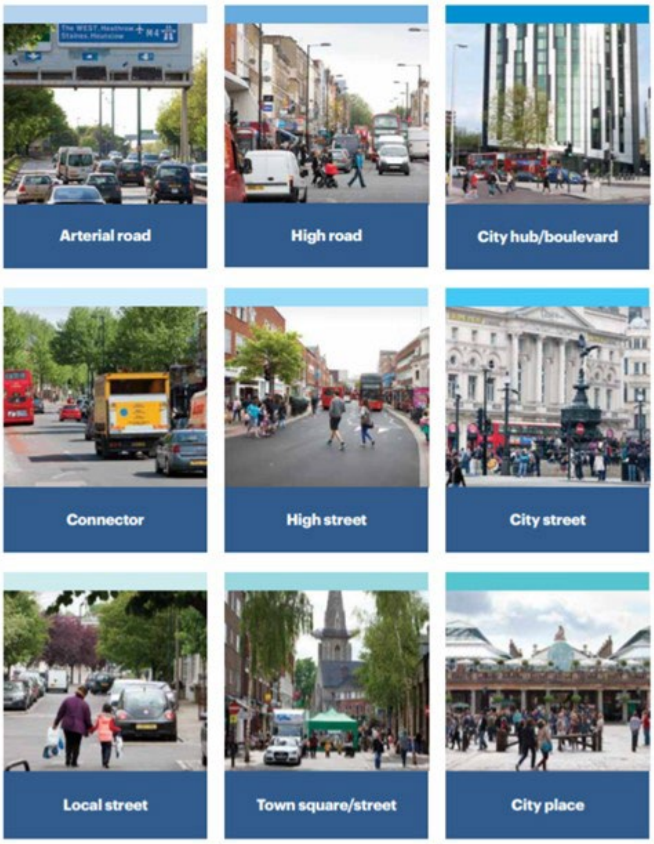
In London, the Roads Task Force, an independent body, was set up in 2012 to develop a long-term strategy for roads. It proposed nine ‘street types’ in the London ‘street family’, according to their 'movement' and 'place' activities and worked with the London boroughs to classify the road network according to these street types (Roads Task Force, 2013). **Figure 10.1** shows the nine street types in the typology according to their movement and place characteristics, **Figure 10.2** provides photographs of examples of each of these street types and **Figure 10.3** shows the implications of these street types for the transport vehicle speed environment.

Figure 10.1: The nine street types in the London street family



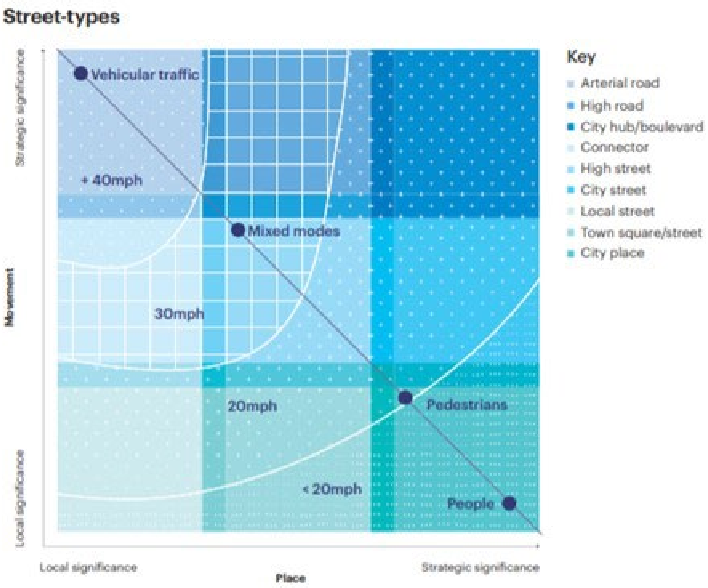
Source: Roads Task Force, 2013.

Figure 10.2: The nine London street types illustrated



Source: Roads Task Force, 2013.

Figure 10.3: The implications of London street types for the speed environment



Source: Roads Task Force, 2013.

When the Mayor of London and Transport for London adopted the Healthy Street Approach (see **section 3**), it seems that the street types approach put forward by Roads Task Force was no longer pursued.

In 2016, the Commission on the Future Of London's Roads and Streets was established. This was an independent, expert commission convened by the Centre for London, "to examine how London can best manage the conflicting pressures on its roads and streets, and tackle problems of congestion, pollution, affordability and road safety besetting London's surface transport system". In its consideration of the situation in London, The Commission's 2017 report noted that, although kerbside is a finite commodity and faces growing competition for its use thereby requiring an important need to manage kerbside space, "there is a dearth of borough-wide kerbside management strategies, let alone London-wide ones. London urgently needs to review the regulations and price incentives that govern access to kerb space" (Barrett et al., 2017, p.56). The report went on to note that, "the principle of road user hierarchies is well-established as a tool to manage movement. The Commission believes that London highway authorities should adopt equivalent kerb space hierarchies to guide their decisions on the allocation of parking and drop-off space. Kerb space hierarchies should prioritise cycle parking, especially around stations and bus stops, and loading bays to accommodate servicing and delivery activities" (Barrett et al., 2017, p.56-57). The report provided indicative kerb space hierarchies for high streets and residential areas. The following kerb space hierarchy, in order of importance, was suggested for the high street (Barrett et al., 2017):

- Safety and access (i.e. provision of a safe layout for vehicles and pedestrians)
- Public transport stops (that are accessible to all users without obstructing pedestrian flows)
- Cycle parking (for individual and private hire cycles)
- Deliveries (access for loading and servicing that provides safe access to premises and minimises disruptions to pedestrians)
- Pick up and drop off (locations where private vehicles, taxis and private hire vehicles can safely pick up and drop off with minimum disruption to other road users)
- Parking for disabled users
- Short-stay car parking (generally charged)

In terms of residential streets, the report provided the following indicative kerb space hierarchy in order of importance (Barrett et al., 2017):

- Safety and access (i.e. provision of a safe layout for vehicles and pedestrians)
- Parking for disabled users (for disabled residents)
- Cycle parking (cycle parking and open visitor parking)
- Car clubs (bays reserved for car club vehicles)
- Short stay bays (that can be used for deliveries to residential addresses and for pick up and drop off by taxis and private hire vehicles)
- EV charging bays (for vehicle charging bays for residents and short stay use by other vehicles)
- Residential car parking

The report recommended retiming and consolidation as means by which to increase the efficiency of freight transport and reduce its need for kerbside space (Barrett et al., 2017). A further report published in 2020 reiterated the call that all London boroughs, "should develop kerbside strategies that allocate road and kerb space in accordance with clear user hierarchies" (Barrett et al., 2020, p.61). It recommended that, "Boroughs' kerbside strategies should include a commitment to reallocate a certain percentage of parking space (even if it is as little as one to three per cent) every year to other high-priority uses, such as cycleways, EV charging, disabled bays, or green space (Barrett et al., 2020, p.63). The report went on to discuss parking pricing as the main means by which to manage demand and the future role of technology in facilitating dynamic management of kerbside parking (Barrett et al., 2020).

In the American city of Seattle, the kerb space (also recently referred to there as the 'flex zone') is also used for many activities (including waiting for a bus, parking a car, hailing a cab, dropping-off and picking up passengers, loading/unloading goods, socialising, doing business, providing 'streateries', and relaxing in parklets). Given the level of demand for kerb space, the city authority set about considering priority for kerb use by function. The six function categories that were considered in deciding about how to make best use of the kerb space are as follows (City of Seattle Department of Transportation, 2021):

- Mobility - Moves people and goods (e.g. sidewalks, bus or streetcar lanes, bike lanes, general purpose travel lanes including freight travel, right- or left-turn only lanes)
- Access for people - People arrive at their destination, or transfer between different ways of getting around (e.g. bus or rail stops, bike parking, kerb bulbs, passenger load zones, short-term parking, taxi zones)
- Access for commerce - Goods and services reach their customers and markets (e.g. commercial vehicle load zone, truck load zone)
- Activation - Offers vibrant social spaces (e.g. food trucks, parklets and streateries, public art, street festivals)
- Greening - Enhances aesthetics and environment health (e.g. plantings, boulevards, street trees, planter boxes, rain gardens and bio-swales)
- Storage - Provides storage for vehicles or equipment (e.g. bus layover, long-term parking, reserved spaces such as for police or other government use, construction)

The city authority devised a Comprehensive Plan in 2017 that sets priority for kerb use by function according to land use. The three land uses considered were i) residential, ii) commercial & mixed use, and iii) industrial. The Plan states that the type of specific street should be considered in relation to these land uses. These priority functions for kerb use in these land uses are shown in **Figure 10.4**.

Figure 10.4: Priorities for kerb space (Flex zone) by predominant land use of area in Seattle

Priority	Land use		
	Commercial & Mixed Use	Industrial	Residential
1	Support for Modal Plan Priorities	Support for Modal Plan Priorities	Support for Modal Plan Priorities
2	Access for Commerce	Access for Commerce	Access for People
3	Access for People	Access for People	Access for Commerce
4	Activation	Storage	Greening
5	Greening	Activation	Storage
6	Storage	Greening	Activation

Source: adapted from City of Seattle Department of Transportation, 2021.

