CENTRE FOR TRANSPORT STUDIES
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Developing low-carbon freight microhubs in London

Principles, benefits and locational analysis

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Contents

Executive summary

Microhubs are relatively small facilities located in or near city or town centres, where freight is received in bulk and then re-distributed to nearby residential and/or commercial premises by low emission vehicles (e.g. electric vans, cargo cycles). Interest in urban microhubs has been growing, as evident by the increased number of these facilities in many cities and in the willingness of public authorities to encourage and sometimes co-fund them. The deployment of microhubs, and the associated shift towards employing low-emission vehicles is becoming urgent, given trends such as the increase in demand for home and business deliveries, shifts in political and public priorities towards sustainability and liveability (including carbon reduction, cleaner air and accident reductions), concerns about congestion, and increased competition for roadspace and kerbside space.

Microhubs can not only reduce environmental problems associated with last-mile freight distribution in cities, but under the right conditions can also generate benefits for shippers, freight operators and customers, as well as wider economic and social benefits for the communities they serve. This report reviews international evidence on the realisation of these benefits, and then looks specifically at London. Simulation and evaluation studies have shown that, in general, microhubs located in denser urban areas reduce emissions while allowing for faster, more reliable, and more flexible deliveries, compared with conventional delivery systems. Previous studies have shown that the viability of microhubs, both from the operator's and society's perspective, is location-specific and depends, among other things, on the density of demand, the supply of labour, and on the characteristics of the road infrastructure in the surrounding areas.

Drawing upon this prior knowledge, the report develops and demonstrates a method for identifying the most suitable potential locations for urban microhubs served by cargo bikes. This method was applied to Greater London, using a grid of 39,861 points at 200m intervals, covering the whole of the Greater London area. The suitability of each point was assessed based on (i) the demand for deliveries (from residents and businesses), (ii) road infrastructure and operational conditions for cycling in the surrounding area, and (iii) the availability of a suitable pool of labour. Once these filters had been applied, the remaining 3,109 potential sites was then characterised in terms of (iv) wider social and environmental benefits of shifting motorised deliveries to cargo cycles and (v) local on site-level constraints.

The report concludes by mapping the locations of four potential microhub sites owned by British Land, in Central and Inner London, onto the remaining grid points.

1

Setting the scene

1. Setting the scene

1.1. Introduction

The need for a transition towards low-carbon economies is pressing, as evidence accumulates on the possible irreversible damage to the global environment if this transition is not made. One of the key areas is urban transport, especially freight transport, which is currently responsible for a disproportionate share of emissions of harmful pollutants, while also showing a tendency to increase, rather than decrease, the level of emissions over time.

Microhubs have been offered as a possible solution to decrease the environmental impact of urban freight systems and have been implemented with success in several cities around the world. Microhubs (also known as micro consolidation or micro distribution hubs) are facilities located in or near city centres, where freight is received and then re-distributed to several end receivers nearby, in residential or commercial premises. In other words, they are a logistics system dealing with what is known as "last mile" freight distribution. The distribution is usually made by low or zero emission vehicles (e.g., electric vans, cargo cycles) or even by pedestrian porters.

This report was commissioned by British Land. It describes the benefits of microhubs for all parties involved in freight distribution (shippers, logistics providers, customers) and for the wider community, including not only global environmental effects but also local environmental, economic, and social aspects.

This chapter introduces the topic, identifies factors generating increased interest in microhubs, the different types of microhubs, and their potential benefits and costs. Chapter 2 reviews the evidence of those benefits and costs around the world and Chapter 3 reviews the same type of evidence in the case of London. Chapter 4 discusses how the success of microhubs in delivering their potential benefits is related to their location within a city. Chapter 5 is a summary of empirical research carried out to identify potential sites for successful microhubs within Greater London, that meet the various criteria. Chapter 6 shows how the locations of four British Land sites in Central and Inner London map onto these potential sites, and Chapter 7 provides some overall conclusions.

Following our definition of microhub above, this document focuses on microhubs located in cities and distributing freight using low or zero carbon vehicles in relatively small areas. It thus excludes facilities for freight distribution at the regional and national level and facilities relying on distribution by fuel-based vehicles. In particular, it excludes many of the facilities usually categorised as "urban consolidation centres", which are often located in industrial areas at the edges of cities, consolidating freight to distribute over large areas (sometimes whole cities), and in many cases still using fuel-based vehicles. The concept of microhubs also excludes collection facilities (e.g., lockers) to which carriers deliver packages which are then collected by end users.

1.2. Factors generating increasing interest in distribution hubs

Interest in microhubs has been growing, reflected not only in the increased number of these facilities in many cities around the world, but also in the willingness of public authorities to fund or co-fund them, and in the wide literature (both academic and reports) discussing their benefits. Nevertheless, information on the current number of microhubs in a given country or even city, is unavailable, given the fast growth, and the fact that some hubs are temporary trials.

The growing interest in microhubs can be explained by several factors, related both to the freight industry and to wider societal trends, as listed below.

Demand for home deliveries

Image credit: Dougal Waters Photography Ltd, via Getty Images.

In many countries, demand for home deliveries has been increasing fast in recent years. This is explained by the increase in the number and efficiency of online businesses, and the development of smartphone-based applications for ordering products from those businesses. In particular, same-day and instant delivery are the fastest-growing segments of online sales, growing by an average of 36% and 17% per year, respectively (WEF 2020, p.8).

With the onset of the Covid-19 pandemic in 2020, these trends have accelerated, due to the extended periods of lockdowns and isolation imposed in most countries, and the associated increase in remote working. Some of this increase became permanent, as companies changed their work arrangements, allowing workers to work from home several days a week, even after the worst period of the pandemic. This has contributed to a substantial increase in demand for home deliveries, as people spend more of their time at home.

To accommodate this increase demand for home deliveries, and the growing customer expectations about fast and reliable deliveries, new solutions are needed for urban logistics. Microhubs are one of those solutions.

Demand for business deliveries

Image credit: Marko Geber via Getty Images.

The growing interest in microhubs is also related with supply factors, such as a shift towards business models that rely on less storage space and on just-in-time deliveries. This implies more deliveries and requires a more efficient system to organise those deliveries, especially in areas of the city subject to road congestion (which makes delivery times unreliable). The use of microhubs located in city centres (usually the most congested areas in the city), and relying on smaller vehicles for distribution, are a possible solution for achieving that efficiency in organising deliveries.

Concern about local and global environment

There is also a growing public concern about environmental quality. Shifts towards healthier lifestyles are associated with higher demand for high-quality streets and public places where people can walk, spend time, or do exercise, free from air pollution and noise. At the same time, there is also a growing awareness of global environmental issues such as climate change. In many cities, these public concerns are translating into changes in transport and urban planning, with the emphasis shifting from building new roads and providing car parking spaces to ‘place-making’ and improving the quality of streets for pedestrians. These aspects have become even more important since the onset of the Covid-19 pandemic.

Attending to these concerns requires policies to restrict the level and speed of motorised traffic in cities, which imply strategies to reduce motorised freight traffic and its environmental impacts. As it will be explained later in this document, microhubs are an effective way to achieve that reduction.

Scarce roadspace and parking/stopping spaces

Image has been edited to remove vehicle identification. Image credit: Kenneth Allen / Blocked - High Street, Omagh / CC BY-SA 2.0, via Wikimedia.

In many cities, there is an increased demand for roadspace due to the emergence of new road uses and mobility services, including electric vehicles, car clubs, cycle share systems, and e-scooters. These new uses require space for movement, parking, and charging. At the same time, due to changing political priorities mentioned above, authorities are allocating more space for the exclusive use of pedestrians and “place” activities (e.g., parklets, outdoor cafés). In other cases, traffic restriction policies are applied to reduce the number of motorised vehicles using a given road or area of the city, or even to ban all motorised vehicles at all or at specific times of day or days of week.

These measures have reduced the space available for freight vehicles to move, park, and stop, especially in city centres, where available roadspace tend to be lower and demands for roadspace more intense and diverse. This lack of space for freight delivery increases potential conflicts with other road users, leads to stress for delivery workers (exacerbated by payment rates linked to performance) and to delays in delivering products (because of the time wasted in congestion and cruising for parking).

The use of smaller vehicles, including cargo cycles, associated with a microhub, are a possible solution to solve the problems caused by scarce roadspace in city centres.

1.3. Typologies of microhubs

Microhubs differ in terms of areas of the city served: central business districts, historical centres, other specific areas in the city, or single large business location (such as airports, shopping centres, and construction sites). In addition, some microhubs are fully operational and permanent schemes, while others are trials running for a limited time or are temporary (for example, serving a construction site).

Another distinction regards the type of distribution vehicles used. To be environmentally sustainable, microhubs require the use of low or zero emission distribution vehicles. Usual options are electric vans, cargo cycles (electric or not), hand carts. Some hubs rely on pedestrian porters. Other possible options in the future include drones and automated electric vehicles.

There are also several possible business and operation models:

- **Single-company hubs**, owned by a carrier or (less often) by a manufacturer, supplier, or retailer. The carrier distributes the products from depots outside the city centre to the hub (or hubs), from where they are distributed to the final consumer using low-carbon vehicles.
- **Shared hubs** – several carriers distribute their products to the hub. Some of the carriers may use these shared hubs in addition to their own hubs. Shared hubs may also be operated by the product receivers (e.g., shop owners).
- **Public-funded shared hubs** – as above, but with funding for setting up the hub partially or fully covered by subsidies from local governments.

