Appendix 2

LONDON CYCLING CAMPAIGN

# MICROMOBILITY AND ACTIVE TRAVEL IN THE UK

## THE RISE OF SMALLER MODES, AND RESULTING INFRASTRUCTURE, SAFETY AND REGULATION IMPLICATIONS


A research paper by the
Policy Forum of the London Cycling Campaign

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# EXECUTIVE SUMMARY

**LCC is a strong supporter of all forms of active travel. Walking and cycling are the older active travel modes, while over the years, a wider range of cycle types, including electric cycles, adapted cycles and commercial cargo cycles, have become available. To these, a range of new travel modes such as electric scooters have recently been added, under the wider term of 'micromobilities,' along with the proliferation of shared cycle, e-bike and e-scooter schemes.**

In this paper, while we use a wider definition of micromobility that includes pedal cycles in some contexts, we are focusing on the new electric micromobility (e-micromobility) modes notably e-bikes, e-scooters and e-cargo bikes. Such powered modes constitute active travel to a smaller (e-scooters) or greater (e-bikes) extent. It is important to understand what impacts the new powered modes will have on both travel in general and on active travel in particular, which offers benefits beyond those of transport.

Micromobility, in the widest sense, and its electrification, presents an opportunity to achieve a reduction in private motor car use and enable more and a wider range of people to move about without using motor vehicles.

In this research paper LCC's position on road danger reduction, notably in consideration of the speed and mass of the vehicle, was paramount when considering e-scooters, and micromobilities in general. The emerging evidence shows significant similarities between e-scooters with pedal cycles and e-bikes in these considerations, partly because of the similarity of speeds and mass. The common issues include a higher risk of injuries involving motor vehicles compared to other road users, and the safety gains to be had from segregated space for their use.

This paper offers arguments and options regarding the practical application of e-micromobility in the United Kingdom. It defines micromobility using mass and speed boundaries, as is increasingly the common approach, taking into account electric motor and pedalling requirements.

The paper specifically considers: the rise in two types of e-micromobility (e-bikes and e-scooters), within the last decade; the use of e-micromobility for freight deliveries; regulation, in the context of the UK Government's consultation on e-micromobility, including product (hardware) and sharing (operations) regulations; street design and parking.

## KEY POINTS FROM CHAPTER 1 – INTRODUCTION

A more equitable distribution of road space and reduction in those problems which negatively impact our health is required for a humane city: a city that is calm and enjoyable, and promotes social connections with others.

Any form of e-micromobility has much more in common with cycling than public transport such as buses or trains. The ability to move around the city unencumbered by an enclosed vehicle, to choose a route and to diverge from it, is consistent throughout cycling, walking and micromobility.

## KEY POINTS FROM CHAPTER 2 – WHAT IS 'MICROMOBILITY'

Speed and mass of vehicles impact the safety of streets and the opportunity for everyone to access streets without fear of road danger. It is also evident that faster and heavier vehicles produce more pollutants, which harm us, our cities and the planet.

While some doubt the longevity of micromobility and suggest that e-scooters are a fad, the sheer number of trips already occurring in cities across the world cannot be ignored. This paper considers micromobility as a collection of viable transport modes that raises a range of issues for the cycling community.

This paper accepts the basic categories of micromobility defined by the International Transport Forum (Figure 2-4) and proposes some amendments as the basis for a regulatory structure in the UK. How these types develop and interact will be key to making a variety of micromobility modes work long-term in cities.

## KEY POINTS FROM CHAPTER 3 – EMERGING E-SCOOTER DATA

A simple analysis from averaging worldwide data showed a large shift to e-scooter use from private vehicles (36%) and walking (37%), with a lower shift from public transport (13%) and cycling (9%). Data from European cities, which typically have better public transport than the US, shows a greater shift from public transport. Notably, cycling experienced the lowest of all shifts in all scenarios.

There is evidence from numerous e-scooter pilot reports indicating that users have the same preferences as cyclists: riding on low-speed streets and in segregated lanes.

Charging a privately owned e-scooter amounts to a small fraction of an individual's annual $CO_2$ emissions, based on typical annual usage patterns. While shared e-scooters also have low emissions, re-charging practices – particularly collection of scooters by van overnight – can result in higher total emissions.

## KEY POINTS FROM CHAPTER 4 – THE GROWTH IN E-BIKES

Electric bicycles represent one of the most significant opportunities for a micromobility future. They allow a wider range of users to access individual mobility with all the time saving and many of the health benefits that entails.

## KEY POINTS FROM CHAPTER 5 – LAST MILE DELIVERY E-CARGO MICROMOBILITIES

A coalition of personal users of micromobility, in the wider sense, and commercial e-cargo freight users could be a strong force lobbying for wider lanes to suit all users.

Adaptations to (normally electric) cycles push the boundaries of ’micro’mobility, with trailers, extra seats, extra wheels, extending beyond current regulatory categories. This raises important questions about the functionality of segregated cycle lanes, and the inclusion of larger types of commercial micromobility potentially at the expense of more vulnerable cyclists.

## KEY POINTS FROM CHAPTER 6 – REGULATING MICROMOBILITY

Regulations should be applied to micromobility, and regulation has already been developed in a number of places. Usually, a national definition of mode is used to decide where on the road those vehicles can travel, while regulations about sharing operations are applied at a local authority level.

The rapid uptake of some e-micromobility modes as a novelty could lead to overstating the risks involved, and consequent over-regulation of all micromobility – including cycling.

The ’novelty’ of e-micromobility modes, combined with the ease of access through an app, may encourage constituencies who do not cycle to try out micromobility.