As well as drawing up priority uses of kerb space, Seattle has also considered how to provide space for pedestrian activities on the footway (i.e. pavement) and the roadway for various types of vehicles that need to travel along it. The authority recognises that not every kerb function can fit in every street. Their policies state that the adequacy of the pedestrian realm (footway) must be considered before allocating space to the kerb space or roadway and that in the pedestrian realm, space use and allocation should prioritise safety concerns, network connectivity and activation. When considering the roadway, mobility needs should take priority that are based on safety concerns, followed by the networks and facilities identified in the modal plans. Kerb space should be allocated to accommodate access, activation, and greening functions, unless its use for mobility is critical to address safety or connectivity needs in modal master plans. When mobility is required for only part of the day, the kerb space should be designed to accommodate other functions at other times. The kerb space should be allocated to support nearby land uses, modal plan priorities and accommodate multiple functions (City of Seattle, 2020).

The San Francisco Municipal Transportation Agency has noted the changes in transportation in American cities in the last decade with new modes of personal mobility (including ride-hailing, cycling and bike hire, electric scooters), together with on-demand parcel and meal deliveries that are competing with traditional modes for roadway and kerbside space (San Francisco Municipal Transportation Agency, 2020). It also recognises that urban policy makers have been implementing new policies and tools to make encourage active travel such as dedicated bus lanes, segregated bike lanes, and pavement extensions that user safety. They acknowledge that all these changes are resulting is increasing competition for kerbside space and conflicts between To address this the Agency has reconsidered how this valuable kerb space is allocated and managed, and so that its use can be more flexible, dynamic, and responsive to these changes. It has therefore developed a new approach to managing the city's kerb space. This strategy, "defines five key kerb functions, and how these functions and users are prioritised in different land use contexts, to reflect how kerb needs vary across the city" (San Francisco Municipal Transportation Agency, 2020).

The strategy involved a review of the city's existing curb management regulations and kerb conditions, a review of practice in other cities and discussion with planners and engineers working there; interviews with the Agency's staff whose work involves kerb issues; data collection on kerb usage and design; initial stakeholder workshops; the development of the kerb framework together with kerb management strategies, policies and tools; further stakeholder engagement to obtain feedback on the kerb framework and management strategies.

The five kerb functions in the San Francisco strategy are:

- Access for People - Active space that prioritizes transit boardings, and accommodates pick-ups/drop-offs, and shared-mobility services
- Access for Goods - Space for deliveries of different types and sizes, used for short periods of time
- Public Space and Services - Kerb designated for use by people and public services
- Storage for Vehicles - Space intended to be occupied by vehicles for extended periods, such that no other users can access the space
- Movement – Kerb lane is used for the through-movement of motorised and non-motorised means of transportation, such that the kerb lane is unavailable for other functions

The six types of land use for which kerb use has been prioritised in San Francisco are:

- Low-Density Residential - Predominately single-family homes or single-family homes split into several units. There may be a small number of businesses serving nearby residents such as corner stores, dry cleaners, and coffee shops.
- Mid- to High-Density Residential - Predominately mid- to high-rise apartments with businesses nearby serving residents such as corner stores, dry cleaners, and coffee shops.
- Neighbourhood Commercial - A mix of residential and commercial services such as restaurants, coffee shops, corner stores, laundry services, and small-scale retail.
- Downtown - High-density and intensity area. Predominately office, retail and other commercial with some high-density residential. Well served by transit.
- Major Attractor - Areas, institutions, or buildings that attract a unique set of users that may have specialized or discrete kerb needs. These needs may be specific to the day, time or season.
- Industrial/Production, Distribution & Repair - Areas that serve light or heavy industry, or production, distribution, and repair services.

Figure 10.5 shows the San Francisco kerb framework that was developed for the five kerb functions in relation to the six land use types.

Figure 10.5: Kerb functions prioritized by land use in San Francisco

Priority	Type of land use					
	Low-Density Residential	Mid- to High-Density Residential	Neighbourhood Commercial	Downtown	Major Attractor	Industrial/ Production, Distribution & Repair
High	Movement	Movement	Movement	Movement	Movement	Movement
	Access for people	Access for people	Access for people	Access for people	Access for people	Access for goods
	Storage for vehicles	Storage for vehicles	Access for goods	Access for goods	Public spaces and services	Storage for vehicles
	Public spaces and services	Access for goods	Public spaces and services	Public spaces and services	Access for goods	Access for people
Low	Access for goods	Public spaces and services	Storage for vehicles	Storage for vehicles	Storage for vehicles	Public spaces and services

Source: adapted from San Francisco Municipal Transportation Agency, 2020.

The American Institute of Transportation Engineers has produced a guide on good practices for the analysis and implementation of kerb space allocation schemes, based on a framework and toolbox for achieving this. It addresses loading/unloading as well as other kerb space functions and considers space, time and pricing approaches (Institute of Transportation Engineers, 2018).

A toolkit has produced by another organisation aimed at improving the design and management of the kerbside for its various vehicle stopping and parking uses including car parking, bus stops, loading/unloading, drop-off and pick-ups, taxi and ride-hailing services, bicycle and motorbike parking and bus/coach parking and waiting areas drew on international knowledge and experience. It sought to reduce conflicts between vehicle uses and improve city liveability and ease parking demand. It provides principles and steps by which this can be achieved (Barter, 2016).

An American guide for urban authorities seeking to implement a kerb management framework suggests the following seven steps (Mancini Nichols and Dorsett, 2022):

1. Set kerbside goals and functions – use existing strategy, policy initiatives, and stakeholder engagement to set goals and then devise functions for kerb use (as discussed above in relation to Seattle and San Francisco).

2. Identify and categorise different land use types (as discussed above in relation to Seattle and San Francisco) and then use kerb functions and land use types to determine priorities.

3. Create a digital kerb inventory – this inventory provides the tool by which to understand kerb space availability, regulation and use. This inventory can then be used to visualise, analyse and modify kerb strategies and regulations.

4. Understand kerb use – by different types of user and by time of day. Traditional means of kerb use data collection such as observational surveys can be supplemented with video surveys, parking meter data and electronic sources of data provided by taxi, ride-hailing and freight transport companies.

5. Define your strategy – once kerb goals, priorities, and data are in place, it is then possible to analyse and define strategies for kerb allocation for different transport users.

6. Launch a pilot program – this will allow strategies to be tested in the real-world with stakeholder interaction and feedback.

7. Develop a user-friendly guide – detail the strategy, design and review processes for kerb management together with user information and guidance in an easy-to-read guide.

10.4 Recent work in the UK on kerbside management

The Department for Transport commissioned an unpublished study by Urban Movement in 2019 entitled 'Future Streets: Designing and Managing the Kerbside' which was intended to study existing and future use of the kerbside and develop a kerbside access strategy. This study proposed a four-step process for developing "a rational Kerbside Access Strategy for any given street" which "could also be used as a structure for developing authority-wide kerbside strategies." This is summarised in **Table 10.3**.

Table 10.3: Four step approach to developing a kerbside strategy

Step	Explanation of step	Objective
1.	Consider needs and wants of different user groups to occupy kerbside and time required.	To provide basic framework for understanding different types of demand that exist, and how they may compete.
2.	Calculate kerb-space requirements for different users/uses (e.g. number and length of bus stop cages; number and length of loading bays; width of pedestrian crossings).	To provide much greater level of applied research to kerb-space requirements informed by detailed data-collection. Existing and emerging sensor and AI technologies can support this.
3.	Determine local priorities, in order to guide decisions on allocating space to different users/uses in the light of Steps 1 and 2 and of considerations of the street's role as place.	The challenge of prioritising kerbside access. Even in rare cases supply of kerb-space exceeds demand, questions remain about where different kerbside acts should take place, how 'spare' space should be used etc.
4.	Consider opportunities for designating the same stretch of kerbside to different users/uses at different times of day or days of the week.	To consider opportunities to use a given amount of kerb-space more efficiently by allocating certain sections for different uses at different times.

Source: summarised from reporting of unpublished 2019 study in Urban Movement, 2022.

The unpublished 2019 study also suggested the use of 'Kerbside Mapping', a tool "intended to enable clearer thinking about the use of space in specific streets or small areas, but which could also help authorities develop their wider kerbside strategies. Kerbside Mapping is a simple exercise to help practitioners understand how a finite amount of kerb-space might best be used. It can be undertaken following Steps 1 and 2 of the Kerbside Access Strategy and can be used to test optional scenarios at Steps 3 and 4. Such an exercise should be considered an essential process in flushing out the chief supply and demand issues for any given street" (reported on in Urban Movement, 2022).

As part of the EU-funded MORE research project, UCL has developed two tools to generate options to redesign urban streets. One tool generates options to redesign, reallocate, or regulate streetspace to meet specific priorities for street users and economic, social, and environmental objectives with 210 options available. The other tool generates street designs based on user priorities and feasibility checks of all possible combinations of design elements that fit into the available space. The tools were trialled in five European cities (Lisbon, London, Malmo, Constanta, Budapest) and the work in developing them received input from stakeholders representing pedestrians, cyclists, public transport operators, and the freight transport industry (MORE, 2022). A book version of the tool is also available, where all of the 210 potential solutions are described. Most of these solutions refer to pedestrians, cyclists, buses, cars and place-based activities but a few refer to goods vehicles (Anciaes, 2022).