A variety of locations have been used for microhubs, including industrial units, car parks, garages, and underused urban spaces (e.g., under railway arches). Some hubs are simply small spaces where trucks or vans stop, and products are moved to (smaller) electric vans or cargo cycles. Others are ‘mobile hubs’, i.e., trucks with loading/unloading facilities that stop in a parking lot or another space to distribute parcels to pedestrian porters or delivery workers using cargo cycles.

‘Dark stores’ and ‘dark kitchens’ (or ‘ghost kitchens’) can be considered as a special type of microhub, catering exclusively for online orders. Dark stores sell a variety of products while dark kitchens sell meals for delivery. Dark kitchens can source their products from dark stores. Delivery is usually made by motorbike or cargo cycle. The main advantage of these arrangements is saving on rental costs (as less space is available) and on other costs related to selling directly to the public (e.g., restaurant chairs and tables).

1.4. Potential direct benefits

Microhubs have several potential direct benefits for all parties in commercial transactions that involve shipping. **Table 1** synthesises these benefits. In this table, “shipper” means the company selling the products, and “receivers” mean the final consumers or commercial establishments ordering those products. Logistics providers include transporters, carriers, and hub operators (which in some cases, can be the same company).

Table 1: Potential direct benefits of microhubs

	Shipper	Logistics provider	Receivers
Service quality	Faster, more reliable, and more flexible delivery, customer satisfaction, more efficient handling of returns	Faster, more reliable, and more flexible delivery, more efficient handling of returns, reduced distance covered and times spent.	Faster, more reliable, and more flexible delivery, more efficient handling of returns
Financial	Lower delivery cost	Smaller transport costs. More efficient use of vehicles and warehouses. Less waste, fewer parking fees and fines	Lower delivery cost
Safety	Goods safety	Goods safety	Goods safety
Environment	-	ISO Certification	-
Accessibility	-	Easier to load/unload	-
Liveability	-	Driver conditions	-
Equity	-	Gender and age composition of workforce	-

In theory, microhubs improve service quality, with faster, more reliable, and more flexible deliveries, compared with conventional delivery systems. This benefits shipper, logistic provider, and receivers. The shipper also benefits from increased customer satisfaction.

The potential improvement in service quality is explained by possible reductions of travel time and travel time variability, because smaller vehicles are able to access roads that cannot be legally used by larger vehicles. In addition, delivery time (and its variability) may decrease, because smaller vehicles require less kerbside space and thus can stop more easily nearer the delivery place. There are also potential gains in flexibility, as proximity from the hub to the delivery areas mean that it is possible to better adjust delivery schedules, compared with deliveries directly from the shipper or from consolidation centres far from the delivery areas. Proximity to the hub, and consolidation of freight in the hub, also allow for a more efficient handling of returned products.

Using the hub for consolidating deliveries and using small vehicles in roads closed to larger vehicles may also benefit logistics providers through a reduction of the distance covered and time used per delivery. However, this needs to be balanced with a possible increase in the number of delivery trips, due to the smaller loads carried by smaller vehicles.

It should be noted that the benefits mentioned in the previous paragraphs are potential. In practice, the existence (and size) of these benefits depends on options taken regarding scheduling, routing, and the number and type of vehicles used. The use of microhubs also means an extra stage of handling goods, which can increase total time spent and costs incurred.

Logistics providers may have other benefits from microhubs. For example, adhering to ISO certification or environmental standards (for example, in relation to the type of vehicles used) can improve the image of the companies among the public. Using small electric vehicles or cargo cycles also makes it easier to load and unload goods, simplifying delivery and saving time.

Driver conditions may also improve, if the smaller vehicles and cargo cycles used to deliver goods from the microhub can use routes that larger vehicles cannot, avoiding congestion and reducing delays and stress. If the use of the microhub leads to a large reduction in the number of large vehicles on the road network in the delivery area, congestion can be reduced even in other routes. Smaller vehicles are also easier to manoeuvre in narrow roads and to park in areas with high demand on kerbside space, which reduces delays, conflicts, and stress to find a place to stop for delivering the products.

However, driver conditions may deteriorate if delivery is in areas with high volumes of motorised traffic and the use of the microhub does not lead to a noticeable reduction of those volumes. This is especially the case when delivery from the microhub is done using cargo cycles, as drivers will be exposed to noise and air pollution. The use of cargo cycles in unsuitable locations, with large volumes of motorised traffic, no suitable infrastructure (e.g., protected cycle lanes), and no cycle priority or protection at junctions, can increase the risk of collisions, injuries, and fatalities, as cargo cycles are more fragile than motorised vehicles. In addition, workers using cargo cycles are also more exposed to natural elements (rain, sun, wind) and are required to make more effort to complete their deliveries (especially if the cycle is human powered).

The positive/negative change in workers' safety and other conditions can then be associated with a more/less balanced workforce composition, in terms of age and gender. If safety and other conditions improve, it is possible to see an increase the proportion of women and older people in the industry, which currently has a disproportionate number of young men.

1.5. Potential wider benefits for society

Through their influence on transport and other variables, microhubs also have potential benefits for the wider community in the areas served by the hubs, i.e., for people not using the delivery services but indirectly affected by them. **Table 2** synthesises those benefits.

Table 2: Potential wider benefits of microhubs

Economy	Economic growth, employment
Safety	Reduced collisions
Environment	Reduced motorised traffic levels, energy consumption, noise, local and global emissions, visual impact of large vehicles
Accessibility	More space and better access for all road users, improved road speed and travel time reliability, test of new types of vehicles
Liveability	Well-being of all stakeholders, reduced congestion
Equity	Possible positive equity effect if societal benefits are in low-income areas

The use of smaller freight vehicles contributes to the optimization of kerbside space, possibly releasing space for parking and loading of other vehicles and for other uses of the kerbside, such as stalls or outdoor cafés. This can contribute to the financial vitality of local businesses and to an increase in local employment. If freight consolidation leads to a reduction in the levels of motorised traffic and congestion, this also improves customer access to shops and the quality of the local environment, two factors that can increase demand for local businesses.

The impact on employment in the freight industry can also be positive. It is possible that consolidating freight in a single location and using several small vehicles rather than fewer larger vehicles can increase the number of people employed.

Road safety impacts can be positive, if overall traffic volumes, and the share of large vehicles decreases due to the operation of the microhub. However, as mentioned in the previous section, if this decrease is small, safety can decrease, in areas without suitable cycling infrastructure, if more small and fragile vehicles, such as cargo cycles, share the same road space as motorised vehicles.

The use of low or zero-emission vehicles for delivery, plus a possible reduction in total distance travelled, overall levels of motorised traffic, congestion, and cruising for parking/stopping, should improve the local environment through a reduction of emissions of air pollution and noise. The same factors might also reduce the emission of CO_2, contributing to the progression towards a sustainable global environment. At the same time, the shift towards low-emission vehicles and non-motorised modes can reduce energy consumption for transport, and negative impacts on local climate, soil, and water. The reduction of van and heavy goods vehicles traffic also reduces the visual impact of road traffic, especially if they are replaced by cargo cycles, which have a smaller imprint on the visual environment. This benefits not only pedestrians and people using local public places, but also local residents and workers in buildings with windows facing the road.

It should be noted that the environmental benefits listed above can be localised. It is possible that the reduction in motorised traffic levels and congestion in the areas served by the hub is associated with increases in those variables in the areas around the hub.

Accessibility gains are also likely. The consolidation of freight can lead to a more optimised use of the road network, due to the use of smaller vehicles and (possibly) more efficient routing and scheduling of delivery trips in the delivery area. It can also improve road and kerbside operation reducing pressure for space in busy areas. This can contribute to increased accessibility to all road users, increasing travel speeds and travel time reliability. More generally, microhubs also provide an opportunity to test new types of vehicles, which can then be deployed in other contexts, bringing overall accessibility gains for society.

The reduction of volumes of large fuel-based vans also improves pedestrian accessibility, by reducing delays and detours to cross the road and psychological barrier effects that cause people to suppress trips and feel separated from neighbourhoods across the road.

There are wider impacts on liveability following from the environmental and accessibility improvements described above. The reduction of local environmental nuisances improves the physical and mental health not only of road users but also of local residents, workers, and visitors. The improvement of pedestrian accessibility also can increase the propensity for physical activity and social interaction, contributing to social cohesion and social inclusion. If pedestrian flows increase, there can be also an increase in perceptions of personal security, and possibly a reduction in the number of crime incidents.

Finally, there is a potential equity effect, if the benefits described above occur in areas with disadvantaged populations, especially low-income. The improvement of pedestrian accessibility and environmental quality also improves quality of life among older people who would otherwise suppress some walking trips.

All these benefits described in this section can be multiplied if the reduction of motorised freight traffic and larger goods vehicles leads governments to reallocate space for vehicle circulation to green areas, parklets, and outdoor cafés.

Image credit: Pacopac, via Wikimedia.

2

International evidence

2. International evidence

This chapter reviews evidence on the benefits of microhubs, assessing whether the potential benefits described in the previous section have been achieved or can be achieved, and if there are substantial costs offsetting those benefits. The evidence covers various cities, excluding London, which is examined separately in Chapter 3. The literature is a mix of theoretical models, simulation using real-world data, and evaluation of trial schemes. Some studies focus on microhubs while others assess the use of cargo cycles, which implicitly assumes some sort of consolidation near the delivery areas, as cargo cycles cannot be used to travel long distances. We present here the results of some of the available studies, which are representative of the type of results found, while covering cities in as many different countries as possible.