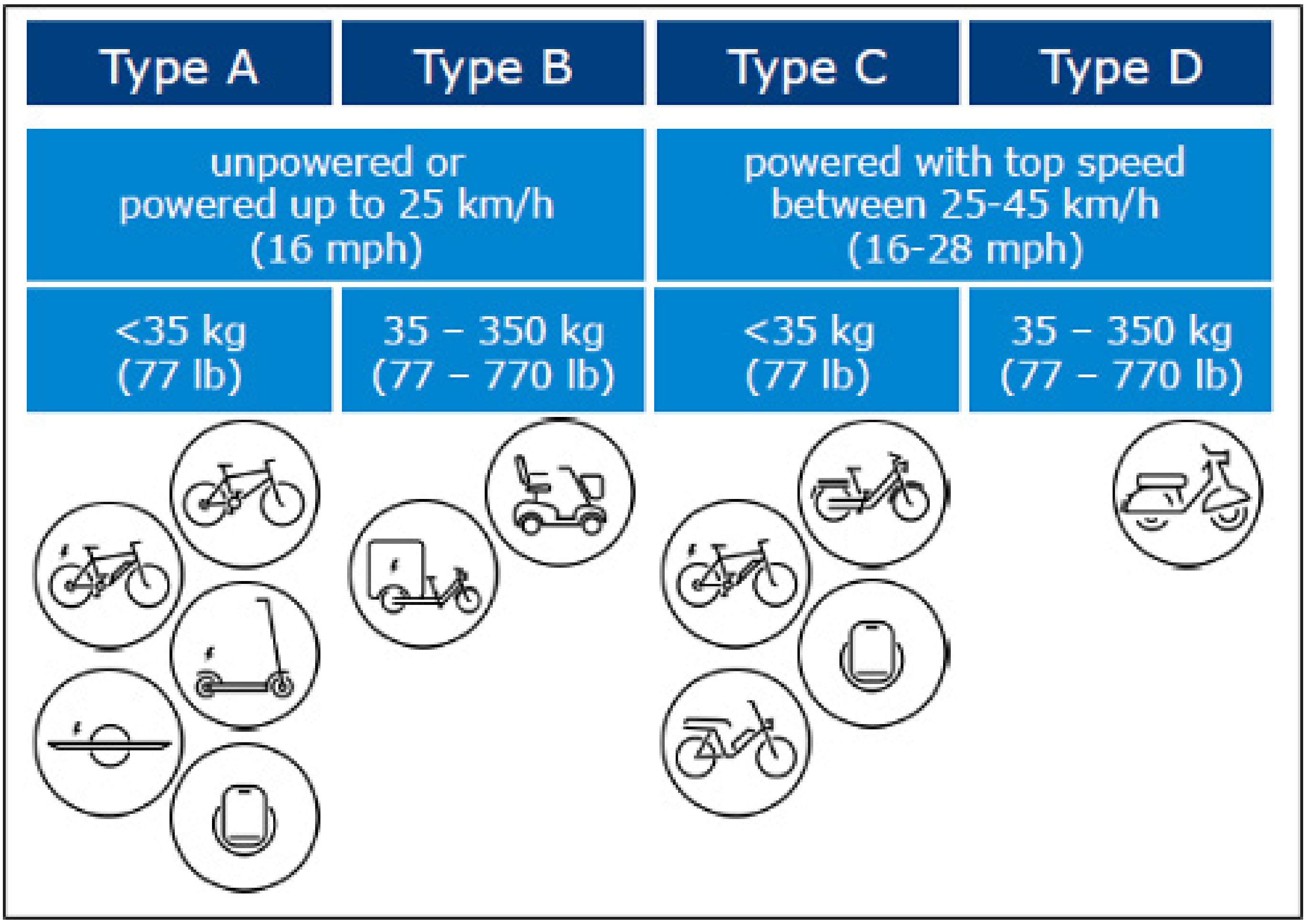
## KEY POINTS FROM CHAPTER 7: INFRASTRUCTURE AND DESIGN FOR MICROMOBILITY

Increased pressure on cycle routes is not a bad thing – it indicates the need for more road space reallocation. The implications of greater mode share for micromobility could be significant: many roads free from motor traffic, larger cycle lanes and freight delivered by e-bike and electric vans rather than diesel-powered lorries

Using the types of micromobility defined in Chapter 2, the chapter discusses how micromobility might open up new, safe and equitable layout options for UK streets.

Getting parking right is difficult but crucial: both for sharing schemes and for personal e-micromobility vehicles. The UK has the advantage of coming late to the regulatory sphere in that it can draw on the successes of other countries’ e-micromobility parking solutions.

Planning policies may need to be adjusted to provide space to securely park (and charge where relevant) significant numbers of micromobility devices, both at home and at various destinations. Just as different kinds of streets require different types of infrastructure, different destinations need different kinds of parking.




Proposed micromobility definition and classification from the ITF's Safe Micromobility report (Source: Safe Micromobility, International Transport Forum, 2020)

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# 1. INTRODUCTION

**LCC's *Climate Safe Streets* report sets out a roadmap for the radical steps needed to decarbonise London's road transport system by 2030. Micromobility will play a large role in this future. Many changes are already visible on our streets today as a rising tide of dockless bikes, electric scooters and private hire apps influence people's transport choices. Many more changes and innovations that will affect us do not exist yet, or are still not visible.**

The rise of micromobility is clearly evident both in the news and on our streets, with e-bikes and e-scooters the most prominent recent newcomers. We have also seen the rise of the concept of Mobility as a Service (MaaS) which seeks to integrate, through a unified digital gateway, a range of shared and hired transport modes enabling, for example, a journey combining e-bike, rail and e-scooter. Across the world, we have seen the rapid rise of these technologies – not just due to venture capital-funded start-ups providing shared use, but also the convenience they provide to users. Despite the illegality of the use of e-scooters in the UK, we are seeing them being taken up by a growing number of people.

The majority of our journeys are short: the Department for Transport's National Travel Survey found that, in England in 2018, 25% of trips were under 1 mile, and 68% under 5 miles.[1] Many of these short trips are currently made in private motor vehicles. Their size, speed and emissions, make the large numbers currently on our roads ill-suited for a healthy, emission-free urban environment. Smaller transport modes whether pedal cycle, e-bike or e-scooter, address this problem by offering greater space efficiency, as well as less air and noise pollution.

In the UK, e-scooters and other new forms of electric micromobility are currently illegal to use on public roads, while e-bikes are legal under certain conditions. At the time of writing, the Department for Transport (DfT) has announced a trial and consultation on e-scooters. Given this, and particularly the consideration of legislation on e-micromobility, it is imperative that cyclists and other active travel users develop an understanding of how e-micromobility fits into our cities.

This discussion paper asks how electricity-powered micromobility devices fit in with cycles and active travel. Do e-scooters and other forms of e-micromobility enable the promotion of, and greater access to active travel, and if so, how? What measures do city and national authorities have to put in place so that e-micromobility is conducive to active travel, rather than encouraging modal shift away from active travel?

Our discussion starts with e-scooters, and draws on our knowledge and work with cycles and infrastructure, to envision a likely future of e-micromobility and a policy framework around encouraging sustainable growth in e-micromobility – without negatively impacting other active travel modes or decarbonisation goals.

This paper reviews existing literature and evidence on the matter, and sets out LCC's position on e-micromobility policy in the near and medium future. Regarding the weighting of evidence in this paper, there is a focus on e-scooters more than any other form of e-micromobility, whereas discussion of e-bikes provides links to other sources or reports. Although e-bikes are relatively new technologies, there have been peer-reviewed studies on their benefits to health, collision rates, mode shift and policy proposals on the density of charging spaces. E-scooters on the other hand, have been introduced in many cities by the private sector without discussion with authorities. As such, most of the data cited relating to their implementation was derived from usage statistics provided by the companies themselves.

Throughout this paper, we highlight actions that can be taken now to support micromobility, in the wider sense: future actions that prioritise active travel, provide car-free roads, ample micromobility parking, and those which create equitable and just transport. It is a future in which private car usage is significantly reduced, a future that focuses on the human scale, a future that is calm and enjoyable.

## 1.1 EQUITY, ACCESS AND HEALTH CONSIDERATIONS OF MICROMOBILITY

LCC's *Climate Safe Streets* report highlighted the social justice problems of the current transport system. Not just in London, but across the UK, there is a lack of access to reliable public transport or convenient and safe active travel modes. Transport poverty and poor health disproportionately affect those who are BAME and/or poor. It is the people who contribute least to road danger, air pollution and congestion, that suffer most from their effects. We highlight below key areas where micromobility could impact these issues both positively and negatively.

### 1.1.1 ACCESSIBILITY

Shared micromobility whether shared e-scooters or e-bikes invariably require access to smart phones. Those without internet access or without apps that are compatible with a range of user needs, will be unable to access those services.[2] This is a problem across all smart technology, and should not be forgotten. Consideration should be given to access via alternative means such as terminals at so-called mobility hubs where a range of sustainable transport modes are available.

### 1.1.2 AFFORDABILITY

The high cost of transport can reduce the economic potential of individuals, families and cities. A 2018 UK government analysis showed, "transport was the category with the highest average weekly spend of £80.80, equivalent to 14% of households' average total weekly household expenditure."[3]

Micromobility can be more affordable than motor vehicles and public transport. A non-electric bicycle or scooter can cost less than £200 to buy, and maintenance costs are low. Electric bikes and scooters cost more (from £300 for e-scooters and £500 for e-bikes) but charging costs are very low compared to larger vehicles and parking charges can be avoided. E-scooters have the advantages of being easy to store effectively inside homes and to be taken on some buses and trains. Cycles, on the other hand, are currently hard to store securely for residents of flats.