In 2022, the Department for Transport also commissioned a study entitled 'Provision of Kerbside Management Discovery' which is being carried out by Deloitte with an expected completion date of 2023. This work is intended to carry out user-focused research "into the as-is, painpoints, and opportunities for the digitisation and re-purposing of the kerbside to support active travel/new forms of mobility and freight distribution/EVs/CAVs, and to consider the constraints of the current regulatory framework (TROs, traffic signing etc.)." The reporting is expected to provide, "expert recommendations for improved management are required reflecting both current and future kerbside needs, clearly identifying the role for local and central government" (Department for Transport, 2022d). This user research has tested five hypotheses (reported on in Urban Movement, 2022): "(1) A shared, formal definition for managing access to the kerbside does not exist and is required, (2) There is a role for both local and central government and a requirement for a more proactive posture in addressing unmet user needs at the kerbside, (3) Digitisation, data integration and interoperability are key enablers in addressing unmet user needs in the short-term, (4) Users and the wider public will accept the role of digital services in the governance of their access to the kerbside, (5) There is a need for a change agent in order for local authorities to adopt new ideas and ways of doing things at the kerbside…Hypotheses 1-3 and 5 were found to be proven, with no.4 found to be partially proven." The lack of substantial evidence to support hypothesis 4, "points towards public acceptance of automating access to streets and to the kerbside being one of the most difficult yet important hurdles to overcome, if the goals relating to that access (e.g. greater efficiency, safety and fairness) are to be achieved" (reported on in Urban Movement, 2022).

A recent study of kerbside management in the UK has suggested that in its forthcoming guidance on Local Transport Plans (LTPs) the Department for Transport should make a requirement for a street or kerbside management strategy. It has also recommended that Local Authorities "need to develop, assert and clearly communicate a sense of their true ownership of street and kerb space and of the common value associated with that property" with this requiring such authorities to adopt "a properly business-like approach to the care and management of a public good" (Urban Movement, 2022).

10.5 The movement and place functions of freight transport

The street / land use type categorisation and kerb space function categorisation schemes in London, Seattle and San Francisco discussed in **section 10.3** help to provide urban authorities with a consistent approach to considerations about the prioritisation and allocation of kerb space that can be based on the views and experiences of various stakeholder groups. Even though UK cities may differ considerably from Seattle and San Francisco in terms of street layouts, carriageway and footway widths, types of industry present and the extent to which zoning has been applied to land use planning, it is the existence of consistent methods for addressing kerb space allocation considerations that matters. However, given its importance to many movement and place functions and the extent to which the demand for kerb space exceeds supply, decisions about how to prioritise and allocate kerb space will remain contentious regardless of the quality of the data and the consistency of the framework used.

The ‘place’ functions of streets include a wide range of activities associated with living, working, socialising, relaxing. This includes the provision of goods and services (from places including shops, restaurants, cafes, bars, entertainment and leisure venues, clinics, surgeries, hospitals, and offices) that support and contribute to the urban economy and the quality of life of urban residents, workers and visitors. Freight transport operations are essential to the provision of goods and services to and from these places as well as direct to residential homes. As a freight industry representative stated in a seminar about freight transport and its kerbside requirements, you cannot have a café culture without coffee and croissants being able to be delivered (Chapman, 2021). One of the place functions of the kerbside is as a place of work for freight transport operators making deliveries and collections and providing services. Freight transport vehicles are also a key user of the movement function of streets, in the journeys that these vehicles need to make in order to provides these goods and services that facilitate and support urban life.

11. Concluding remarks on active travel, car use and freight transport in urban areas

11.1 Active travel and car use

In 2020 the UK Government commissioned market research into public attitudes to traffic and road use in England. **Table 11.1** shows the views of respondents on whether government should act in local areas to increase road safety, improve air quality, and reduce traffic congestion and traffic noise. The survey results show that respondents strongly supported such action with 88% agreeing or strongly agreeing that government should act to increase road safety, and similar support for improving air quality (86%), reducing traffic congestion (83%) and reducing traffic noise (75%).

Table 11.1: Respondents' views in 2020 on whether the government should act in local areas in England to… (proportion of respondents)

Topic	Strongly agree	Agree	Disagree	Strongly disagree	Total
Increase road safety	40%	48%	5%	8%	100%
Improve air quality	39%	47%	6%	9%	100%
Reduce traffic congestion	35%	49%	8%	10%	100%
Reduce traffic noise	25%	50%	13%	3%	100%

Source:, Kantar, 2020.

This same survey found that a large majority of respondents supported the reduction of road traffic both in towns and cities in general and in their own local area (see **Table. 11.2**).

Table 11.2: The extent to which respondents support or oppose the reduction of road traffic in towns and cities in England (proportion of respondents)

Topic	Strongly support	Tend to support	Tend to oppose	Strongly oppose	Total
In towns and cities in England	28%	49%	10%	4%	100%
In my local area / neighbourhood	29%	49%	10%	3%	100%

Source:, Kantar, 2020.

This survey also investigated respondents' views on their support or not for the reallocation of road space for walking and cycling both in towns and cities in general and in their own local area (see **Table. 11.3**).

Table 11.3: The extent to which respondents support or oppose reallocating road space to walking and cycling in England (proportion of respondents)

Topic	Strongly support	Tend to support	Tend to oppose	Strongly oppose	Total
In towns and cities in England	27%	39%	15%	7%	100%
In my local area / neighbourhood	26%	39%	15%	8%	100%

Source:, Kantar, 2020.

Despite the views expressed in the above survey work, there is no evidence of the uptake of walking and uptake active travel in the last fifteen years. However, cycling has increased. **Table 11.3** provides data for active travel (bus, cycling and walking) as well as car use from the National Travel Survey for the personal travel of private households[1] who live in urban areas in England (i.e. towns and cities with a population of 10,000 or more people). This data indicates that, on average, people living in urban areas reduced the total distance walked and their use of buses and cars for personal travel while increasing their cycling in England over the period from 2004 to 2019, but cycling has increased from a low very base of, on average, 46 miles per person per annum in 2004 (i.e. less than 1 mile per person per week). However, in the most recent five year period from 2014-2019, when active travel has been most greatly promoted and invested in by national and urban government, on average, both cycling (-1%) and the use of buses (-15%) decreased per person. Also, walking, cycling and bus use failed to increase their share of all road passenger travel between 2004 and 2019 (with car remaining by far the dominant mode, accounting for approximately 80% of miles travelled per person in urban areas).

Table 11.3: Average annual distance travelled per person by mode of those residing in urban areas in England

Mode	2019 (miles travelled)	% of all road passenger travel		Miles travelled by mode (% change)			
		2004	2019	2004-2009	2009-2014	2014-2019	2004-2019
Walk	223	3%	3%	-6%	-7%	9%	-12%
Bicycle	60	1%	1%	16%	12%	-1%	29%
Bus	344	6%	5%	-7%	0%	-15%	-7%
Car	5,395	84%	80%	-8%	-2%	-2%	-10%

Notes:
Bus includes local bus, non-local bus, private hire bus and school bus.
Car includes both as driver and passenger in car or taxi/minicab.
Source: calculated from data in Department for Transport, 2021n.

[1] This National Travel Survey data reflects the personal travel of these households (i.e. travel for private purposes or for work or education, provided the main reason for the trip is for the traveller to reach the destination (trips made in the course of work are included provided that the purpose of the trip is for the traveller to reach a destination - travel to deliver goods, or to convey a vehicle or passengers are excluded). It also excludes people not living in households, such as students in halls of residence and tourists.

Table 11.4 provides this same National Travel Survey data for those living in all settlements in England (i.e. including rural areas). This shows that bus use has declined even more steeply in England when those living in rural areas are also taken in to account and that the relative modal split of car use has hardly changed.

Table 11.4: Average annual distance travelled per person by mode in England (including urban and rural areas)

Mode	2019 (miles travelled)	% of all road passenger travel		Miles travelled by mode (% change)			
		2004	2019	2004-2009	2009-2014	2014-2019	2004-2019
Walk	305	5%	5%	-5%	-9%	4%	-9%
Bicycle	54	1%	1%	16%	21%	-6%	32%
Bus	378	7%	6%	0%	-10%	-13%	-21%
Car	5,069	86%	87%	-7%	-4%	-1%	-11%

Notes:
Bus includes local bus, non-local bus, private hire bus and school bus.
Car includes both as driver and passenger in car or taxi/minicab.
Source: calculated from data in Department for Transport, 2021n.

Government data also shows that, in England, 21% of people aged 16 and over spent no time walking and 84% spent no time cycling in 2018-19 (see **Table 11.5**).

Table 11.5: Usual time spent by people in England cycling and walking per day in 2018/19

Usual minutes spent per day doing activity	Walking	Cycling
No activity	21%	84%
1 to 29 minutes	6%	2%
30 to 59 minutes	21%	4%
60 to 89 minutes	24%	4%
90 to 119 minutes	8%	1%
120 or more minutes	19%	5%

Notes:
Those aged 16 and over
November 2018-November 2019.
Walking refers to any continuous walk of over 10 minutes, irrespective of purpose.
Cycling refers to any cycling, irrespective of length or purpose.
Source: Department for Transport, 2021o.