Section 2.1. and 2.2. present evidence on direct and wider benefits and costs of microhubs, respectively. Section 2.3. identifies evidence gaps.

Image credit: CityHarvestNY, via Wikimedia.

2.1. Direct benefits and costs

As an example of the general benefits of introducing microhubs in the freight distribution system, Fikar *et al.* (2018) developed a decision-support system linking agent-based simulation and routing and scheduling procedures, applied to assess strategies for food delivery in Vienna. The use of microhubs reduced delays and travel distances in high demand settings. A simulation study in Nantes also showed that delivery of non-food products to local depots could reduce overall delivery costs, compared with direct home delivery, in several different scenarios. This is explained by fewer delivery failures (Durand *et al*. 2013). A microhub in Berlin has also led to increased customer satisfaction (Engelhardt and Seeck 2022).

There is also a growing body of evidence on the benefits of mobile depots for operators. For example, a survey-based study showed that the use of a mobile hub in Dublin has resulted in enhanced delivery time reliability as deliveries were less affected by congestion (Finnegan *et al*. 2005). However, in a simulation study applied to a real-world example in Rio de Janeiro, Marujo *et al*. (2018) found more nuanced results. Using a mobile hub did not impact total distance travelled, total time spent for delivery, or customer satisfaction, compared with direct delivery by truck. The mobile hub solution reduced total costs in dense areas, but increased costs in other areas.

The benefits of microhubs for customers can be inferred from their willingness to pay for deliveries using those hubs. For example, in a survey in 80 major cities in Germany, Hagen and Scheel-Kopeinig (2021) found that 36% of customers are indeed willing to pay extra for deliveries made through a microhub inside the city. This willingness to pay can be explained either by the expected increase in service quality or to environmental benefits of using cargo cycles. Another survey in the five largest German cities (Engelhardt 2023) found that 61% of online shoppers would be willing to pay extra for consolidated parcel delivery by cargo bike. However, this may be explained by the delivery times specified in the survey (delivery within 2 hours).

Some studies assessed the economic competitiveness of using low-emission vehicles, in comparison with other vehicles:

- In Austin, the existence of a depot within the delivery area increased the competitiveness of using cargo cycles for deliveries for the US Postal Service, compared with vans and other vehicles (Choubassi *et al*. 2016).
- In São Paulo, replacing diesel vans with electric cargo cycles for last mile deliveries could save up to 31% in delivery costs (Ormond *et al*. 2019).
- In Rio de Janeiro, using cargo cycles could reduce 28% in delivery costs per route, compared with conventional delivery systems (Bandeira *et al*. 2019).

2.2. Wider benefits and costs

A review of four microhubs, in several countries, showed a reduction in vehicle distances travelled by diesel-based vehicles and reduced CO_2 emissions (UFL 2020). Simulation studies have also showed potential benefits. The use of local depots to deliver non-food products in Nantes could reduce CO_2 emissions in several different scenarios, due to fewer failed deliveries (Durand *et al*. 2013). Veličković *et al*. (2018) used a survey and emission accounting in Novi Sad (Serbia) to show that freight consolidation for last mile delivery increased driving distance in the city, but some consolidation options reduced driving distance of long-haul heavy- and light-duty vehicles, thus reducing emissions.

Mobile depots also tend to be linked with environmental benefits. In Brussels, a trial of a mobile depot led to a reduction of 24% in CO_2 emissions, and reductions of 59%, 24%, and 22% in emissions of $PM_{2.5}$, PM_{10}, and SO_2, respectively, compared with business-as-usual. However, emissions of NO_x increased 48% (Verlinde *et al*. (2014).

In Rio de Janeiro, mobile depots and last-mile delivery by cargo cycles could lead to reductions of 52% in CO_2 emissions and of between 19% and 49% in local pollutants in the delivery areas, compared with direct delivery by truck (Marujo *et al*. 2018).

Studies comparing the performance of low-emission vehicles and diesel vehicle for last-mile freight distribution have produced similarly encouraging results, in various parts of the world, showing potential transport-related and environmental benefits:

- In Portland, the use of electric cargo cycles could reduce CO_2 emissions between 51-72%, compared with diesel vans, even using a conservative estimation approach (Saenz *et al*. 2016)
- In Porto, a market shift of 10% towards the use of cargo cycles could reduce distance travelled by 16% and traffic delays by 10% (Melo *et al*. 2014)
- In Sao Paulo, replacing diesel vans with electric cargo cycles could reduce CO_2 emissions by 97% (Ormond *et al*. 2019).
- In Rio de Janeiro, electric cargo cycles could reduce CO_2 emissions by 99%, compared with conventional delivery systems, while also reducing delivery workers' heart rates (Bandeira *et al*. (2019)

As shown above, most results are consistent in pointing to societal benefits of integrating microhubs in freight distribution systems. However, Van Rooijen and Quak (2010) showed that the reduction of numbers of trucks and distance travelled linked to the use of a hub in Nijmegen (Netherlands) was not enough to achieve substantial reductions in air pollution and noise - although there were still benefits in terms of less inconvenience to local residents related to the reduction of loading/unloading activities. Katsela *et al*. (2022) also alerts to some caveats in the benefits of freight consolidation in microhubs. This was found to reduce only slightly the number of vehicles and vehicle-km travelled and to increase emissions, compared with no consolidation. However, combining microhubs with previous consolidation in larger hubs, for each freight operator, leads to large reduction in emissions. If this previous consolidation is shared in a single facility, the reduction is even larger.

2.3. Gaps

While research on the topic is growing, there are still aspects with little or inconclusive evidence. Social aspects, including working conditions in the hubs and during delivery, as well as gender equality and other equity considerations, have been understudied. In particular, safety aspects of using cargo cycles in areas with no suitable cycling infrastructure are a crucial factor with little empirical evidence, especially when comparing with the large amount of evidence estimating impacts on costs and profits for the employers.

There has also been no attempt to compute the overall impact of the hubs, combining economic and non-economic aspects and impacts on a range of stakeholders, for example in a cost-benefit or multi-criteria analysis. This is in part because it is difficult to assign monetary values to non-economic aspects, which makes the comparison of different impacts more difficult.

There is also little evidence comparing the effectiveness of logistics hubs for delivering different types of products. It is likely that the gains are higher for lighter products (packets, parcels) than for heavier products. There is also no evidence quantifying benefits and costs for different type of hubs and operating systems, and no cross-site comparisons, or studies analysing how the benefits of microhubs depend on city size.

3

The case of London

3. The case of London

Image has been edited to remove vehicle identification. Image credit: Jorge Franganillo via Wikimedia.

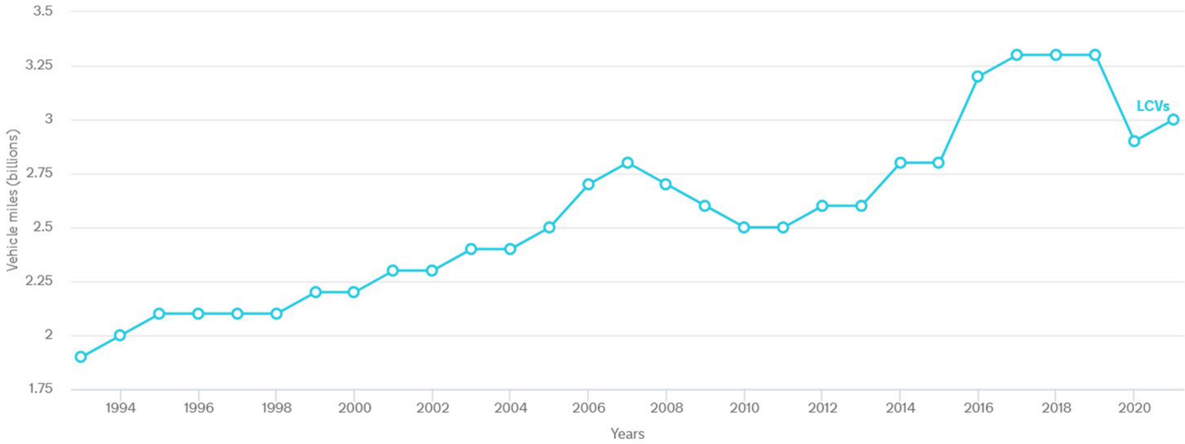
This chapter discusses microhubs in the context of London, starting with relevant trends explaining the need for efficient and sustainable freight distribution solutions (Section 3.1). We then review existing evidence on benefits and costs of microhubs in London (Section 3.2) and identify opportunities and challenges (Section 3.3).

3.1. Relevant trends

Growth of van traffic

Vans are the fastest-growing traffic mode in London. As shown in **Figure 1**, the increase has been sustained since 1993, but faster since 2012, with only a decrease in 2020 due to the impact of the Covid-19 pandemic. From 2012 to 2019, van traffic has increased 48% from 2012 to 2019. This is in contrast with car and taxi traffic, which increased by 14%. In 2019, van traffic already accounted for 16.4% of all traffic in London. This growth is linked to population and general economic growth, but also to the fast growth in online shopping deliveries, and changes in logistics systems, with a reduction of space in business premises.

Figure 1: Annual traffic volume of Light Commercial Vehicles in London (billion vehicle miles)



Source: Department for Transport (https://roadtraffic.dft.gov.uk/regions/6)

The growth in van traffic is leading to increased congestion and pollution in London, calling for more efficient and sustainable freight distribution systems, which can meet demand while at the same time minimising social and environmental negative impacts. This becomes even more important if we consider the economic inefficiency associated with van traffic in London. For example, a survey found that the average load factor for vans in London was only 38% and that 39% of vans were less than one quarter full (RTF 2013).