Any reduction in spending on personal transport has a direct and immediate monetary benefit to individuals and households.

### 1.1.3 AIR POLLUTION

LCC's *Climate Safe Streets* report[4] highlights the numerous air pollution problems we face due to our mobility choices. A majority of emerging micromobility is electric, which certainly limits 'tailpipe' emissions from vehicles, and, if charged with renewable energy, then overall emissions would be lower as well. Smaller battery sizes and less overall material usage further reduces the scale of air pollution compared to motor vehicles.

### 1.1.4 MENTAL AND PHYSICAL HEALTH

Simply being outdoors can be beneficial for people's health. Many studies have shown the positive benefits that access and exposure to nature can have on people's mental health and well-being. Being outdoors is one of the most consistent predictors of physical activity levels. It also has social benefits, increasing opportunity for social exchange with others, particularly when movement is at slower speeds.

All forms of micromobility offer the benefits of being outdoors, as compared with car travel, where the user is effectively inside a metal box and removed from social activity on the street. Micromobility also entails movement at slower speeds, allowing for increased interaction and exchange and, as with other forms of travel such as walking and cycling, it makes it easier to stop when necessary at places of interest, such as local shops and services. Anecdotally, e-scooter riders and e-unicycle riders in London have expressed an enjoyment at being in the open air and riding along the river on the way to work having switched from the Underground.

In this respect, any form of micromobility has much more in common with cycling than public transport transit such as buses or trains. The ability to move around the city unencumbered by an enclosed vehicle, to choose a route and to diverge from it, is consistent throughout cycling, walking and micromobility. This leads towards a different idea of the city, where you can step outside of your home and have control over which route you take and which mode you use.

### 1.1.5 INTEGRATED TRANSPORT

The rise of micromobility can support integrated and multi-modal transport whether that's cycle-rail, e-scooter-rail-e-scooter or other combinations. The smaller size of the vehicles make them easier to carry on public transport (including getting around rail operators' restrictions) and will mean it is easier to provide significant amounts of parking and docking stations at public transport interchanges.

# 2. WHAT IS 'MICROMOBILITY'

**New forms of technology are rapidly being rolled out across the globe from e-cycle freight to hover shoes. Development of new mobilities is accelerating rapidly, and can contribute not only to decarbonisation and air quality, but also to improving the way our cities function. In city centres where space is at a premium, larger vehicles are inefficient for moving people and goods. At its core, this is what micromobility is about: going smaller. It allows for the most efficient use of existing road infrastructure for our cities, our health and our future.**

How is micromobility defined? The report *Safe Micromobility*, published in February 2020 by the International Transport Federation (ITF), defines micromobility as:

"Personal transportation using devices and vehicles weighing up to 350 kg and whose power supply, if any, is gradually reduced and cut off at a given speed limit which is no higher than 45 km/h. Micromobility includes the use of exclusively human-powered vehicles, such as bicycles, skates, skateboards and kick-scooters."[5]

The ITF definition is the one used in this paper because of its advantage in recognising the fundamental similarities between vulnerable, wheeled road users based on their mass and speed. Noting the absence of a consistent definition in the transport industry in general, the ITF definition has value in rethinking the arrangements of our streets based on this fundamental similarity, sparking more ideas and opening up new ways to allocate space in our cities. The variety of existing designs means that definitions and classifications should rely predominantly on speed and mass, rather than design specification.

Figure 0-1: Types of powered micromobility vehicles (Source: Taxonomy & Classification of Powered Micromobility Vehicles (SAE J3194), SAE International, 2019)[6]

**TYPES OF POWERED MICROMOBILITY VEHICLES**[1]

| | Powered Bicycle | Powered Standing Scooter | Powered Seated Scooter | Powered Self-Balancing Board | Powered Non-Self-Balancing Board | Powered Skates |
|---|---|---|---|---|---|---|
| Center column | Y | Y | Y | Possible | N | N |
| Seat | Y | N | Y | N | N | N |
| Operable pedals | Y | N | N | N | N | N |
| Floorboard / foot pegs | Possible | Y | Y | Y | Y | Y |
| Self-balancing[2] | N | N | N | Y | N | Possible |

[1]All vehicles typically designed for one person, except for those specifically designed to accommodate additional passenger(s)
[2]Self-balancing refers to dynamic stabilization achieved via a combination of sensors and gyroscopes contained in/on the vehicle

Another important thing to note about micromobility is its status within technology circles: e-micromobility has seen accelerated capital investment growth of more than $5.7 billion over the last four years.[7] Indicative of the broader move towards shared models of ownership across the economy, shared micromobility is leading this charge. Lime and Bird, two large shared e-micromobility operators, set records in 2018 for the most rapid achievement of 'unicorn' status – achieving $1 billion (£800 million) valuations in just six months.[8] In early 2019, Lime reached a valuation of $2.4 billion.[9]

The growth in micromobility has been mainly e-scooters and cycles (including e-bikes). Given the similarities of the two modes in terms of size, speed and preference for separate road space among users, their operators and users have a common interest in improved infrastructure and road danger reduction. While some doubt the longevity of micromobility and suggest that e-scooters are a fad, the sheer number of trips already occurring in cities across the world cannot be ignored. This paper considers micromobility as a collection of viable transport modes that raises a range of issues for the cycling community, notably with regard to the allocation of road space.

## 2.1 CLASSIFYING MICROMOBILITY

> "This report proposes to define micromobility as the use of micro-vehicles: vehicles with a mass of no more than 350 kilograms (771 pounds) and a design speed no higher than 45 km/h. This definition limits the vehicle's kinetic energy to 27 kJ, which is one hundred times less than the kinetic energy reached by a compact car at top speed."[10]
>
> *Safe Micromobility*, International Transport Forum, 2020, p.14.

Decarbonising cities is, at its root, tied up with designing cities at a human scale. As part of her campaign for re-election in 2020, the Paris Mayor, Anne Hidalgo, defined a transport strategy that focuses on delivering a city where all residents' needs can be met within 15 minutes of their doorstep. This kind of spatial view of urban planning (rather than economic) focuses on reconnecting the city and its residents rather than the separation and isolation that has occurred with car-centric planning. Such redesigning of cities for shorter and varied trips – the kind of trips people make every day – requires some reconsideration of how transport modes are ordered on our streets and the hierarchy inherent in that classification.

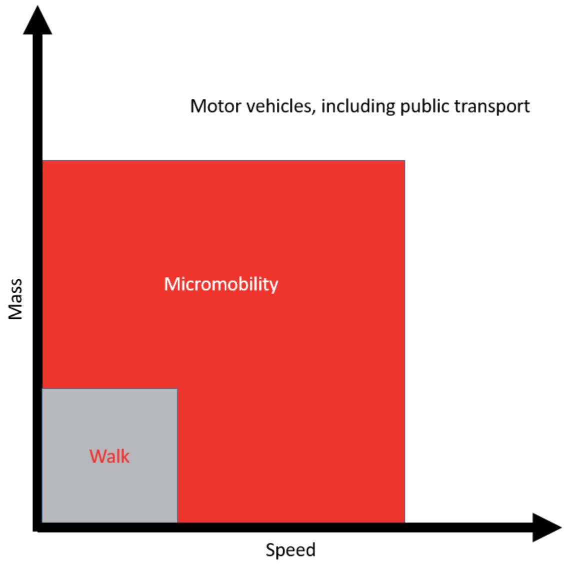
Cycle campaigners know that speed and mass of vehicles are key issues in road design, and when engineers and planners get these right, the results can have a major impact on reducing road danger. This point is emphasised in relation to micromobility in the ITF *Safe Micromobility* report: "Speed and weight together determine the kinetic energy of a vehicle, which correlates with the risk of fatal or serious injuries."[11]

It is also evident that faster and heavier vehicles produce more pollutants, which harm us, our cities and the planet. A city designed for faster and heavier vehicles is not one designed at a human scale – where walking and cycling are the natural choice for short journeys.