Table 11.6 shows the total distance travelled by bicycles, buses, cars and HGVs and HGVs on urban and national roads in Britain in 2019, as well as the change in this total distance since 2009. Unlike the National Travel Survey data presented above, this includes travel by all people (i.e. including those not living in private households, visitors and tourists) and travel in the course of work (i.e. by those delivering and collecting goods and conveying passengers). Also, rather than providing annual travel on a per person (as the National Travel Survey does) it includes all travel on roads so includes the effects of population growth. This data shows that while bus traffic reduced by 19% on urban roads between 2009 and 2019, bicycle and car traffic has increased by 8%. This pattern is also reflected on all roads in England. This indicates increasing bicycle use and reducing bus activity together with increasing car use in urban areas over this period during which time the UK national and urban governments have been promoting active travel and attempting to discourage the use of cars.

While LGV traffic can be seen to be growing faster than all other vehicle modes both at the urban level and nationally since 2009, HGV traffic on urban roads fell by 10% between 2009 and 2019 and grew far less than LGV, car and bicycle traffic nationally.

Table 11.6: Change in road traffic by vehicle type and road type in Britain

Mode	2019 (total miles)	2009-2014 (% change)	2014-2019 (% change)	2009-2019 (% change)
Bicycle:				
Urban roads	2.5 billion	3%	9%	12%
All roads	3.5 billion	16%	0%	16%
Bus and coach:				
Urban roads	2.1 billion	-4%	-16%	-19%
All roads	2.4 billion	-6%	-14%	-23%
Car:				
Urban roads	147.8 billion	2%	6%	8%
All roads	278.2 billion	4%	8%	14%
LGV:				
Urban roads	23.6 billion	15%	10%	26%
All roads	55.5 billion	14%	19%	36%
HGV:				
Urban roads	3.5 billion	-2%	-8%	-10%
All roads	17.4 billion	-1%	7%	7%

Source: calculated from data in Department for Transport, 2021j, 2021p; 2021q.

As discussed in **section 6.2**, the total number of cars licensed in Britain as well as the cars per head of population has been continuously rising over recent years with it rising even more strongly during the Covid-19 pandemic (Department for Transport, 2021i). Given that cars are only driven for approximately 4-5% of the time and parked for the other 95-96% and that (Nagler, 2021) and that 25-35% of UK households are estimated not to have off-street car parking facilities and even more in urban areas (Cliff, 2020; Department for Transport, 2021g; Jennings et al., 2018; Nagler, 2021; Wills, 2020),the demand for kerbside parking space for these cars is greater than ever.

If 30% of the 31.1 million cars licensed in the UK in 2020 are assumed to not have off-street parking facilities and they spend 95% of their time parked (Department for Transport, 2021h; Nagler, 2021), then 9.3 million of the 31.1 million cars licensed in the UK in 2020 require on-street parking space. If it is assumed that these vehicles have an average length of 4.3 metres and are parked for 95% of the time, this equates to a requirement of approximately 31,700 km of kerbside parking space at any given time. This is equivalent to approximately 10% of the distance from the Earth to the Moon, or about 6 times the distance from London to New York.

As well as the number of cars licensed in the UK increasing over time, cars have, on average, become longer over time. If it is assumed that the 30 million cars licensed in the UK in 2000 had an average length of 4.0 metres (which is 7% shorter than the 4.3 metres now), and that 25% were parked on street (the same as in 2019) (Nagler, 2021), these cars would have required approximately 28,500 kilometres of kerbside parking space at any given time in 2000. This indicates that the kerbside length required to park cars at the kerbside in the UK was approximately 10% greater now than in 2000. This provides another indication that car-dependence and its impact of the kerbside is worsening rather than diminishing, despite the efforts of national and local government.

11.2 Potential impacts of active travel and place-based policy priorities on freight transport

As previously discussed (see **sections 6-8 and 10**), national and urban policy makers in the UK have tended to lack expertise and knowledge about urban freight transport operations and their kerbside needs. This has led to them often failing to reflect the economic and social importance of the role of urban freight transport in maintaining prosperous and competitive towns and cities, which offer the liveability and quality of life sought by residents and visitors. This lack of understanding and insight results in the omission of the kerbside requirements of urban freight transport in their urban transport and wider strategies, legislation, in the guidance documents issued by policy makers and professional bodies to be used by transport planners, town planners and urban designers, and in urban authorities' management of the kerbside with respect to freight. **Table 11.1** provides a summary of urban freight's importance and its kerbside requirements, drawing on the findings on urban freight surveys (see **section 5**).

Policy makers advocating active travel and the place-based function of streets have given little consideration to the impacts of policies associated with them on urban freight transport operations (see **sections 3 and 4**). **Table 11.2** provides an indicative assessment of the potential impact of active travel and place-based street function strategies and their associated policies developed by national and local government in the UK on urban freight transport journeys and kerbside loading/unloading activities.

In their policy making paradigm shift from a car oriented urban society to one focused on these new objectives, when consideration is occasionally given to goods vehicles they are viewed in a similar light to cars – as a source of pollution, greenhouse gas emissions, noise and disturbance, and danger to other road users and the general public. Therefore, these national and local policy makers have advocated the need for urban freight transport to become more efficient, without investigating its current rate of efficiency. They have proposed that this efficiency improvement can be achieved through the three approaches of improved vehicle load consolidation, retiming of deliveries and collections and the use of cargo cycles without addressing or resolving the difficulties and limitations associated with achieving each (see **section 7**). **Table 11.3** provides an indicative assessment of the barriers and challenges to these three methods put forward by UK national and local government as means by which urban freight transport efficiency can be improved.

An example of these policy maker limitations with respect to urban freight transport is provided by the example of a strategy document produced by the City of Westminster. Published in 2021, its 'Freight, Servicing and Deliveries Strategy and Action Plan is the most detailed such plan so far published by an urban authority concerning sustainability and freight transport. It sets the following three targets: i) the absolute numbers of freight, servicing and delivery vehicles in Westminster will be reduced by 80% by 2040, ii) all trips made by freight, servicing and delivery vehicles in Westminster will be zero emission by 2040, and iii) working towards the Vision Zero target to eradicate all freight, servicing and delivery vehicle related killed and serious injury (KSI) collisions by 2041 (Westminster City Council, 2021e).

The Plan does not explain the rationale for selecting an 80% reduction in freight vehicle operations in Westminster by 2040 or the economic and social effects that this may have but it has done so as part of the City Council's net zero commitments.

This Action Plan contains 55 measures intended to achieve these targets. Retiming of freight transport operations, increasing load consolidation and the use of cargo bikes are cited as important means by which to make urban freight more efficient is being deployed in the Plan. Six of its measures refer to the need for delivery/collection retiming, while two measures focus on improving vehicle load consolidation (one by requiring new developments to achieve "freight consolidation to reduce trips" and another involving a trial and promotion of joint procurement initiatives which would include "coordinated and area-wide consolidation". Four of the measures refer to the use of cargo bikes.

The Action Plan also includes three measures concerned with pre-bookable freight loading/unloading space at the kerbside (see **section 9.1**). One of these measures involves "Bookable parcel delivery sector kerbside slots" (it is unclear why this is advocated for multi-drop parcel deliveries but not for other types of goods delivery to which it may be more suited such as heavy/bulky loads destined for a single building such a pub or construction site), another measure to "Engage with Central Government, Transport for London (TfL) and others on the potential for road pricing/user charging to facilitate pre-booked delivery slots; encouraging consolidation, remoding and retiming, accompanied by other measures such as reviewing the London Lorry Control Scheme and promoting the use of rail and the river and canal for freight" and another measure to "Assess the potential use of technology to dynamically manage infrastructure and availability of loading/unloading bays and EV recharging infrastructure".

Six of the 55 measures in the City of Westminster Action Plan refer to the kerbside management. One measure is concerned with the need to, "recognise and accommodate the specific kerbside access needs of specialised operations, such as brewery logistics". Another addresses the monitoring of use of loading bays by all goods vehicles to better understand their use, but in order to "target enforcement to reduce misuse". Another is focused on identifying kerbside locations "where goods vehicle and vulnerable road user conflict is evident", and working to reduce these risks. A fourth measure will "review current operation of shared use loading/unloading bays and trial new schemes" based on vehicle type and time options, in designated locations, while a fifth is focused on, "bookable parcel delivery sector kerbside slots". The sixth measure involves the assessment of, "the potential for electric vehicle (EV) fast charging to be made available in loading/unloading bays". The kerb management measures provided in the Westminster Action Plan do not commence this work by reviewing the present kerbside use and requirements of all goods vehicles, and the provision of kerbside space and its location to determine its current adequacy and impacts. The Westminster Plan identifies landowners, property developers and occupiers of buildings who receive and send goods as important stakeholders in efforts to reduce freight vehicle journeys.