Policy challenges

London is facing several challenges affecting the transport and logistics sectors and calling for a solution to reduce the growth of fuel-based motorised van traffic.

Congestion remains a problem, especially in central areas. Congestion costs in London are estimated as £5.1 billion a year, or £1211 per driver (MoL 2022). London is the world's most congested city, according to the INRIX Global Traffic Scorecard, with drivers wasting an average of 148 hours in traffic a year (INRIX 2021).

There are also concerns about local air pollution, especially along major roads crossing central areas. Pollution is responsible for 9,400 premature deaths in London per year and costs an estimated amount of £1.4-£3.7 billion to the health system (London Councils 2017). This is a public health and a social equity problem, as it particularly affects children and older people. There is a clear link between pollution and levels of motorised road traffic.

Road safety remains a problem. In particular, there is concern about traffic collisions involving bicycles and freight vehicles, given the trend for the increase in traffic levels of both types of vehicles and the absence of suitable cycling infrastructure on many major roads. Junctions are especially problematic.

Policy priorities

As with other major cities in Western Europe (Jones *et al*. 2018), there has been a shift in transport and urban policy emphasis in London, away from the provision for motorised traffic, as a response to the policy challenges mentioned above and to meet a shift in the public's expectation of what a city should deliver.

From the late 1940s to the 1980s, transport and urban policies in London were mostly focused on accommodating growing car ownership and use, linked to suburbanisation and disinvestment in public transport (for example, through removing the tram network post war). From the 1980s, the effects of traffic growth led to a change in political priorities, with an improvement of public transport services and some parking and traffic restrictions. From the mid 2000s, there was another refocusing of priorities, with more emphasis on providing for non-motorised modes, active traffic restraint and the recognition of streets as public places for economic and social activities. This has translated into measures such as low-emission zones, access restrictions for motorised modes, reduction of car parking space, and road pricing.

This evolution of political priorities has been both a cause and effect of a shift towards a more sustainable modal share for passenger trips. However, as noted above, there is a tendency for the growth of van traffic, which is inconsistent with the current political priorities, calling for more sustainable (and equitable) ways to organise urban freights distribution in London.

At the global level, London has positioned itself as a city with an ambitious strategy to tackle climate change, as set out in the London Environment Strategy (MoL 2018) which, again, requires measures to revert the tendency for the growth of van traffic and unsustainable freight delivery systems. Crucial measures identified in the strategy include freight consolidation and a shift to lower emission vehicles (MoL 2018, p.79). Transport for London has also recently published a cargo cycle action plan setting out a series of actions to promote cargo cycle use, covering infrastructure, safety, and behaviour change (TfL 2023).

3.2. Empirical evidence on benefits and costs

Several studies have evaluated the benefits and costs of trials of microhubs in London, as below.

Browne *et al*. (2011) reported the evaluation of a 2009 trial led by a major stationery and office supplies company. Deliveries from a depot in the suburbs using diesel vehicles were replaced with deliveries from a microhub located in the delivery area in the City of London, using electric vans and cargo cycles. Most results were encouraging, including a 20% reduction in total distance travelled, a 54% reduction in CO_2 emissions per parcel (with extra reductions in the delivery area). However, there was also an increase in total distance travelled per parcel in the delivery area. This was explained by the smaller load limits in weight and volume of electric vehicles, compared with diesel vehicles.

Gnewt Cargo trialled freight consolidation strategies in London during 2014-15, reported by Clarke and Leonardi (2017a) for Great London Authority. The trials involved two case studies, using electric vehicles.

- Setting up an additional depot to expand the delivery area in Southwest London - this resulted in reductions of 20% in vehicle-km travelled.
- Running operations from multiple depots - leading to a reduction of 52% in vehicle-km travelled, 65% in empty running distances, 81% in emissions of local pollutants, and 88% in emissions of CO_2.

Another trial by Gnewt Cargo in 2015-16 involved freight consolidation into one depot in Central London, using a single electric van (Clarke and Leonardi 2017b). The results were also generally positive: a decrease in distance travelled by 11% and a reduction of emissions of particulates and CO_2 above 90%.

Other studies used models applied to real-world data in London. Allen *et al*. (2018) tested the impacts of using pedestrian porters collecting parcels from vans parked in specific locations and then delivering in a small area in central London. Compared with a system where all deliveries are made by van, this new system could save 86% of driving distance and 69% of driving time. McLeod (2020) found that the use of pedestrian porters and cycle couriers instead of diesel-fuelled vehicles in the City of London could reduce distance travelled by 78%, kerbside parking time by 45%, costs by 34-39%, NOx emissions by 33%, and CO_2 emissions by 45%.

According to Transport for London, cargo cycles could replace up to 4% of van kilometres across Greater London by 2030 (up to 17% in Central London) (TfL 2023). This would represent a reduction of around 100 million van-km and 30,000 tonnes of CO_2 per year.

Some gaps in evidence remain. The existing evidence has focused on delivery performance (e.g., distance travelled to complete the distribution) and environmental impacts. There is little knowledge on financial benefits for logistics operators, worker conditions, road safety, and wider economic, social, or environmental benefits in the delivery area.

3.3. Opportunities and challenges

Several geographic factors make London a particularly suitable context for the implementation of microhubs, compared to other large cities.

London has a high density of population and businesses, and a high prevalence of mixed land uses in central areas. As we will mention in the next chapter, density is a crucial locational factor for both the economic viability and the achievement of wider environmental benefits of microhubs.

The street layout also presents an opportunity. Unlike other cities (particularly in North America), London's street network is irregular, not grid-based, and most streets are narrow. These are limitations for the circulation of large freight vehicles, but not to smaller vehicles such as cargo cycles.

The possibility of waterborne transport is another opportunity. The Thames and other rivers, as well as London's network of canals, are a largely unexplored resource for freight distribution, but could be a component of last-mile freight distribution systems using waterside microhubs. This could lead to cost and time savings for freight distribution, while also allowing the use of vehicles that are less environmentally damaging than fuel-based road transport vehicles. It could also reduce congestion on London's roads. One example of the potential of waterborne transport, is the parcel delivery service launched by DHL in 2020, using the River Thames. Parcels are first transported using electric vehicles and then loaded onto riverboats at Wandsworth Riverside Quarter Pier. This allows for faster deliveries to central London.

Land costs are a challenge. A report by Peter Brett (2019) for Transport for London on strategies for freight consolidation in London concluded that the biggest barriers to implementation of micro hubs were the availability and cost of suitable premises. The report suggested Transport for London and London Boroughs to work together to identify potential locations in "non-traditional" logistics facilities, including car parks, basements of large office or shopping centres and underdeveloped land.

4

Locational aspects

4. Locational aspects

This chapter describes the potential relationships between the location of the hubs, within a city, and their economic viability and potential to generate direct and wider benefits. Sections 4.1 and 4.2. discuss those relationships and Section 4.3. gives examples of experiences in selecting optimal locations.

4.1. An operator perspective

From an operator's perspective, the long-term viability of microhubs depends on the demand for delivery services from those hubs. This depends not only on the size of the delivery areas but also on the location of these areas, in relation to the location of the hub, as this affects vehicle mileage and total time spent delivering, which are key components of the distribution costs. One possible indicator of the potential demand for a microhub is the number of residents and businesses in the areas surrounding the hubs (e.g., within a certain travel time by electric van or cargo bike).

The economic feasibility of using low-emission vehicles for distribution also depends on the characteristics of the delivery area, with density being the key factor. This is shown in several academic studies. For example, the economic benefits of using mobile depots and cargo bicycles in Rio de Janeiro were considerably higher in dense areas with many small traditional shops (Marujo *et al*. (2018). In the study of Choubassi *et al*. (2016) in Austin, some types of cargo cycles had much higher costs than vans when operating outside Central Business District for last-mile mail delivery. In Paris, cargo cycles would only be more cost-efficient than electric vans in a scenario with a few microhubs located in areas where the demand is densest (Robichet *et al* 2022).

Another important factor is the condition of the road transport network in the delivery areas, as this affects both the travel times to delivery locations and the delivery times in those locations (considering the time needed to find a suitable stopping place and to walk to the premise). The characteristics of the road network affecting travel and delivery times include the road layout, surface conditions, congestion, competition for kerbside space, and restrictions impeding access of some or all types of vehicles to some streets at some times of day.

As an example of the importance of road infrastructure on delivery performance, Conway *et al*. (2017) found that, in New York City, the competitiveness, in terms of speed, of using cargo cycles for local deliveries, in comparison with trucks, depended on the type of road. On main roads, the cargo cycle speeds were only slightly lower than the speeds of trucks. On streets, cargo cycle speeds were higher. Furthermore, cargo cycle speeds were higher on roads with protected cycle lanes than in those with unprotected cycle lanes. However, travel times by cargo cycle were always more reliable than those of trucks.

Another important locational aspect is the accessibility of the workforce to the hub. Delivery workers need to access the hub, which thus need to be located in areas with good public transport access (e.g., near stations or bus routes) or in areas with a large density of workers living within walking or cycling distance. Freight operators using hubs located in areas that are not easily accessible may find it difficult to attract workers, especially given the typically low incomes earned in last-mile delivery service work.

The impacts of the hubs on costs and profits also depend on the costs associated with using the hub. These costs depend on land prices, which in turn depend on location. Efficiency gains also depend on the size and the characteristics of the hubs. The hub should provide enough space for the storage of vehicles and products. The choice set of available properties with adequate size and characteristics depends, again, on location. More desirable locations in central areas are associated with a higher cost and a more limited choice set in terms of size and characteristics, due to competition from other land uses (residential, commercial, office, leisure).