Understanding how mass and speed interact will be key to delivering a decarbonised transport future. At a basic level, .

Figure 0-2 highlights the bigger picture: the dangers posed by vehicles are a function of their mass and speed.

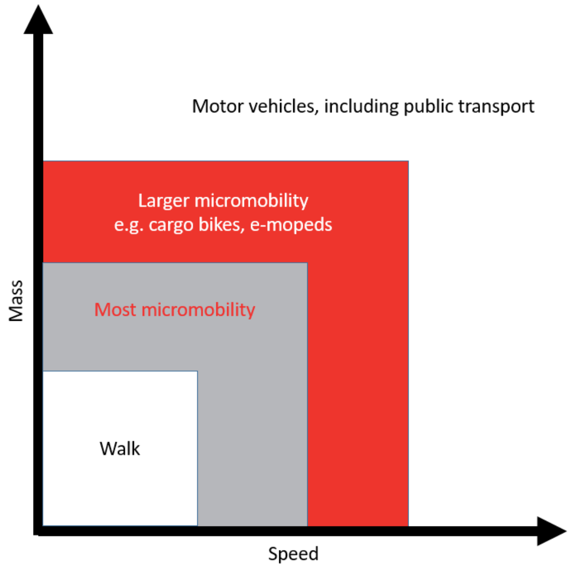
Figure 0-2: Graph illustrating typical operating masses and speeds (Image: Megan Sharkey)




So, how does micromobility fit into this model of road users? With such a wide definition of micromobility as the one being used (quoted above), it is appropriate to introduce subcategories of micromobility. This is both consistent with the larger schema of vehicles defined according to mass and speed, but also permits discussion of active travel and powered mobilities within the definition of micromobility. London Cycling Campaign believes it is important to have a sense of relative activity levels between subcategories of micromobility. This is summarised in .

Figure 0-3.

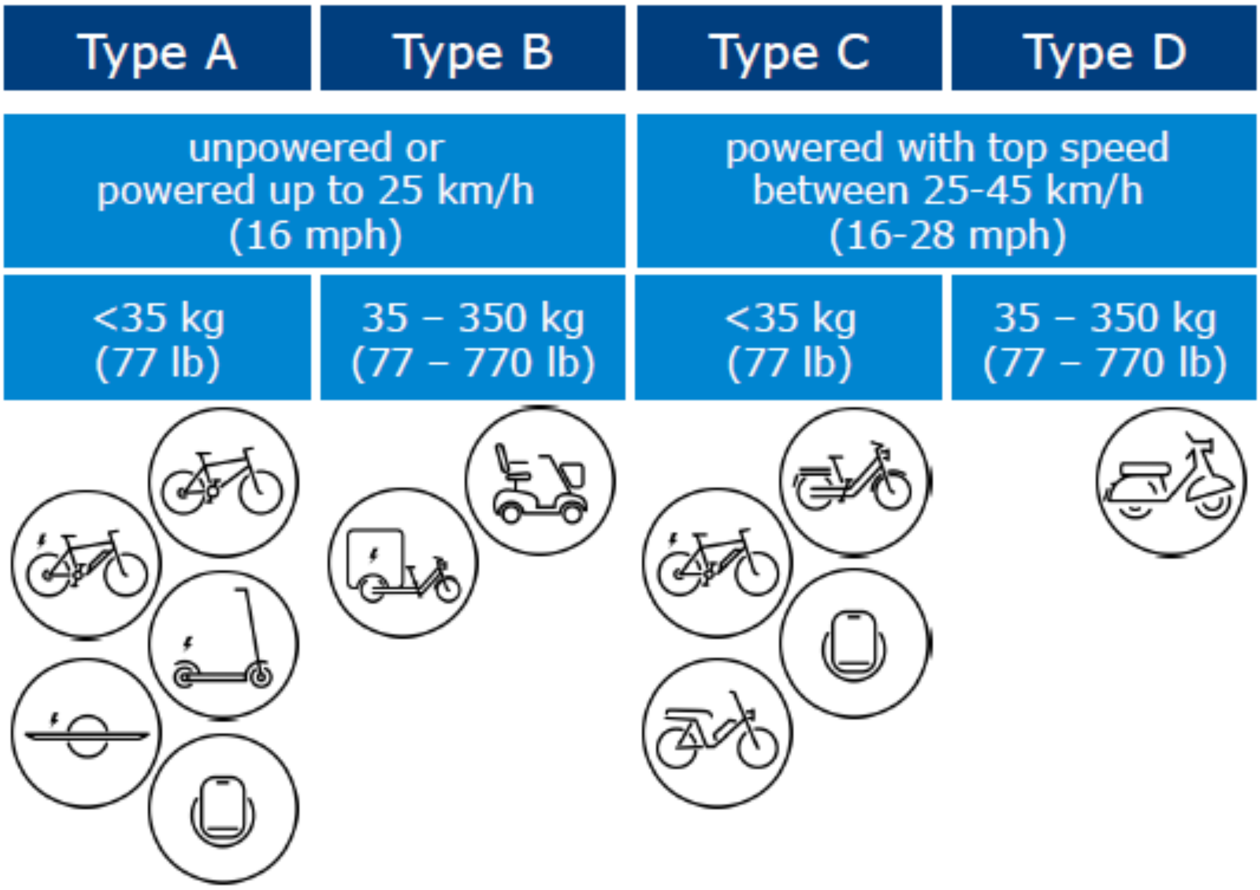
Figure 0-3: Graph of typical operating masses and speeds containing some indicative categories of micromobility, including traditional active modes (Image: Megan Sharkey)




The ITF *Safe Micromobility* report illustrates this point effectively (see .

Figure 0-4). It proposes classification according to other features such as wattage, width and length. These classifications could be used to understand how we should regulate and license, and how infrastructure needs to be developed.

Figure 0-4: Proposed micromobility definition and classification from the ITF's *Safe Micromobility* report (Source: *Safe Micromobility*, International Transport Forum, 2020)[12]



How these types develop and interact will be key to making a variety of micromobility, in the wider sense, work long-term in cities. This paper accepts the basic categories defined by ITF in .

Figure 0-4, and proposes these amendments for the regulatory structure in the UK:

Table 1: LCC positions on micromobility

| Position | Justification |
|---|---|
| • E-scooters (within Type A) should be limited to 12.4mph (20kph). | Although it is possible for many pedal cyclists to reach 15mph, in urban areas it is more common for cyclists to travel at around 10mph. In current conditions where cycle lanes/tracks may be of limited width, fast overtaking by e-scooters should be avoided. |
| • Micromobility vehicles should always have a human rider. | This means autonomous vehicles are not welcome in cycle lanes. Cities should be designed at a human scale, and people of all ages should be comfortable moving themselves around. Active travel modes should be given priority, and goods transport via human-powered micromobility is encouraged. |
| • Type A and Type B vehicles are suitable for use in cycle lanes and tracks. Type C and Type D vehicles are not suitable for any currently existing cycle lanes or tracks. | The current standard width of cycle lanes/tracks in London means use of lanes by Type C or Type D modes would undermine perceptions of safety and separation from fast traffic. Wider lanes or additional lanes could address use by larger micromobilities. |

| | |
|---|---|
| • Width of Type A and Type B vehicles should be limited to less than the operating width of most of London's cycle tracks (approximately 1.3m currently). If a vehicle meets the speed and weight restrictions of Type A or Type B but is wider, it should be considered Type C, and used in the main carriageway instead. | The London Cycle Design Guide (minor updates 2016) recommends minimum widths for cycle lanes/tracks[13] and the operating widths of most types of cycles. This is to avoid a situation in which wider cycles (pedicabs etc) block tracks for other users. It is also assumed that wider vehicles are able to hold space in the road more easily. |
| • Batteries should be of a minimum quality standard similar to that demanded of e-bikes.[14] | The reasoning for this position is that new micromobilities should not be held to a laxer standard as regards batteries than e-bikes. |
| • Licences should be required for riding Type C and Type D vehicles. | Licences are currently required for riding mopeds which travel up to 28mph.[15] Requiring licences for Type D vehicles, even when electric-powered, would be in line with this. Licencing riders of Type C vehicles could take a different form. |