Together with the Plan, a Sustainable City Charter has also been published by Westminster City Council and Westminster Property Association (WPA) which is intended to formalise these efforts by the public and private sector to reduce the energy demand of buildings and their operations on carbon emissions. Various businesses with substantial property in Westminster have already voluntarily signed up to the Charter including The Crown Estate, Grosvenor, Howard de Walden, Capco, Portman Estate, Derwent London, Shaftesbury, the Pollen Estate, Landsec and multiple Business Improvement Districts (BIDs). The seven areas targeted by the Charter are: (i) freight and waste consolidation, (ii) encouragement of the use of zero emission vehicles, (iii) sustainable procurement taking account of GHG emissions in ordering goods and services, (iv) energy use in buildings through energy efficiency and energy saving measures, (i) reducing waste and improving waste management, (vi) improving air quality through sustainable workplace travel, (vii) data transparency and dissemination of the progress made. The Westminster Plan and Charter identifies landowners, property developers and occupiers of buildings who receive and send goods in addition to freight transport operators as important stakeholders in efforts to reduce freight vehicle journeys (Westminster City Council and Westminster Property Association, 2021).

Joint working between policy makers and freight transport operators and the trade associations that represent the industry in the form of discussions and meetings, rather than simply formal consultation processes has an important role to play in better accommodating the needs of these vehicles at the kerbside and in avoiding unintended operational impacts of new streetscape projects.

There is also a need for policy makers to become more familiar with the rapidly growing forms of urban freight transport associated with online shopping for groceries, meals and non-food packages and parcels. These are generating new vehicle movements and kerbside demand that replace passenger shopping journeys and, in some cases, create goods movements that never previously existed. These journeys are carried out by a wide range of vehicle types including bicycles, mopeds, scooters, motorcycles, cars and vans and, in some cases, are resulting in substantial trip generation rates that have traffic, environmental, noise and safety implications for residents living in the proximity of where they originate (see **section 5**).

Table 11.1: The importance and kerbside requirements of urban freight transport and related considerations

Topic	Comments
Importance of freight transport	• Provides goods and services that are required by businesses and residents • Provides these at the time, place, quantity and price required • Supports urban economic prosperity, liveability, quality of life
What freight transport requires in terms of kerb provision	• Adequate quantity of kerb space in suitable locations • Permission to use this kerb space in accordance with the time requirements of receivers • Permission to dwell at the kerbside for a period of time that matches the profile of the delivery/collection being made • Standardisation in kerbside space and time provision across different urban locations
What survey results tell us about the kerbside requirements of urban freight transport	• The vast majority of vehicles collecting and delivering goods in urban areas have to carry out loading/unloading on-street due to the lack of off-street facilities at the receiver's premises (be it a business or a residential home). • In inner urban and city centre location 90% or more of these deliveries and collections to businesses have to take place with the vehicle on-street at the kerbside. In outer urban areas, approximately three-quarters of deliveries and collections require use of the kerbside. • Virtually all goods delivered to residential addresses require use of the kerbside for loading/unloading as, even when flats have private off-street parking, use of this land by goods and service vehicles is typically not permitted. • Results from four high street surveys in London in 2015 (the most detailed ever carried out in the UK) showed that: - Goods vehicles accounted for 6-7% of all vehicle stops in three of the high streets and for 3% of all vehicle stops in the other. - These goods vehicles that were loading/unloading accounted for 6-11% of total time spent at the kerbside by all vehicles for all stopping purposes. - The rest of vehicle time spent at the kerbside was accounted for by (in order of importance: parking 77-85% of total kerbside time, drop-off and pick-up including buses (5-8%), and vehicle waiting (1-5%). - The high street surveys found that the provision of time and space for loading/unloading was inadequate and its location unsuitable on two of the four high streets. This resulted in illegal loading activity.
Important considerations	• Kerbside survey work can help identify whether the current quantity, timings and location of kerbside provision for loading/unloading is adequate and satisfactory or not. • Collaboration (discussions and meetings) with freight transport operators and industry representatives can provide planners and designers with insight into kerbside loading/unloading requirements. • Car parking is currently by far the greatest transport user of kerbside space and time. • Reducing kerbside car parking would free up this space for goods vehicle collections and deliveries, and the active travel and place functions of streets promoted by national and urban government. • Vehicles used to provide importance services to businesses and residents are currently treated in exactly the same way at the kerbside as cars despite their greater economic and social importance.

Table 11.2: Indicative assessment of impact of active travel and place-based street function strategies of UK national and local government on freight transport journeys and kerbside loading/unloading

Topic	Implications and comments
National / urban Government strategic objectives	• Reduce car dependence • increase active travel • improve and promote place functions of streets • increase efficiency of urban freight transport operations
National / urban Government policy actions for vehicle journeys	• Electric vehicle and cargo cycle grants • Prioritisation of desired vehicle types (buses, cycles, walking) in road traffic legislation, street design schemes, traffic light priority, fossil fuel taxation etc.
National / urban Government policy actions at kerbside	• Bus lanes • Cycle lanes • Bike and e-scooter docking stations and cycle parking • EV charging devices and charging spaces • Car Clubs and parking bays • Parklets / pocket parks • On-street dining • Low Traffic Neighbourhoods and modal filters • Pedestrianisation, low traffic streets and Mini-Hollands • Major streetscape schemes • Red Routes
Impacts on urban freight transport vehicle journeys	• Lack of modal shift options unlike passenger transport – only cargo cycles available and they are unsuited to many freight operations/product types – so they only have the capacity to carry a very small proportion of urban freight by weight/volume • Longer, less reliable, more expensive delivery/collection journeys by motorised goods vehicles (LGVs and HGVs)
Impacts on urban freight transport kerbside loading/unloading for deliveries and collections	• Reduction in total loading/unloading space/time at kerbside • Increase in proportion of loading/unloading kerbside space/time in dedicated bays rather than on yellow lines • Location / quantity of dedicated loading bays sometimes not in line with receivers/freight operators needs • Lack of provision of kerbside space for vehicles used to provide service activities (rather than goods delivery/collection – simply treated in the same way as car parking - despite its greater importance than car travel/parking) • Freight is important part of place function of streets but not acknowledged in government strategy

Table 11.3: Indicative assessment of barriers and challenges associated with approaches to achieving greater urban freight transport efficiency promoted by national and local government strategy in the UK

Proposed urban freight measure	Barriers and challenges
Consolidation of vehicle loads	• Physical Urban Consolidation Centres: - lack of business case development by policy makers (to ensure sufficient goods throughput to meet operating costs) - lack of financial support for capital costs of site acquisition and fitout - lack of work by policy makers to resolve allocation of costs and benefits between user groups to encourage participation - if misapplied could result in deterioration in load consolidation in some supply chains (as only likely to result in improved load consolidation for specific products / in specific supply chains) - requirements to use physical UCCs could negatively affect the efficiency and operating costs of existing delivery/collection operations • Vehicle load consolidation within existing supply chains: - much consolidation already takes place within companies' logistics operations but unrecognised by policy makers - no attempt by government to quantify current level of load consolidation in urban freight operations and how much this could be increased by - lack of work by government to address legal and organisational barriers including competition law and commercial sensitivity about data sharing
Delivery/collection retiming	• Lack of work by policy makers to resolve existing tensions and barriers to retiming: - Planning and environmental health conditions imposed on times at which some sites can receive vehicle deliveries and collections (due to past/existing noise and disturbance concerns) - Approval system for technologies and practices that are suitably quiet to prevent disturbance - Means for ensuring costs and benefits are fairly allocated between supply chain partners • Existing urban regulations that can prevent delivery/ collection retiming including: - Kerbside time restrictions on kerbside loading/unloading - Vehicle entry time restrictions in some locations (such as pedestrianised areas) - London Lorry Control Scheme
Mode shift - use of cargo bikes	• Limited application to products (lighter/smaller products only) • Limited application to geography (city centre/inner city – not outer /suburban locations) • Many cycles lanes not designed to accommodate width of cargo cycles and hence safety considerations • Lack of affordable space for logistics hubs where goods can be transferred onto cargo cycles and where they can be stored and recharged overnight

The kerbside is becoming an ever-more contested space and it is clearly not possible to meet all of the requirements of urban freight transport, other road users or place-based functions. However, in drawing up freight transport sustainability strategies, and determining road and kerb space allocation and management approaches, it is essential that urban authority transport and town planners and designers take into account the movement and function requirements and importance of freight transport operations. Urban authorities should:

- Develop kerbside strategies taking account of all stakeholder’s needs and views
- Carry out regular reviews of existing kerbside provision for freight transport (suitability of quantity, location and vehicle dwell time) in serving buildings (retail, commercial, public sector and residential) on streets in their domain
- Engage with and develop working relationships with freight transport industry through regular conversations and meetings to fully understand these operations and kerbside needs
- Better incorporate freight kerbside needs into space allocation hierarchies and streetscape designs

National/local government also need to reform planning policy to ensure landlords and building occupants implement infrastructure and operations to reduce freight use of kerb space and time. This approach would help to avoid unnecessary vehicle km and related emissions impacts as well as negative local business impacts. Such efforts by urban authorities are especially important given the scale of urban development and renewal and the rate of change in retail and commercial land use that is taking place in many towns and cities.