Local road and kerbside management are also important, as these affect travel and delivery times. As an example, Tipagornwong and Figliozzi (2014) showed that the competitiveness of using cargo cycles for delivery in Portland, compared with diesel vans, depended on the local speed limits and parking policies, not on the value of the vehicles or their usage. Figliozzi and Tipagornwong (2017) also proved that operating costs are related to parking availability. A model developed by Muñuzuri *et al*. (2012) and applied in Seville also found that in central areas with access time windows, microhubs were a cost-effective solution.

Other requirements for selecting locations include the availability of electric charging points throughout the delivery area. This is a particularly important aspect for schemes relying on deliveries by electric vehicles.

4.2. A city government perspective

The potential of microhubs for achieving the wider benefits described in Section 1.5 also depends on the location of the microhub, within the city. For example, the possible reduction of congestion and pressure on road kerbsides achieved by shifting from large vehicles to cargo cycles depends on the availability of suitable infrastructure for the movement and parking of those cycles within the delivery area.

The achievement of environmental benefits is also related with location. The potential reduction of emissions (due to a reduction in total distance covered per delivery and/or lower emission per delivery when using cargo cycles) depends on the number and composition of current road traffic in the delivery area, as well as the characteristics of the local road network. As an example, Wygonik and Goodchild (2018) showed that the reduction of emissions generated by a microhub-based last-mile freight distribution system, compared with an unconsolidated system or a system based on regional consolidation, depended on local road density.

Energy savings are also related to location. For example, Figliozzi (2017) showed that electric cycles are more energy-efficient than diesel vans in dense urban areas and multi-stop routes.

Environmental impacts should also be assessed outside the delivery area. It is possible that motorised traffic is redistributed, decreasing in the delivery areas but increasing near the hub (which concentrates the deliveries by fuel-based motorised modes from elsewhere).

The social benefits of the hubs depend on the demographic and socio-economic composition of the surrounding area. There are potential equity benefits if the surrounding population can take advantage of the increased employment opportunities created by the delivery businesses based on the hub, and by the revitalised local businesses benefiting from more efficient distribution and better local environments. The equity aspect is also important if the improved local environmental conditions occur in areas that previously had pollution above standards or affecting vulnerable populations.

Social benefits are also higher in areas where the shift from motorised freight vehicles to non-motorised vehicles leads to a significant reduction of traffic collision risk. However, this reduction depends on the suitability of the local road network for non-motorised vehicles. The increase of cargo cycle traffic in parts of the road network with no cycling infrastructure and no segregation between that traffic and motorised modes can in fact lead to an increase in collision risk, injuries, and fatalities among delivery workers.

The absence of suitable cycling infrastructure also has negative implications for pedestrians. As an example, a study in Seattle found that cargo cycle drivers park their vehicle on pedestrian pavements 80% of the time, and drive on pedestrian pavements 37% of the time, which was partly explained by the insufficiency of the road infrastructure for accommodating cargo cycles (Dalla Chiara *et al*. 2023).

4.3. Selecting optimal locations

Some studies compared the suitability of different locations within a city, for future microhubs. For example, a study for Cross River Partnership ranked 29 potential sites in central London (Steer 2020). The list of these sites was based on suggestions made by local authorities, landowners, businesses, and Business Improvement Districts. The sites were assessed qualitatively, based on several criteria. However, the only locational criterion was proximity to the road network managed by Transport for London. Furthermore, the study was limited to only six of the 13 local authorities in Inner London.

Some academic studies developed analytical methods for selecting optimal locations for microhubs. For example, Rudolph *et al*. (2022) used a multi-criteria approach to find optimal locations for hubs in Stuttgart using three criteria: (level of) demand, land use (commercial, residential, mixed, other) and type of road (cycle street, pedestrian zone, one-way road, and traffic-calmed road). Potential candidate locations were previously identified using GIS methods, considering the size and distance to the delivery area. Using different weights to combine the three criteria resulted in slightly different optimal locations. The solutions can then be validated by stakeholders. Novotná *et al* (2022) also used a multi-criteria approach to determine the optimal location for a hub in Pardubice (Czech Republic). The criteria included distance to the logistics centres of individual carriers, site area, type of cycling infrastructure, cycling distances, and costs. Finally, Arrieta-Prieto *et al*. (2021) developed a heuristics method for finding optimal locations for microhubs in New York, based on city blocks, but the method is complex to be applied in regular practice.

As noted, these approaches have caveats and do not consider all possible criteria for location, especially the scope for achieving wider societal benefits. Overall, there is still insufficient evidence on how the location of microhubs affects their economic viability and the range of potential direct and wider benefits it can achieve. The next section of this report addresses this gap.

5

A systematic analysis of potential sites for microhubs in Greater London

5. A systematic analysis of potential sites for microhubs in Greater London

5.1. Objectives and methods

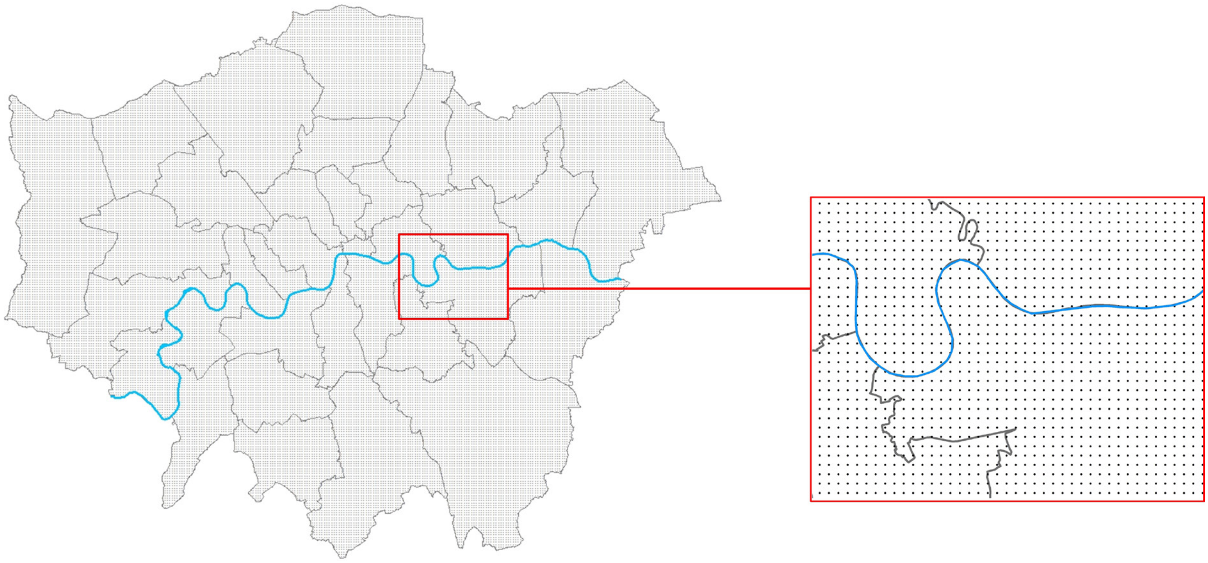
The aim of this analysis was to produce a detailed locational analysis of the locations in Greater London most suitable for the siting of urban logistics hubs, served by cargo bikes. This involved collecting relevant spatial data and combining and overlaying data from various sources.

The suitability of each potential location in Greater London was assessed based on the following factors, derived from the findings of earlier chapters:

- Demand for deliveries, from residents and businesses
- Infrastructure and operation conditions of cycle infrastructure in delivery area
- Availability of labour
- Wider social/environmental benefits of shifting motorised vehicles to cargo cycles in the delivery area
- Site-level constraints

The assessment was done for a grid of 39,861 points spaced 200m apart and covering Greater London **(Figure 2)**.

Figure 2: The 200m analysis grid applied across Greater London



The analysis was carried out in five steps, The first three steps select the number of the grid points assessed as suitable for the location of the microhub. The final two steps characterise the selected points.

Selection of points

Step 1: Identify a minimum viable level of demand, based on:

- Population size and density
- Numbers of businesses and institutions

Step 2: Identify the existence of conditions suitable for deploying cargo bikes:

- Availability of cycle lanes/tracks in the vicinity
- Traffic calming in the surrounding area
- Local area safe for cycling (based on history of collisions involving cycles)
- Sited along freight distribution routes (based on current goods vehicles traffic flows)

Step 3: Identify the availability of a suitable pool of labour:

- Characteristics of the local labour force
- Quality of public transport access for workers living elsewhere

Characterisation of selected points

Step 4: Environmental vulnerabilities:

- Measured environmental conditions (noise and air pollution)
- Sensitivity of population to local environmental conditions
- Sensitivity of land uses to local environmental conditions

Step 5: Site level constraints:

- Siting of an existing car park or a business/industrial area in the vicinity
- Constraints on electricity capacity (for EV and cargo cycle charging)

The outcomes from each stage are summarised in the following sections.