The above adjustments to the ITF subcategories attempt to highlight the mass and speed differential between types of micromobility. Efforts to be inclusive of new technologies should not be at the expense of the most vulnerable users of existing cycle infrastructure such as children on cycles, elderly cyclists or people who just want to travel slower through the city.

Type A and Type D mentioned above should not, unless specific provision is made, share infrastructure space – an e-moped travelling at 45kph and weighing 350kg hitting a child on a cycle could cause a serious injury. There may be a need to develop new forms of infrastructure so that roads can accommodate both groups. This paper advises a conversation about these infrastructures, using the information in Chapter 7.

# 3. EMERGING E-SCOOTER DATA

**It is too early to tell whether the injury rate for shared e-scooter schemes is rising in line with usage, or whether trips resulting in injuries or deaths are higher than comparable vulnerable modes.**

There has undoubtedly been a rise in use of most forms of micromobility over the last few years, but the most attention-grabbing form is e-scooters. Push scooters have long been accepted as an active travel mode, but, as with e-bikes, electrification has opened up a far wider range of uses, enabling longer distance journeys and/or journeys that require less physical effort.

Although electric skateboards, roller skates and unicycles necessitate regulatory attention, it's the introduction of e-scooters in cities across the world by the private sector that has caused the most disruption due to their relative ease of initial use[16] and novelty 'fun' factor. This also means there is data about e-scooters which is an order of magnitude larger than about any other new micromobility mode (not counting e-bikes and e-cargo bikes), and comes mostly from the private sector.

The focus on e-scooters in this report results from this data imbalance. An *active travel* assessment of their introduction has not been done, and little research at all has been done on their introduction into the UK (where they remain legally restricted to private land). Therefore, the following discussion of aspects of e-scooter data is intended to provoke discussion.

Figure 0-1: Bikes and e-scooters share cycle track in Paris (Image courtesy of Tom Bogdanowicz)

## 3.1 MODE SHIFT

Our analysis of existing e-scooter studies of mode shift suggests a significant shift from private car use, and walking, to e-micromobility. This finding forms a central part of how e-micromobility fits into future cities, giving a real alternative to private car ownership.

E-micromobility use on a large scale would not be successful on city streets as they are today: as noted in the infrastructure preference section below, e-scooter users and cyclists alike want to interact with fewer motor vehicles and to use separated lanes. E-scooter users prefer not to ride on pavements designated for pedestrians (and pedestrians don't want them there either). To get to a significant mode share of cycles and e-micromobility, there will have to be a proportionate reallocation of road space.

What impact would the current mode share trends have on UK cities? A simple analysis from averaging worldwide data on e-scooters showed most shift from private vehicles (36%) and walking (37%), some shift from public transport (13%), cycling (9%), with 5% from unknown modes. Data from European cities, which typically have better public transport than the US, shows a greater shift from public transport.

A simple analysis from averaging worldwide data on e-scooters showed most shift from private vehicles (36%) and walking (37%), some shift from public transport (13%), cycling (9%), with 6% from unknown modes. Data from European cities, which typically have better public transport than the US, shows a greater shift from public transport.

Table 2 shows an indication of potential mode shift to e-scooters (adapted from ITF report and LCC research).

Table 2: Modal shift to e-scooters from motoring and walking (Unless otherwise indicated, data is from *Safe Micromobility*, International Transport Forum, p.31)

| Location | Data released by | Mode shift from | | Survey |
|---|---|---|---|---|
| | | Car/ taxi trips[1] | Walking (where data available) | (single, multiple) |
| **Paris, Lyon and Marseille, France[17]** | Lime | 8% | 47% | Single |
| **Paris, France[18]** | Dott | 11% | | Single |
| **Lisbon, Portugal[19]** | Lime | 21% | | Single |
| **Austin, Texas, United States[20]** | Bird | 22% | | Single |
| **Auckland, New Zealand** | Lime | 22% | | Single |

[1] Rounded to the nearest whole number.

| | | | | |
|---|---|---|---|---|
| **Auckland, Hutt Valley, Christchurch, Dunedin, New Zealand** | unknown | 23% | | Single |
| **Atlanta, Georgia, United States[20]** | Bird | 28% | | Single |
| **Seattle, Washington, United States** | Lime | 30% | | Single |
| **Denver, Colorado, United States** | Bird | 32% | 43% | Single |
| **Los Angeles, California, United States** | Bird | 32% | | Single |
| **Phoenix, Arizona, United States** | Bird | 33% | | Single |
| **Portland, Oregon, United States** | Government | 34% | | Single (resident and commuters) |
| **Atlanta, Georgia, United States** | Lime | 37% | | Single |
| **Austin, Texas, United States** | Lime | 40% | | Single |
| **Kansas City, Missouri, United States** | Lime | 40% | | Single |
| **Los Angeles, California, United States** | Lime | 40% | | Single |
| **Portland, Oregon, United States** | Government | 48% | | Single (visitors) |
| **Santa Monica, California, United States** | Government | 50% | | Single[2] |
| **San Francisco, California, United States[21]** | Government | 41% | 31% | Multiple |
| **San Antonio, Texas, United States[22]** | Government | 53% | 37% | Multiple |
| **Chicago, Illinois, United States[23]** | Government | 46% | 30% | Multiple |

[2] This includes bike share.

Overall, companies have claimed the reduction in car use as a victory, whilst largely ignoring the mode shift from walking. It seems evident that, dependent on the city's existing transport usage, there will be shift from all modes. The studies showed cycling experienced the lowest of all mode reductions across the board.

### 3.1.1 CITIES WITH HIGH CAR USAGE

In the USA, a substantially higher percentage of replaced trips come from private vehicles, taxis and shared mobility. London's existing mode shares may be considered incomparable to the conditions for American mode shift data to be of relevance. However, in other UK cities, towns and more rural areas – which have much higher car use – the potential for e-scooter rides to provide a realistic shift option is higher.

One could imagine targeted schemes running between, say, a village and the nearest train station, marketed at commuters and, for example, teenagers attending the town's sixth form college. Barriers that may have prevented these use groups from taking up cycling, such as cycle security or clothing requirements, could be overcome by a shared e-scooter scheme. There are other scenarios where the US data may be more comparable, which may only become apparent over time.

### 3.1.2 OVERALL CHANGES IN TRAVEL BEHAVIOUR

Emerging data on changes in overall travel behaviour provide some light on the replacement of walking trips and trip purpose. Many e-scooter trips were additional trips for entertainment – interviewed users reported they were still using other modes of transport regularly.

A Baltimore study reviewed how often e-scooter users continued to use other modes of transport.[24] If they were using one of the modes of transport noted in the mode shifts, it asked how they continued using it afterwards. When asked "since first using a scooter, has your use of other transportation changed?" more than half the respondents said they drove less and used all taxi types less often than before.