12. Recommendations

12.1 Kerb space prioritisation and allocation in urban areas

The kerbside has long been a contentious and much sought after resource in urban areas in the UK. Traditionally, this has involved competition between car parking, waiting and parking space for other vehicles, drop off and pick up by car and other vehicles and loading/unloading activity by goods vehicles. Demand for kerbside space is growing in the UK as the movement and place functions associated with it increase, driven by the promotion of active travel (bus, cycling and walking) and other place-related uses by UK government and urban authorities. Much space is being reallocated to these other uses and, according to publications by national and urban governmental bodies, this is set to continue. This growing competition for kerb space is not unique to the UK and can be observed in many other countries.

Reconciling these competing demands for kerb space is therefore becoming increasingly challenging for national and urban policy makers in the UK. This is not helped by the lack of knowledge about kerbside space, its use and the restrictions imposed on it these among local authorities responsible for towns and cities and the allocation of kerb space therein. These local authorities typically have inadequate data collection and metrics to understand how well kerb space is used and how its allocation could be changed to improve its efficient use.

Recommendation: There is a need for the development of national strategy by the Department for Transport that sets out a vision for the future use of the kerbside that includes freight transport operations. This strategy needs to reflect both: (i) the typology of streets based on their primary movement and place functions and (ii) a hierarchy of use for the kerbside on these various street types that reflects freight transport loading/unloading, alongside other uses of the kerbside, according to the land use on the street and its surrounding area.

Recommendation: City and other urban highway authorities need to be guided by this national strategy in their development of kerbside management plans that reflect the typology of streets and a hierarchy of priorities for movement and place functions in these street types according to land use. These kerbside management plans should be developed based on an understanding of street use and in collaboration with stakeholders that represent these uses. Kerbside management planning could be made a requirement of Local Transport Plans (LTPs).

Recommendation: National government should also make available a suitable assessment methodology and metrics for reviewing the current use of the kerbside in any given location and whether the existing supply of kerbside space and time is adequate for these uses. This standardised methodology can then be used by local authorities to carry out such assessments, especially on roads that generate substantial delivery and collection activity such as high streets with numerous retail outlets. Survey approaches already exist (as reviewed in section 5) that should be reviewed and adapted by national government in devising a standardised methodology that is robust and cost-effective.

Recommendation: Policy makers in local authorities need to ensure that they collect the data required to understand kerb space supply, the restrictions that apply to it and it current usage for different purposes in accordance with this assessment methodology.

Recommendation: Drawing on this national guidance, these policy makers in local authorities also need to adopt suitable metrics that allow them to understand whether or not and the extent to which the demand for kerb space for these various purposes

exceeds its supply by time of day, by specific location and in total on any given street or area.

Recommendation: Policy makers in local authorities should engage with and develop working relationships with the freight transport industry to better understand their kerb space and timing requirements through regular meetings and discussions (see recommendations below on 'collaboration and joint working between policy makers and industry').

Recommendation: Policy makers in local authorities should use and apply the framework provided in the national guidance called for in this report to draw up a kerb management plan for their locality that relates kerb space activities and uses to land uses / types of street, taking account of stakeholders needs and views, to streets and areas over which they have jurisdiction for kerb space management in order to prioritise kerb space use.

Recommendation: Policy makers at national and local level should not provide kerb management strategies or plans that are not supported by evidence about current kerb use for freight transport loading and unloading operations.

12.2 Kerb space allocation for freight transport in urban areas

Relatively few urban freight surveys have been carried out into the kerbside space and time needs of freight transport operations. However, the few that do exist indicate that the use of kerbside space and time for freight loading/unloading operations has changed little in recent decades. These operations represent a small proportion of total vehicle stops at the kerbside (between 3-7% on London high streets surveyed in recent years) and of total time spent by all vehicles at the kerbside (approximately 5-10% in these same high street surveys). These surveys indicate that the freight transport needs for kerbside use are relatively modest given the essential nature of these activities providing goods to businesses and individuals. In many streets and locations that generate considerable loading/unloading activity at the kerbside there is currently little understanding among policy makers in local authorities of how much loading/unloading space is required, where it is required, when it is required and the extent to which the existing provision of kerbside loading/unloading meets these demands. This is despite both national and urban government strategies and guidance referring to the importance of survey work to understand the suitability of kerbside provision for freight transport.

Recommendation: Urban kerb space surveys should be resourced and carried out on a recurring basis in locations that generate considerable amounts of on-street loading/unloading to provide policy makers with better understanding of freight transport needs in relation to those of other vehicles stopping at the kerbside (both in terms of the quantity, location and dwell time of space required). This will provide evidence of freight transport kerbside needs in different types of street setting and in various towns and cities.

Recommendation: Research should be commissioned into the freight transport trip generation levels and patterns associated with different types of land use and types of business operation within that land use. The data acquired from this research can be used to develop models and analytical techniques that estimate the kerbside loading/unloading requirements of a given location. The outputs of such models and techniques should be compared against survey results to verify their validity. Such models and techniques could help to reduce the costs of better understanding the kerbside loading/unloading requirements of a given location.

The delivery and collection of heavy and/or bulky goods at the kerbside requires that goods vehicles are able to stop adjacent to the building where delivery/collection takes place so that these operations can be carried out safely (both for drivers and other road users and pedestrians) and so that drivers can comply with HSE guidance. In general, the closer that any goods vehicle can stop to the building to which deliveries or collections are to take place, thereby reducing the distance over which goods have to be conveyed between the vehicle and the building, reduces the risk of harm to freight personnel, pedestrians, cyclists and other road users.

Recommendation: Urban kerb space surveys of streets that generate considerable kerbside stopping activity, should pay particular attention to the location where loading/unloading activity that involves heavy and/or bulky goods takes place and the activity patterns and needs of this specific type of loading/unloading activity.

Recommendation: Having carried out such urban freight surveys, local policy makers should review the adequacy of existing kerbside provision for loading/unloading for freight transport operations, and make changes accordingly, where possible, in instances in which the supply of kerbside time or space does not meet demand. This includes considerable of both freight demand across the surveyed street or area as a whole, as well as in relation to specific sections of street where buildings exist that receive regular deliveries and/or collection of heavy and bulky goods.

The traditional arrangements in the UK of using yellow lines not subject to loading restrictions for loading/unloading is more flexible for goods vehicle operations than the provision of dedicated or shared loading bays. However, the latter has become more common over time in streetspace redesigns in busy urban areas. This approach of allocating dedicated loading space can also result in underutilised kerb space at certain time of day, but sharing loading bays with other kerb functions can result in traffic problems if the space is not available for goods vehicle on their arrival. This shift away from using yellow lines for loading to dedicated loading bays has been accompanied by a gradual reduction in the quantity of kerb space allocated for loading/unloading, resulting in drivers having to transport goods further from their vehicles to the point of delivery/collection, thereby increasing vehicle dwell times, more interaction with other road users and pedestrians and safety risks. Where kerbside loading bays are provided rather than a yellow line loading regime, international studies have regularly found that they are poorly located for the businesses that goods vehicle have to serve and they are insufficient in terms of capacity provided. The specific design of loading bays is also extremely important in making their use safe, efficient and attractive.

Recommendation: Given that kerbside capacity is finite, where freight demand for the kerbside is not currently wholly met in a given location, the needs of these freight transport operations will need to be carefully balanced against other kerbside uses in accordance with the priority of uses for that location according to the kerbside framework and management plan already drawn up.

Recommendation: Where the total freight demand for kerbside space in any given street cannot be met, thought needs to be given by local authorities to ways in which the kerbside could potentially be shared between freight and other uses at different times of day to increase kerbside capacity for these uses.

Recommendation: However, it is important to bear in mind, that goods vehicles that cannot find kerb space available on arrival may contravene stopping regulations leading to safety and traffic flow issues or may circulate while searching for space to become available adding to traffic. Therefore, efforts to share kerb loading space with

other uses needs to ensure that the space is available solely for loading/unloading at the appropriate times.

Recommendation: In designing kerbside loading bays, consideration should be given to their specific positioning in relation to businesses that they will be used to serve. The length of such bays should be such that they facilitate easy vehicle ingress and egress and ensure that offloading from the back of the vehicle can take place. The width of such loading bays should also be sufficiently wide to ensure the safety of drivers, cyclists and other road users and support side-unloading where required.

Street furniture at the kerbside such as bollards, railings, bins, signposts, post boxes, utilities boxes, benches, cycle and e-scooter docking stations, and cycle and motorcycle parking can deter and hinder loading/unloading activity. It can impede movement by goods vehicles and interfere with the unloading of vehicles, the transfer of goods to the footway surface and their movement using manual handling equipment.

Recommendation: Urban designers should start from a position of having no street furniture and only introduce these elements when they serve a clear function. Where it is necessary, street furniture should not be placed alongside lengths of kerb where loading/unloading is permitted.

12.3 Methods of increasing freight transport efficiency proposed by government

Freight transport is essential to the economic prosperity and liveability of UK settlements, from the largest cities to the smallest hamlets. Loading and unloading by goods vehicles is one of the many activities competing for kerbside space, especially in busy urban areas. Urban freight surveys have shown that in many commercial and retail locations, the vast majority of loading/unloading activity by goods vehicles takes place at the kerbside, due to the lack of available off-street space.