5.2 Step 1: Minimum viable level of demand

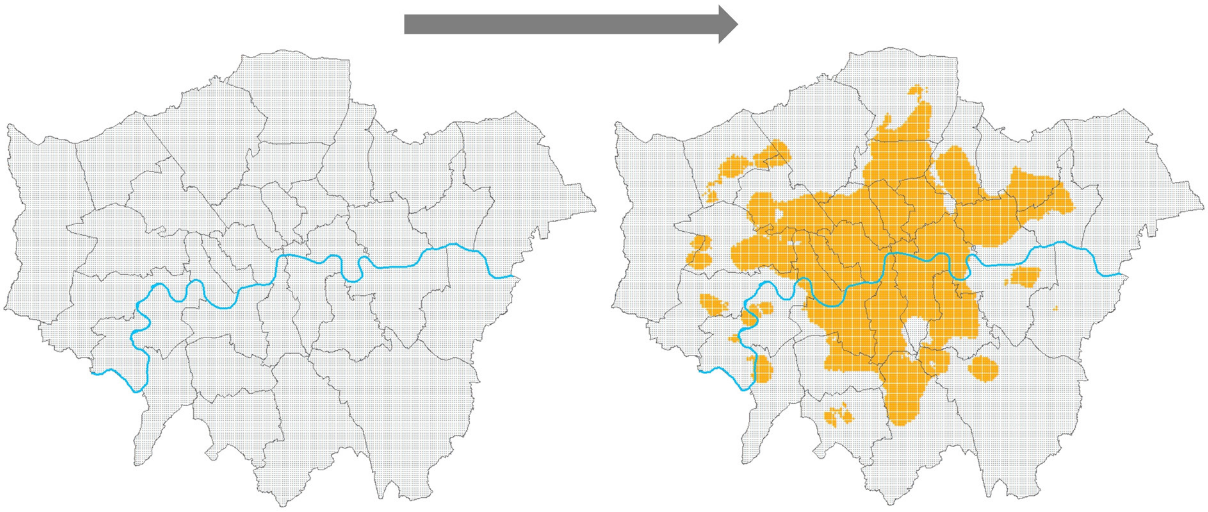
Table 3 defines the filtering criteria used to identify grid points that provide a potential minimum level of service to commercially support cargo bike deliveries in the local area, and the data sources used. The cut-off is based either on a minimum population size (representing potential demand for home deliveries) or on a minimum number of business and institutional 'points of interest' (representing potential demand for commercial services). It uses the 75% percentile values for all grid points across Greater London (i.e., the value exceeded by 25% of points), corresponding to a population of over 54,836 people or a number above 1,339 points of interest. A cut-off crow fly distance of 1600m around each grid point was used – generally equivalent to about a 2km network distance.

Table 3: Criteria for locations providing a minimum level of demand

	Indicator	Radius around grid point	Data source	Condition
Population	Number of residents	1600m	2011 population census[1]	>75% percentile (>54,836)
Business and institutions	Number of businesses and institutions	1600m	Ordnance Survey Points of Interest (2021) Selected categories: • 01 Accommodation, eating and drinking • 02 Commercial services • 03 Attractions • 04 Sport and entertainment • 05 Education and health • 0633 Central and local government • 0635 Organisations • 09 Retail	>75% percentile (>1,339)

The consequence of applying these filters is shown in **Figure 3**. The number of grid points reduces from 39,861 points to 11,904 points – a reduction of over 70%.

Figure 3: Reduction in grid points after applying the viable level of demand filters



[1] The 2021 Census of Population data were not available at the local level, at the time of this analysis.

5.3 Step 2: Suitable infrastructure and operating conditions

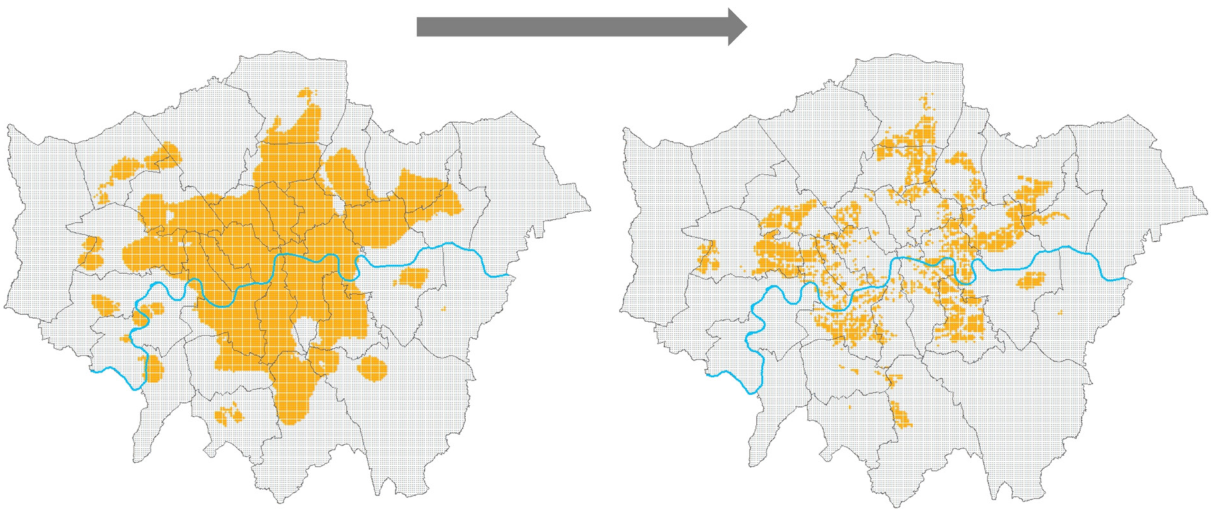
The second set of filters were applied sequentially and considered the provision of cycle and road safety infrastructure, cycle collisions, and access to the road network carrying high volumes of Heavy Goods Vehicles, as an indicator of ease of access for inbound bulk loads. These filters are defined in **Table 4**, which also shows the cut-off threshold values in each case.

Table 4: Criteria for suitable infrastructure and operating conditions

	Indicator	Radius around grid point	Data source	Condition
Availability of cycle lanes/tracks	Metres of cycle lanes/ tracks	400m	Transport for London (2021) Includes lanes shared with buses	>0
Traffic calming	Number of structures for traffic calming	400m	Transport for London (2021)	>median (>8)
Safe for cycling	Number of collisions involving cyclists in last 5 years	200m	Department for Transport (2016-2020) Indicator sums collisions involving bicycles and motorised vehicles or pedestrians	<90%percentile (<5)
Along freight distribution routes	Annual average daily flow of goods vehicles	1600m (mean)	Department for Transport (2019) Indicator adds light and heavy goods vehicles	>median (>3,816)

Figure 4 shows the cumulative effect of applying these four filters. The number of prospective grid points further reduces, from 11,904 to 3,704 points.

Figure 4: Reduction in grid points after applying the infrastructure/operating conditions filters



5.4 Step 3: Availability of labour

The next step involved assessing the likely availability of labour to operate the hub and ride the cargo bikes. This was based on three factors: local availability of labour, accessibility by public transport over a wider area, and a composite index of local labour market composition. This index comprised three variables: proportion of resident workers in routine and semi-routine occupations, proportion of unemployed residents, and non-car ownership levels. Further details are provided in **Table 5**.

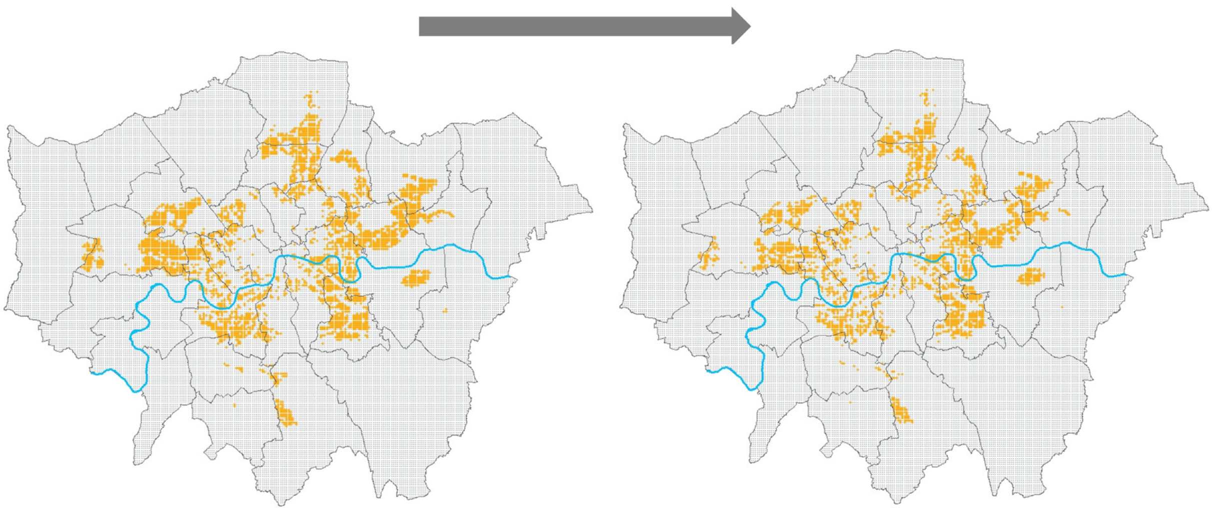
Table 5: Criteria assessing labour supply and suitability

	Indicator	Radius around grid point	Data source	Condition
Local labour	Composite indicator (0-1) – see below	1600m	2011 census[2]	>median (>0.18)
Public transport accessibility	TFL Public Transport Accessibility Levels (PTAL)	In census output area	Transport for London (2015) NOTE: Indicator considers…	>=2

Local labour composite indicator					
0.4 *	Number of residents working in routine and semi-routine occupations (as a proportion of maximum)	+ 0.4 *	Number of unemployed residents (as a proportion of maximum)	+ 0.2 *	Number of households with no car (as a proportion of maximum)

Figure 5 shows the effects of applying these filters across Greater London. The number of potential grid centroids that might be suitable locations for microhubs reduces from 3,704 sites to 3,109 sites.