A Chicago study investigated this further, asking how often e-scooter users reduced their use of other modes. Chicago is one of the most comparable American cities to London in terms of urban form: It is a large metropolitan area of 9 million, with adequate public transport and a growing cycleway network (currently over 200 miles of separated cycleways).

Table 3: Percent of Users by E-scooters Use Frequency Who Reported Reducing Use of Other Modes (Source: E-Scooter Pilot Evaluation, Chicago Department of Transport, 2020)[25]

[Divvy refers to Chicago's shared bike scheme]

| | Daily | Weekly | Occasional | Once | Overall |
|---|---|---|---|---|---|
| **Ride-hail Use** | 63% | 64% | 36% | 5% | 42% |
| **Driving** | 42% | 37% | 16% | 4% | 23% |
| **Walking** | 41% | 28% | 14% | 3% | 18% |
| **CTA Bus Use** | 36% | 28% | 13% | 4% | 18% |
| **CTA Train Use** | 27% | 17% | 7% | 2% | 11% |
| **Divvy Use** | 26% | 16% | 11% | 3% | 12% |
| **Personal Bike Use** | 20% | 12% | 6% | 2% | 8% |

Table 4: E-scooter Survey Respondents Change in Chicago Transport Authority Bus and Train Use (Source: E-Scooter Pilot Evaluation, Chicago Department of Transport, 2020)[26]

| Pre-Pilot Frequency of CTA Bus Use | Number of Respondents | Percent of Respondents who Reported Using CTA Buses... | | |
|---|---|---|---|---|
| | | Less Often | About the Same | More Often |
| **Daily** | 734 | 26% | 71% | 3% |
| **More than 3x per week** | 707 | 31% | 65% | 3% |
| **1-2x per week** | 813 | 25% | 70% | 5% |
| **Less than 1x per week** | 1436 | 22% | 76% | 1% |
| **Never** | 901 | 11% | 88% | 2% |
| **Total** | **4591** | **22%** | **78%** | **3%** |

| Pre-Pilot Frequency of CTA Train Use | Number of Respondents | Percent of Respondents who Reported Using CTA Trains... | | |
|---|---|---|---|---|
| | | Less Often | About the Same | More Often |
| **Daily** | 1240 | 9% | 87% | 4% |
| **More than 3x per week** | 899 | 15% | 80% | 5% |
| **1-2x per week** | 895 | 14% | 80% | 5% |
| **Less than 1x per week** | 1204 | 16% | 81% | 4% |
| **Never** | 420 | 15% | 83% | 2% |
| **Total** | **4822** | **13%** | **82%** | **4%** |

### 3.1.3 DATA ISSUES

Given the exploratory nature of this discussion paper, we felt it best to include all studies found and note differences. The data noted in Table 2 is not methodologically sound, and has four key limitations:

1. Reliance on private company self-reporting
2. Merging multiple data sets (single and multiple choice for replaced trip)
3. Reliance on single replaced trip, rather than overall shift in travel behaviour
4. Limited data from European cities

## 3.2 INFRASTRUCTURE PREFERENCE

Chapter 2 set out a rationale and general principles for the reallocation of road space. The principle that modes should be separated according to mass and speed, and heavier modes should be slowed – a principle of road design in countries like the Netherlands – forms the basis of LCC's decarbonisation recommendations in its *Climate Safe Streets*[27] report and overall policy.

In terms of micromobility, there is evidence from numerous studies on e-scooters indicating that that users of electric forms of mobility have the same preferences as cyclists: riding on low-speed streets and in segregated cycle lanes.[28] In Portland, many of the streets most highly utilised by e-scooter riders were part of the city's cycleway network. According to the Portland Bureau of Transportation, observations by its staff also found lower rates of pavement-use by e-scooters on low-speed streets or those with dedicated space for non-motorized users.[29] Users ranked bike lanes as their preferred road type, and pavements last.

In Auckland, Lime bosses say, "We know that over 50 per cent of our users… would feel safer on a protected cycle path."[30] In Paris, Lime reports that "in general, when a bike lane is available, 93% of e-scooter users ride in the bike lane."[31] Lime explains this by pointing out that "the number one cause of feeling unsafe on an electric scooter is being forced to navigate street traffic or ride on sidewalks [pavements] due to the absence of dedicated micromobility infrastructure." Further USA studies noted:

- Denver – 28% said more suitable infrastructure would encourage them to scoot more.[32]
- Austin – Over 7,000 respondents ranked protected bike lanes as a 4.1 out of 5 as very comfortable and 2.09 for multi-lane, a clear preference for segregated lanes.[33]
- Baltimore – 29% noted they mostly or always used pavements.[34]
- San Antonio – 32% were very comfortable on bike lanes, but only 9% said they were comfortable on multi-use lanes.[35]

Pedestrian and e-scooter interactions on the pavement are prevalent in many cities that permit e-scooters. Use of the pavement was or is allowed in the following cities: Paris[36] (until September 2019), Auckland,[37] Denver (until August 2019)[38] and Washington DC (in some areas).[39] E-scooter use of pavement is not allowed in Chicago,[40] San Francisco,[41] Los Angeles,[42] Portland[43] or in some areas of Salt Lake City.[44] It is not a surprise that in many cities, even e-scooter users think the pavement is unsuitable for e-scooter riding.

In New Zealand, over 90% of e-scooter users had ridden on the pavement, but around half (51%) of users and far fewer non-users (26%) think that the pavement is an appropriate environment to ride an e-scooter.[45] In line with the mass and speed arguments above, for the safety of pedestrians and in the interest of getting through the city quickly, the pavement is not the best place for e-micromobility modes. The ITF confirms in its report on micromobility that "sidewalks are more often used by e-scooter riders where the streets are hostile and missing safe cycling infrastructure."[46]

Despite the massive uptake of e-micromobility, particularly e-scooters, in the USA, a widespread reallocation of road space has not occurred. The first recommendation from the ITF report is to allocate road space for micromobility, broadly defined: "Authorities should create a protected and connected network for micromobility, either by calming traffic or by redistributing space to physically protected lanes for micro-vehicles."[47] The evidence cited above, along with other available evidence, shows a clear preference for users not riding in the road and not riding on the pavement. User preference is for what is currently known as the 'cycle track' or 'segregated cycle lane.'

The case for high quality cycle tracks has been made by cycle campaigners for decades, with some success in cities like London. Exact configurations of separate lanes, wider lanes or filtered streets is discussed in Chapter 7. For the purpose of this paper, it is important to note that e-micromobility users have the same infrastructure preferences as cyclists, providing opportunities for alliances and joint campaigning to improve the networks that cycling groups have lobbied for and to reallocate road space from less efficient transport modes.

## 3.3 DECARBONISATION AND RECHARGING BATTERIES

The *Climate Safe Streets* report recommends on-street parking and charging facilities for various types of micromobility, and for shared electric cars. While the emissions from the re-charging of e-scooters depend on the source of the energy used, their low weight gives them a significant advantage over cars. One calculation[48] found that in Washington DC, e-scooters account for 1% to 2% of the $CO_2$ emissions that driving a car the same distance does.[49]

Despite the different electricity requirements of e-micromobility and electric cars, e-micromobility charging has several issues that need unpicking if implementation in the UK is to properly decarbonise our streets. One factor is the difference between privately owned and shared model e-scooters and e-bikes.

Micromobility has been criticised for not being sufficiently carbon-neutral particularly in respect to the short lifespan of the hardware and batteries. The former is being addressed by many of the large shared use operators, who have switched from non-durable leisure models of e-scooters to heavy-duty e-scooters with durability in excess of 18 months in regular, shared use. The latter is something that should be addressed through product regulations.