The consideration of the kerbside needs of goods vehicles for loading/unloading activities in urban areas has been something of a blind spot often receiving little, if any, attention in strategy, policy and kerb management plans developed by national, city and local governments in the UK.

Recommendation: The Department for Transport should emphasise the importance of the loading/unloading kerbside needs of goods vehicles in its national strategy and policy for the future of freight transport operations.

Some policy makers responsible for kerb space management, treat freight transport journeys and kerb use for loading/unloading in a similar way and with a similar priority to car use and parking (i.e. viewing it as an activity that imposes negative impacts on society and the environment and which therefore needs to be reduced). However, unlike car use, there are no suitable modal alternatives to the use of road-based goods vehicles (i.e. vans and heavy goods vehicles) for the vast majority of goods collection and delivery work to businesses and residents in urban areas and none are likely to emerge in the near future.

UK national transport policy and the kerbside strategies of some urban authorities are of the view that the use of the kerbside by goods vehicles carrying out collections and deliveries can be made more efficient, and thereby reduce the demand for kerb space and duration, by these vehicles. While there may be some limited scope to improve this efficiency, these vehicle journeys are made to fulfil the deliveries and collections of goods requested by businesses and individuals and their kerbside stops to carry out this loading/unloading is generally conducted as quickly as possible, so that the driver and vehicle can continue to their next location to perform their next job.

UK policy documents and strategies at the national and urban level expect greater freight transport efficiency in the delivery and collection of goods to be achieved. However, policy makers have not quantified the current efficiency level nor the scope that exists for greater efficiency. Notions held by these by policy makers about reducing freight transport demand for the kerbside (through compulsory physical urban consolidation centres, delivery retiming and use of cargo cycles) may succeed at the margins. But previous research into, and trials of, physical consolidation centres serving urban areas have demonstrated the challenges and barriers to their success which, to date, remain complex, numerous and unresolved.

Cargo cycles and on-foot porters have an important role to play, but are limited to the movement of specific types of lightweight, non-bulky goods (such as meals, and some parcels and other lightweight products) and are only likely to prove economic and competitive over relatively short distances from an urban hub to a delivery point in dense, busy central urban locations. They are unsuitable for the movement of many types of freight and for operations in suburban locations and other supply chains in which inter-drop distances are not short. In addition, the use of cargo cycles is not currently covered by same operating regulations as motorised goods vehicles to ensure driver and public safety. In addition, logistics land has becoming increasingly scarce and expensive in central urban areas, and therefore only affordable by the largest retailers and operators. Policy makers have an important role to play in the provision of affordable logistics lands if these sustainable freight modes are to become more commonly used in dense, busy urban centres.

The Cabinet Office, Department for Transport and Transport for London have all commissioned studies and trials and encouraged delivery retiming over the last twenty years, producing guidance documents and protocols. This work has been carried out with the active participation of industry. However, this has led to few changes in existing planning and environmental health conditions that prevent it from taking place at specific sites. In addition, government has not carried out or supported the research needed to develop and validate technologies and practices that are deemed suitably quiet so as not to cause disturbance. M any additional business barriers exist to the implementation of delivery retiming. Therefore, while an attractive proposition, achieving efficiency gains in freight transport through delivery retiming and the reductions in kerbside space needed for loading and unloading during peak hours is difficult to achieve in practice.

The vast majority of delivery and collections of goods in urban areas in the coming years are likely to continue to be made during working hours, direct from company warehouses and depots to point of delivery/collection, in vans and lorries, albeit ones that are not diesel powered.

Recommendation: Policy makers at the national and local levels should not state in policy documents that freight journeys and kerbside use can be made more efficient through the use of practices including physical urban consolidation centres and retiming of these activities unless these views are supported by evidence and the means by which outstanding challenges to their successful operation are provided.

Recommendation: Policy makers should focus consolidation efforts on what can be achieved through company collaboration rather than through physical urban consolidation centre schemes as there is little evidence that they can be operated cost-effectively in the long term (see section and recommendations on 'Collaboration and joint working between policy makers and industry' below).

Recommendation: Policy makers at the national and local levels should not state in policy documents that freight journeys and kerbside use by goods vehicles can be replaced by cargo cycles and on-foot porters without clarifying which types of goods movements and urban locations these modes are viable for, the proportion of all urban freight activity that this represents and providing evidence of the means by which the land requirements for logistics hubs that support these modes can be providing at affordable prices.

Recommendation: Local authorities should work with property owners and developers to consider the potential for vacant commercial space in dense urban areas to be used to provide logistics hubs that support last-mile deliveries by cargo bike and on-foot porters

Recommendation: Local authorities should consider the extent to, and ways in, which they can support kerbside and off-street space provision for mobile logistics hubs (such as mobile adapted vehicle trailers) and for more permanent buildings (such as and former public car parks) from which last-mile deliveries by cargo cycles and on-foot porters can be carried out to help facilitate these delivery methods in dense urban areas.

Recommendation: Policy makers should consider the ways in which they can support and assist with the costs of operating logistics hubs among service providers that could not otherwise afford to use such facilities (and cannot therefore make use of cargo cycles and on-foot porters for last-mile deliveries). This includes working with freight transport companies and local businesses to find workable solutions.

Recommendation: Vehicle use and handling regulations that govern motorised goods vehicles need to be extended to cargo cycles to help prevent injury and death in the case of collisions and spillages.

Recommendation: If they believe it to have merit and potential, national and urban governments could revisit their previous guidance and protocols on delivery retiming with the freight transport industry, retailers, local authorities and other interested parties to determine how best to proceed this agenda and reinvigorate the efforts to bring about more retiming of deliveries.

12.4 Collaboration and joint working between policy makers and industry

Conversations and joint working between policy makers and the road freight transport industry can play an important role in ensuring the design of the kerbside meets loading/unloading needs and that reallocation of the kerbside for new uses disrupts freight transport operations as little as possible. The importance of such collaboration has been noted by various UK governmental bodies and various examples of such joint working have been provided in this report. However, the extent to which this collaboration currently takes place is far less than is possible.

In the case of major kerb space reallocation and streetspace redesign projects in commercial areas, local authority planners and designers and consultants that they appoint to carry this work out for them are often not familiar with the freight transport loading/unloading needs of the streets and areas that their project focus on, and often overlook these freight considerations in their initial designs. Working more closely with road freight transport operators and trade associations representing the freight industry through informal meetings and discussions, in addition to formal statutory consultation processes, can help to ensure that scheme designs are viable and efficient in terms of goods delivery and collection to businesses located in the project area.

Recommendation: Local authorities carrying out major kerbside reallocation and streetscape redesign projects should seek at the outset of such schemes to engage with the freight transport industry about the loading/unloading requirements and practicalities of the kerb allocation ideas being developed. Such communications can take place through existing public-private sector freight transport partnerships where they already exist, or through contact with trade associations that represent the freight transport industry such as the Logistics UK (formerly the Freight Transport Association), the Road Haulage Association and the Brewery Logistics Group. This will facilitate conversations, discussions and the provision of information that goes far beyond what is captured in typical statutory consultation processes.

Recommendation: Local authorities should also work closely with the freight transport industry, the users of freight transport services (e.g. manufacturers and retailers), property owners, and residents affected by goods delivery and collection operations by forming Freight Quality Partnerships with them. These partnerships provide the opportunity for issues to be discussed on an on-going basis and strong relationships to be formed between the public and private sectors concerning freight transport and its kerb space use.

Recommendation: Representatives of the freight transport industry, including trade associations such as the Logistics UK, the Road Haulage Association and the Brewery Logistics Group, and major logistics companies should develop general guidance about the loading/unloading requirements of goods vehicles in different urban settings that can be used as resource and consulted by local authority planners and designers in the course of their kerb management work.

Collaboration between freight transport and logistics companies has the potential to improve efficiency of freight transport operations, reducing total distance travelled, carbon emissions and local air pollution as well as the total kerb side space and time for loading/unloading. However, achieving such collaborative freight transport operations requires the overcoming of legal and organisational issues and barriers including competition law, commercial sensitivity about data sharing, and issues of trust.

Recommendation: Freight transport operators should consider the ways in which they can collaborate with each other to improve load consolidation and reduce the impacts of their goods vehicle operations, including their kerb space requirements. They can consider whether it is best to achieve this by working directly together or via a neutral logistics provider that they all select.

Recommendation: National government should ensure that such discussions about collaborative working to improve load consolidation and reduce impacts including kerb space and time requirements are permissible within competition law.

National, regional and local government would benefit in its policy development and day-to-day management of road network operations and also in its kerb management by having access to company data about goods vehicle movements (captured by vehicle tracking and tracing technologies) and digitised data about kerb space and restrictions applicable at the kerb in urban areas. Such data would fill gaps in information and knowledge currently experienced at all levels of government.

Recommendation: National, regional and local government should open discussions with freight company operators, and technology providers of vehicle tracking and

tracing and kerb management systems to determine means by which their data sources could be made available to help inform and shape policy making.

12.5 Supply chain disruption due to online shopping and its kerb space needs and impacts

Supply chains are experiencing disruption as a consequence of the growing use of online shopping for groceries, non-food products, and meals. These changes in business and consumer behaviour are resulting in new origins and destinations of some freight transport operations, together with substantial freight trip generation rates, and non-typical operating patterns and impacts.