Figure 5: Reduction in grid points after applying the labour supply and suitability filters



[2] Based on 2011 Census of Population data, as local level data for 2021 was not available at the time of analysis.

5.5 Step 4: Environmental vulnerabilities

Environmental conditions with 400 metres of the remaining 3,109 sites were measured by three pairs of indicators: measured environmental conditions (noise and PM10), potential vulnerable population groups (younger and older cohorts), and sensitive locations (primary schools and health institutions). A threshold is defined for each indicator. Further details of the indicators and data sources are provided in **Table 6**.

Table 6: Variables assessing environmental vulnerabilities

Pair of indicators	Indicator	Radius around grid point	Data source	Threshold
Measured environmental conditions	Annual average roadside noise levels (7:00–23:00) (db(A))	400m (mean)	DEFRA (2012)	55 dB(A)
	Annual average PM10 concentrations (µg/m3)	400m (mean)	GLA and TFL (2019)	3
Sensitivity of local population to environmental conditions	Number of residents aged below 18	400m	2011 population census	Median (480)
	Number of residents aged above 65	400m	2011 population census	Median (284)
Sensitivity of local area to environmental conditions	Number of primary schools	400m	Ordnance Survey Points of Interest (2021) Selected categories: • 05310375 First, primary and infant schools • 05310377 Independent and preparatory schools	0
	Number of health institutions	400m	Ordnance Survey Points of Interest (2021) Selected categories: • 0528 Health practitioners and establishments (only sub-categories 365, 369-73, 780, 809, 812, 815)	0

Figures 6, **7** and **8** characterise the previously selected 3019 points in terms of the three pairs of indicators described above. Each figure shows the points above one of the threshold values, the points above the two threshold values, and the other points (equal or below the two thresholds).

Figure 6: Measured environmental conditions in the selected points (noise and air pollution)

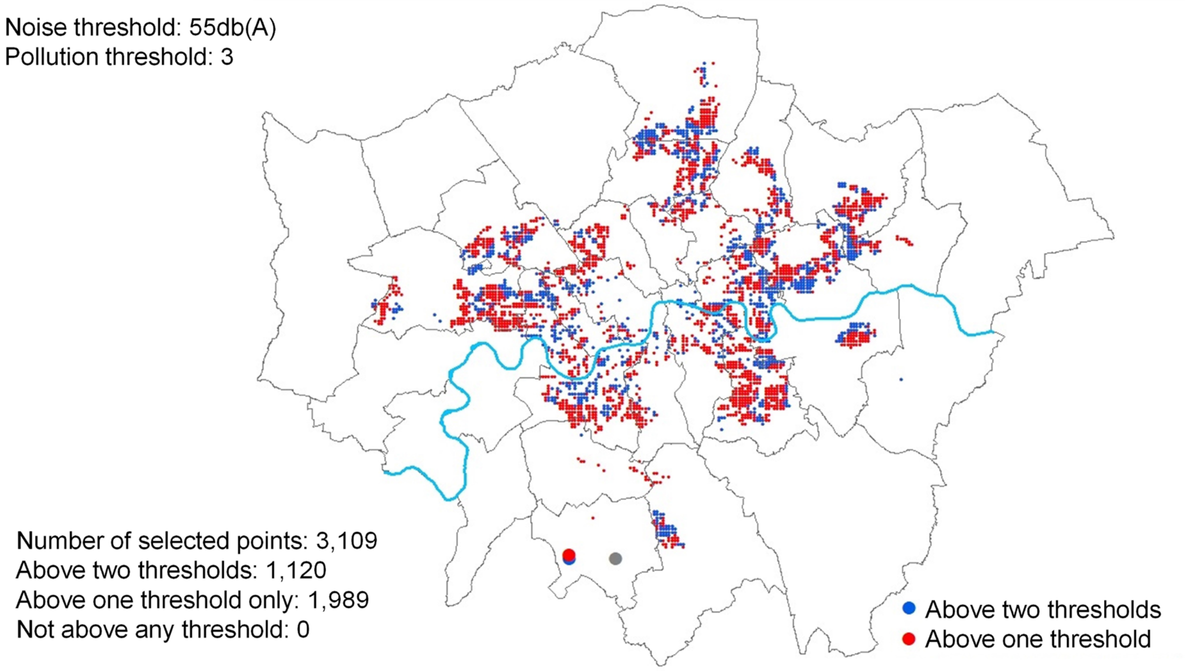


Figure 7: Vulnerable populations in selected points (aged<18 and >65)

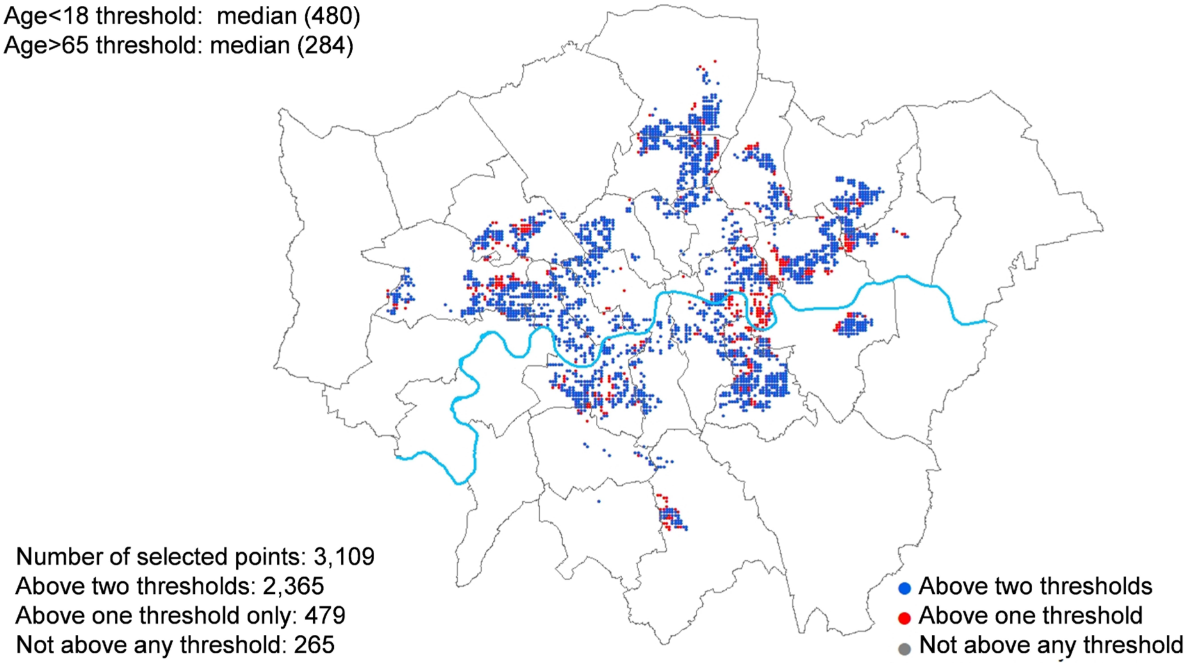
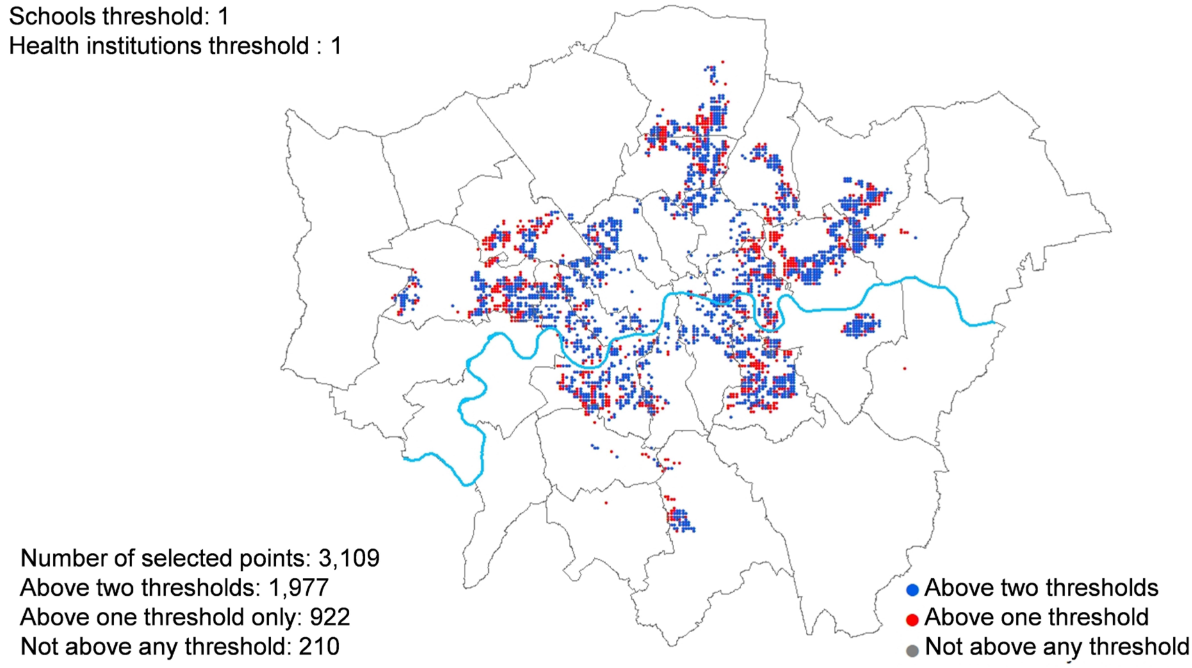