The ITF report on micromobility notes a trend towards higher capacity batteries, which are usually larger, and can increase the weight of the vehicle[50] and reduce likelihood of vandalism.[51] This is a broadly positive move, although the additional weight should be monitored to ensure that e-scooters are in the most appropriate place on the road, according to the mass and speed charts above.

The main contribution to $CO_2$ emissions made by shared use operators comes from the 'juicing' operations, that is, recharging the e-scooters or their batteries, sometimes including 'rebalancing' the fleet to ensure even spread across the area of operations. This happens via collection, often in a van, and sometimes at night after the e-scooters have had their 'curfew' and cease operations for the day. Juicing practices can outweigh any reduction in carbon emissions from other parts of the business.

One study[52] noted 43% of the lifetime carbon impact comes from this daily collection for charging. As noted in the ITF report,[53] recharging and rebalancing practices by sharing operator companies can counter modal shift effects of e-scooter operations by putting internal combustion engine (ICE) collection vehicles on the roads. But, the ITF report also notes, Lime's own e-cargo bikes are used to rebalance e-scooter fleets, and in the Bird pilot programme in Stratford, London, juicers use e-scooters to transport other e-scooters.[54] These types of low-carbon juicing should be encouraged by future regulations around sharing operations.

Some e-scooter sharing companies have decided to recharge their e-scooters using off-grid, renewable electricity. In October 2018, Lime announced it had partnered with NativeEnergy in a relationship which involves[55] funding solar panel energy (but not buying its output), and buying wind energy from a wind farm in Texas.[56] The wind energy will, according to Lime, be used to recharge its e-scooters, thereby reducing the carbon emissions associated with direct e-scooter usage. However, this practice is not sufficiently prevalent among e-scooter manufacturers or distributors to constitute an industry-wide consensus.

In the future, public parking and charging facilities in the UK may be able to derive electricity from energy projects in which local authorities and communities are involved,[57] whose locally produced electricity produces less $CO_2$ than the National Grid. These could serve both privately owned and shared model e-micromobility, or be paid for as part of an e-scooter operator agreement. The ITF report suggests that user charging, in this way or at home, could be combined with user financial credits in the sharing scheme.[58] User financial incentives to (p)rebalance distribution of dockless or semi-docked cycles are already in place in UK cities, including Brighton.[59]

Some e-micromobility business models include layers of subcontracting to avoid responsibility for carbon emissions. Certain juicing jobs created by e-micromobility companies are typical of the 21st century 'gig economy' model. One such company, Bird, includes in its juicing contract: "You and Bird agree that nothing in this Agreement should be construed to create [...] an employer-employee relationship, or [...] any other relationship other than that of an independent contractor between you and Bird."[60]

The two biggest operators, Lime and Bird, both re-charge their e-scooters through a 'crowdsourced'[61] network of people, many of whom collect the e-scooters using their own vehicle and charge the e-scooters in their homes.[62] As will be discussed in Chapter 6, potential expansion of this capability into the UK should contain requirements on the companies to ensure juicers are not subject to unsuitable employment contracts[63] and that the most environmentally-friendly juicing options are being employed.

## 3.4 HEALTH AND SAFETY

Issues of safety are a primary concern for users of active travel, including all micromobility users vulnerable to motor vehicle collisions. Shared/hired e-scooters made headlines in 2019 with a number of deaths in cities across the world. In the UK, a Londoner was killed by an HGV whilst riding a privately owned e-scooter in Battersea, London.[64]

While some media reports highlight e-scooters as dangerous for users, as well as those around them, many of the published academic studies are retrospective, or not linked to overall trip information, and are therefore difficult to assess for real safety implications. Based on our review of existing literature, and backed by the ITF report, it is too early to tell whether the injury rate for shared e-scooter schemes is rising in line with usage, or whether trips resulting in injuries or deaths are significantly higher than comparable vulnerable modes. For an in-depth review of all safety data, see the ITF *Safe Micromobility* report.

### 3.4.1 FATALITIES

Motor vehicles are involved in a large majority of vulnerable road user fatalities. Sixty percent of fatalities in car crashes are non-car occupant users, e.g. bicycles, pedestrians and other vulnerable road users.[65] Data on the relatively small number of e-scooter fatalities remains limited. On the basis of available data, the ITF report suggests that the risk level is similar to that for cycles.[66]

### 3.4.2 HOSPITAL INJURIES

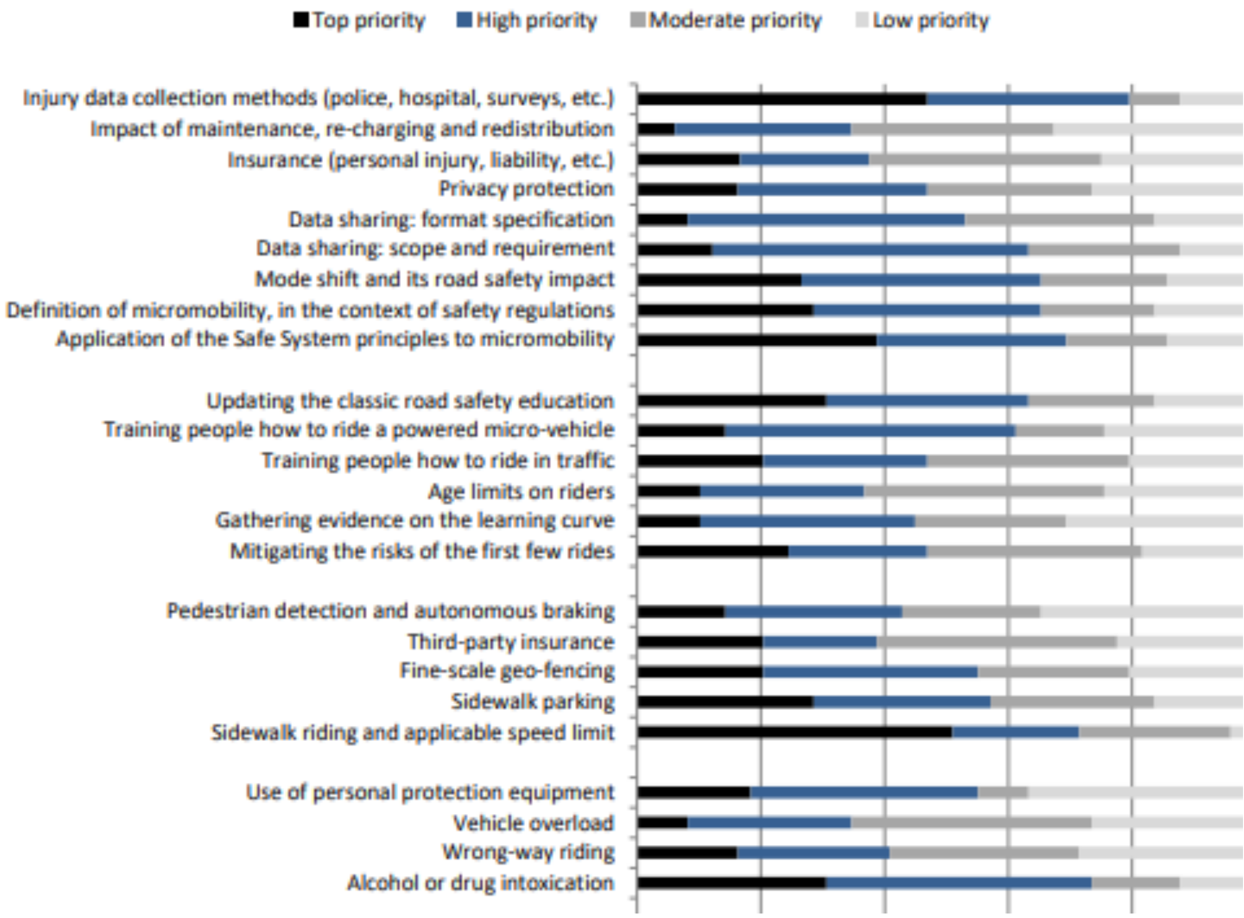
E-scooter injuries are increasingly being reported. However the data is also quite limited with less than 10 studies available. A review of nearly a year's worth of data at two hospitals in southern California found 249 patients were admitted due to e-scooter injuries (91.6% as riders and 8.4% as non-riders).[67] This is similar to other studies, in that it is usually riders going to the hospital, though it is worth noting the likelihood of underreporting when it comes to injuries to pedestrians.