Considerations of these changes in freight transport operations need to be taken into account in developing strategies for the future kerbside needs of freight transport, both in high streets and in residential areas. At present, many residential areas have little available kerb space for goods vehicles making deliveries due to car parking, and these deliveries are likely to cause increasing traffic impacts if consideration is not given to the kerbside requirements of these deliveries. Similarly, freight trips generated by fast-food restaurants and cafes and takeaways are substantial and growing and can cause negative traffic impacts as well as noise, disruption and litter at late-night times by delivery drivers for those living nearby. However, little research has been carried out into the freight trip generation associated with these activities and the businesses they operate from, or the kerbside impacts they can result in.

Recommendation: Further research needs to be carried out into freight trip generation rates and delivery patterns of businesses and sites involved in the provision of online grocery, parcel and meal orders (especially grocery outlets and restaurant, cafes, fast food takeaways and 'dark kitchens').

Recommendation: Research should be carried out into the delivery of online orders to consumers in residential locations and the impacts of these deliveries on traffic flow and safety.

Recommendation: Research is also needed into the negative traffic, environmental and social impacts these operations can result in different urban settings. Consideration needs to be given to means by which any negative impacts can be mitigated to reduce disruption they may cause to local residents.

Recommendation: Local authorities need to reflect the growth in this freight transport activity associated with online shopping and its related freight transport activity in their local planning and transport plans and kerbside space management plans.

Agnostic collection points and locker banks (i.e. which are shared between many retailers and carriers rather than dedicated to a single retailer or carrier supply chain) from which consumers can collect their online purchases as well as return them can help to consolidate the flow of products through fewer points of collection, and thereby offer the potential for reduced goods vehicle activity and kerbside space use in urban areas. If well situated they can also to facilitate consumers to use them as part of their commuting and other public transport journeys, and thereby limit the extent to which consumers travel to these facilities by car.

Recommendation: Urban and local authorities should hold discussions with the freight transport industry (freight operators, online retailers and online shopping technology providers) to investigate the ways in which the provision of such networks of well-situated agnostic locker banks and collection points could be provided.

12.6 Bookable kerbside loading/unloading space

Currently, kerbside loading and unloading in urban areas in the UK takes place without any need for freight transport operators to pre-book space. However, various technology providers have been digitising the kerbside in urban areas in the UK with this intention in mind. These providers as well as various public sector strategy and policy documents have argued that such an approach of dynamic kerb management could improve kerb space utilisation for loading/unloading operations and possibly even reducing total freight transport journeys. There are already schemes in place in which this approach has been applied to car parking, using on-street sensors to record usage of the kerb space for this purpose.

The electronic pre-booking of loading/unloading and obtaining parking dispensations could be useful in relation to the loading/unloading of heavy and bulky goods that needs to take place adjacent to the delivery/collection point. However, its usefulness is far less certain in other loading/unloading operations. It raises questions in terms of enforcement would take place (i.e. how would a pre-booked space that, on arrival, is found to be occupied by another vehicle be dealt with), and how such an arrangement would work in relation to multi-drop vehicle operations which can require kerbside stopping at many different locations during the course of a vehicle round, which makes arrival times at each location difficult to predict. In general, arriving at a specific kerbside location is difficult to achieve in freight transport operations or in any motorised vehicle journey given urban traffic conditions. With a bookable kerbside loading space system, vehicles arriving early could result in more double parking while drivers wait for the space to become available thereby disrupting traffic flow or to the driver circulating in the traffic until the appointed booking time thereby adding to traffic levels. Vehicles arriving late at the booked kerbside space may result in the space being unused and then the vehicle having nowhere to load/unload at the kerbside if their time slot has ended. This could result in loading/unloading space being less well utilised than it is at present.

Recommendation: Research is required to provide insights into the potential impacts of bookable kerbside loading/unloading space on kerb space utilisation and freight transport and total road traffic levels and flow.

12.7 Charging for kerbside loading/unloading space

The developers of these bookable parking and loading/unloading systems present a business model in which this parking and loading space is also charged for. While car parking in urban areas is already regularly charged for, this is not the case for loading/unloading at the kerbside, which is currently available free of charge in the UK. This lack of charging is due to loading/unloading traditionally taking place on yellow lines without loading restrictions in force, rather than in dedicated loading bays, as well as recognition that freight transport operations provide an essential service to urban businesses and residents. Charging for kerb loading/unloading space is encouraged by some commentators and technology providers as a means of making freight transport operators' use of kerbside loading/unloading space more efficient and even reducing freight transport activity.

Both the availability of car parking spaces (near people's home and the destinations they travel to) and parking charges influence people's choices about whether to drive or use another mode of transport, the times at which to drive, and even whether to own a car. These tools (car parking spaces and pricing) are used by policymakers to manage demand for car use and car parking. The application of pricing to kerbside loading/unloading activities would be unlikely to have the same effect on the use of this space as it does for car parking.

First, no suitable alternatives exist to the vast majority of this goods collection and delivery work in urban areas being performed by goods vehicles using the road network and kerbside and none are likely to emerge anytime soon. Second, the demand for freight transport services is derived from the need to collect and deliver goods to and from businesses and private individuals, and is inelastic with respect to price. Drivers of goods vehicles typically carry out loading/unloading stops at the kerbside as quickly as possible, so that they can continue to their next location to perform the next job.

Charging for the space and time used at the kerbside where loading/unloading activities is therefore likely to have little effect on the total level of goods vehicles using these kerb spaces or the time they spend in them. It would, however, result in higher freight transport operating costs that some smaller operators may struggle to pass on to customers, resulting in inequitable effects among different types and sizes of freight operators. Charging for kerb loading space may also potentially lead to a greater proportion of such activity being carried out in violation of loading rules and restrictions, resulting in less safe operations and greater negative impacts on traffic flow. It could also lead to higher prices for certain goods and services, especially where freight transport accounts for a substantial proportion of their total cost. It may also result in businesses in some locations experiencing difficulties in obtaining goods if some freight transport operators are unwilling to provide their services in such places.

Recommendation: Research is required into the potential impact of imposing charges for kerb loading/unloading space both in terms of the total level of freight transport activity (and its efficiency) and its impact on road safety and traffic levels, goods provision in locations where such charges were implemented and equity effects on different types of freight transport operators.

12.8 Kerbside needs of goods vehicles used for servicing activities

As well as deliveries and collections made by goods vehicles, servicing activities provided via the use of goods vehicles are also essential to the economic prosperity and liveability of urban areas. Examples of such servicing includes work of engineers providing utilities and telecommunications, plumbers, electricians, air conditioning and lighting engineers, roofers, pest controllers, cleaners, security system providers, property maintenance personnel, surveyors and caterers. Those providing these services may carry goods as part of their work; they are also likely to carry tools and equipment that are necessary to the services they provide that can be heavy and bulky. The time spent by these personnel providing service at the location at which it is required is often substantially greater than the time spent solely making deliveries to buildings by goods vehicle.

These service personnel often have to park their goods vehicles and vans at the kerbside as no off-street space is available or provided at the business or residential premises they are visiting. However, their stay at the kerbside is not treated in law as loading/unloading, and is instead considered to be parking. These vehicles used to provide such services are treated in exactly the same manner as car parking, despite their importance. Often no parking space is available close to where the servicing has to take place. Despite the importance, growth and prevalence in these servicing activities and their related vehicle use, the requirements of these vehicles has been overlooked in kerbside stopping regulations.

Recommendation: National and local policy makers need to give consideration to the kerbside parking needs of goods vehicles and vans used to carry out servicing activities, so as to improve the efficiency of this service provision and vehicle dwell times. These important and growing operations have never been taken account of in kerbside considerations by national or local policy makers.

12.9 Residential development and car parking policies

Various national and city government policy documents expect car ownership levels to fall in future as more people switch to using public transport, cycling and walking. However, there is currently no evidence of car ownership levels declining either at a national or urban scale. Consequently the kerbside in many urban streets, both residential and commercial, is regularly filled with cars. The residential development policies of planning authorities can exacerbate the kerbside parking of cars in residential areas. This takes kerb space away from other more important functions including loading/unloading and servicing activities. High street surveys in London have indicated that parking accounted for 77-85% of total vehicle stopping time at the kerb (Transport for London, 2015a, 2015b, 2015c, 2015d). The figures would be even higher in residential streets.

Recommendation: Policy makers should consider ways in which they can discourage and reduce the amount of kerb space and time occupied by parked cars that prevent the use of this valuable resource for other more important functions.

A major switch from private car ownership/use to the use of ride-hailing connected autonomous vehicles (CAVs) is predicted in the not too distant future by some commentators. This would free-up substantial kerb space for uses other than car parking, given the time taken to drop-off, pick-up and wait for passengers compared to the time that privately-owned are parked at the kerb.

Recommendation: Policy makers should develop plans to encourage the use of ride-hailing CAVs when this technology is available and legal. They should also consider how to reallocate the kerb space that this would free-up as privately-owned cars diminish and ensure that freight transport loading/unloading is retained as a priority, essential use of kerb space.

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