Figure 8: Vulnerable land uses in selected points (schools and health institutions)



5.6 Step 5: Site-level constraints

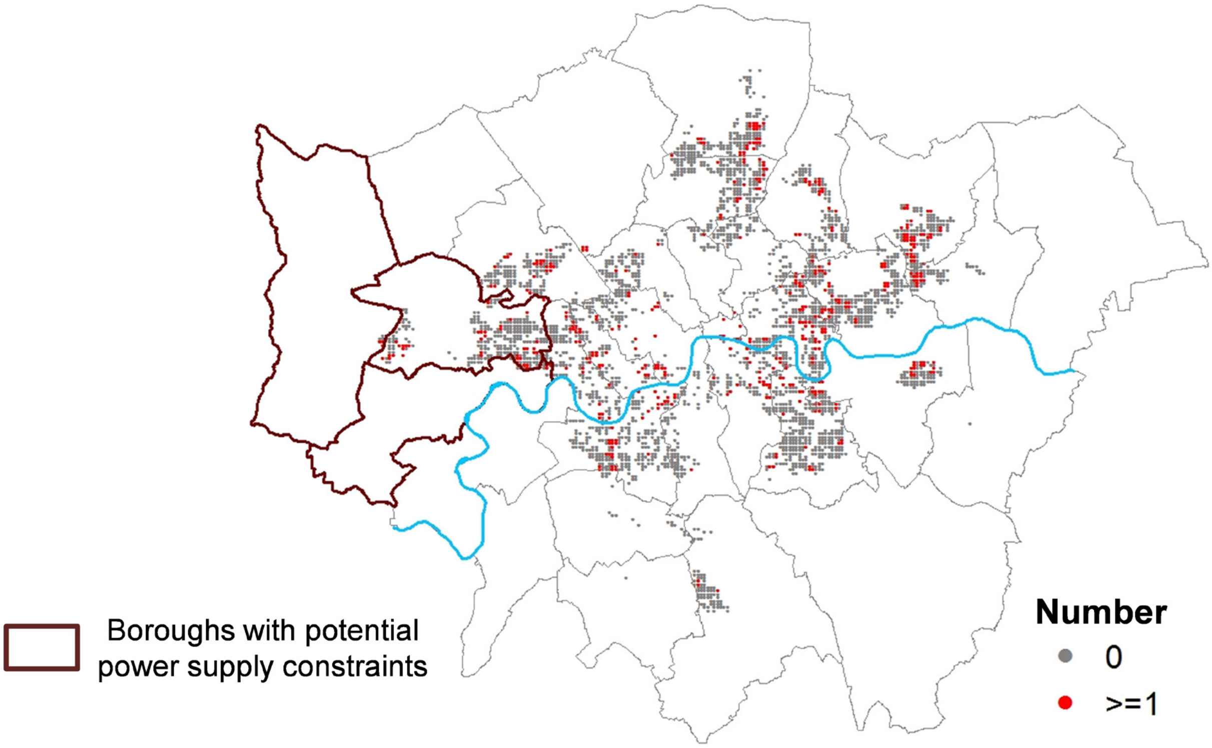
The selected points were also characterised in terms of the likelihood of finding a suitable site within 200m based on the availability of an existing off-street car park and/or a business area or industrial estate. Details are provided in **Table 7**.

Table 7: Site-level constraints

Indicator	Radius around grid point	Data source
Number of car parks	200m	Ordnance Survey Points of Interest (2021) Category: 10540736 Parking
Number of business areas and industrial estates	200m	Ordnance Survey Points of Interest (2021) Category: 07410531 Business parks and industrial estate

Figure 9 shows the locations of the points near either an off-street car park or a business area or industrial estate. The figure also shows the areas of London with major constraints on electricity capacity, using information from GLA (2022)[3].

Figure 9: Number of nearby local car park or business car/industrial estate, also showing electricity capacity constraints



[3] GLA (Greater London Authority) West London Electrical Capacity Constraints., https://www.london.gov.uk/sites/default/files/checked_westlondoncapacity_0.pdf

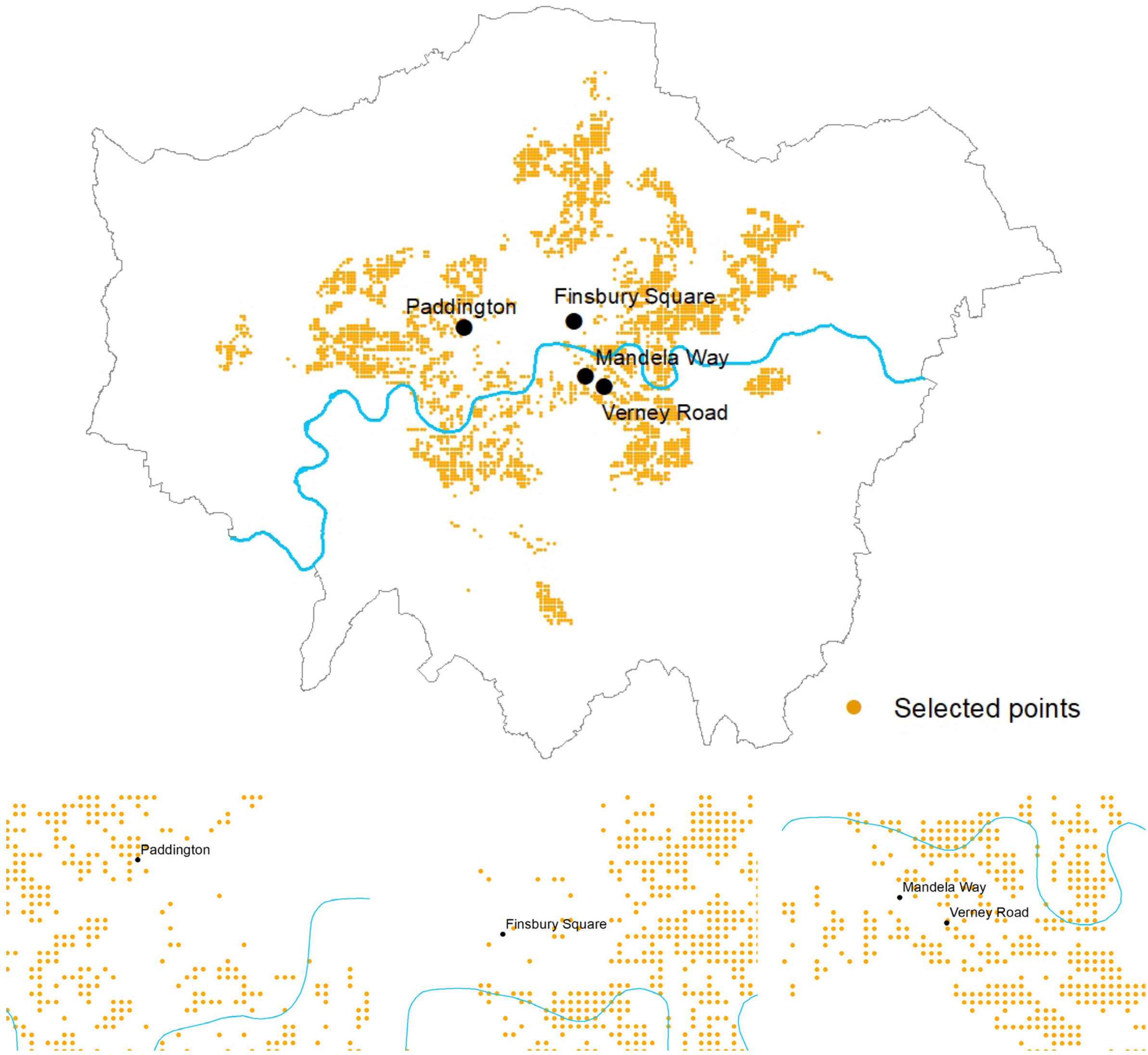
6

Assessment of potential British Land microhub sites in Central and Inner London

6. Assessment of potential British Land microhub sites in Central and Inner London

The preceding analysis was applied to four sites in Central and Inner London, where British Land is exploring the case for building a microhub, either into a new development or through retro-fitting. **Figure 10** shows the site locations, overlayed with the set of grid points selected in the previous chapter (Steps 1-3). All four sites are located in or close to clusters of selected points

Figure 10: Potential sites vs. selected grid points



7

Conclusions

7. Conclusions

Low-carbon microhubs, largely served by cargo bikes and by foot deliveries, are one solution to reduce the contributions of the urban freight sector to local and global environmental problems, and to contribute to wider societal benefits. The deployment of these hubs and the associated shift towards employing more sustainable transport modes is becoming pressing, given trends such as the increase in demand for home and business deliveries, shifts in political and public priorities towards sustainability and liveability, growing concerns about congestion and increased competition for roadspace and kerbside space.

In theory, microhubs can not only reduce environmental problems associated with last-mile freight distribution in cities, but can also deliver direct benefits for shippers, freight operators, and customers, as well as wider economic and social benefits for the communities served. However, sites need to be carefully selected for such benefits to be realised, and for operating cost savings and improved customer service to be achieved.

This document discussed these potential benefits and costs, and reviewed evidence on their realisation, internationally and specifically in London. The study has also developed and demonstrated a method for assessing optimal locations for microhubs, using London as a case study.

8

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