A brief study from medical imaging at Auckland Hospital noted a large increase in radiology imaging required following collisions involving micromobility devices. Authors felt this seemed notable, but did not compare against vehicle miles travelled or trips.[68] A report from Austin, Texas noted that 20 individuals were injured per 100,000 e-scooter trips taken during the study period.[69] Improving data records will be key to understanding injury risk.

The ITF Report suggests an extensive research agenda[71] to fill in gaps and create a consistent evidence base.

> "Research on micromobility safety requires accurate crash data to be collected by the police and health services, and trip data to be collected by governments through operators, travel surveys and on-street observation. Collecting this data should be a priority for road safety agencies."[70]
>
> *Safe Micromobility,* International Transport Forum, 2020, p.11.

Figure 0-2: Micromobility safety research priorities: Survey results (Source: *Safe Micromobility*, International Transport Forum, 2020)[72]



### 3.4.3 ALCOHOL AND NEW USERS

Alcohol has been noted as a risk factor for micromobility users in some studies. Several studies including one in the Netherlands noted alcohol use, especially in later evening hours, as a potential contributor to incidents. Injury studies in the US have noted prior consumption of alcohol among up to 18% of injured riders.[73]

The number of injuries among new e-scooter users also appears to be high. In Austin, Texas, interviews with e-scooter riders with injuries noted that one-third injured themselves on their first ride and 63% had "ridden a scooter less than nine times when they were injured."[74] This would indicate that experience is a factor in injury rates. It would also suggest that privately owned e-scooter riders may suffer fewer injuries per mile than shared-model e-scooter riders – this would be a fertile topic for future academic research.

### 3.4.4 DEMOGRAPHICS

Usage by under 18s was less than 10% in studies reviewed. Usage by under 18s in e-scooter trials appears to be low likely due to most terms of shared e-scooter use requiring riders to be over 14. One study noted e-bikes caused higher injury severity among children than manual bikes. Similar to bicycle injury statistics, males represent a higher percentage of e-scooter use and injuries.[75]

### 3.4.5 PHYSICAL ACTIVITY

Physical health is a main tenet of the Mayor's Transport Strategy and a strong reason to promote active travel policies. Active travel, which is most commonly walking and cycling, is known to have many health benefits. As a form of physical activity, taking part in active travel forms part of a person's necessary daily activity levels, reducing their risk of cardiovascular disease, type 2 diabetes, dementia and depression.[76] Adults are recommended by Public Health England (PHE) to do a minimum of 20 minutes of physical activity per day, whilst children are recommended to do at least 60 minutes per day.[76] Yet only 63% of adults in England manage to achieve these targets and only 17% of children.

There are not the same evidence based-claims for major individual health benefits of e-scooters: scooter sellers say they help with balance and stress relief. For push scooters, "scootering speeds of 6.0–10.5 km/hr meet the criteria for moderate-intensity exercise (3.0–5.9 METs)."[77] Interviews with e-scooter users noted that it was the quickness which they liked and not any potential physical activity benefits. Most noted limited to no health benefits.[78]

Micromobility in its various forms is likely to have various health impacts, though this is in part determined by which alternative travel mode it is compared against. E-scooters may have a negative health benefit if replacing a form of active travel such as walking or cycling. If e-scooters are replacing a car trip, the benefits in terms of emissions, for example, would certainly be clear, while its impact on physical activity is less so and requires further research.

# 4. THE GROWTH IN E-BIKES

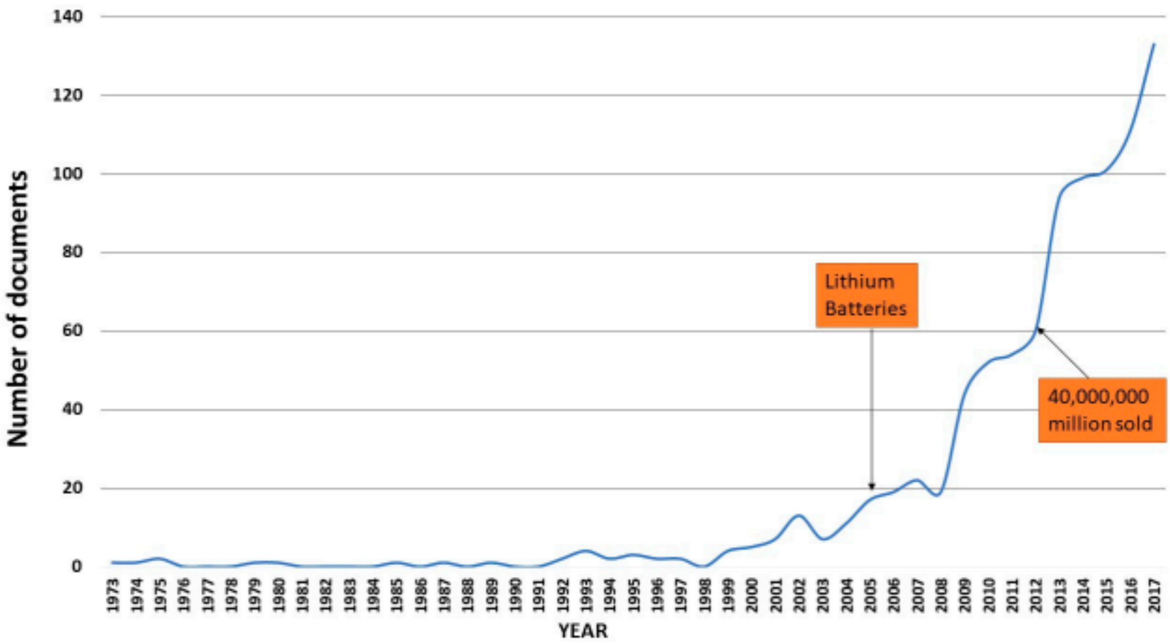
**Electric bicycles represent one of the most significant opportunities for a micromobility future. They allow a wider range of users to access individual mobility with all the time savings and many of the health benefits that entails. E-bike users can often make longer trips and cover steeper gradients than they would on pedal cycles. Many older people and those with disabilities are able to make trips on e-bikes that they would not otherwise undertake.**

E-bike sales and maintenance offer commercial opportunities, as do shared dockless bike schemes, most of which feature e-bikes or are moving in this direction. In London, the Jump (Uber), Bird, Lime and Freebike dockless schemes are all based on e-bike rentals.

In 2018, 70,000 e-bikes were sold in the UK and this figure is increasing each year.[79] Based on company data, population figures, decreasing rates of car registration, and the latest market statistics, UK firm Halfords is predicting 1.5 million e-bike sales by 2050.[80] Dockless bike programs across the world are increasingly electric only. The National Association of City Transportation Officials in the US found electric bikes were used twice as frequently as pedal cycles.[81] An e-bike trial with employees in Brighton noted an average use of 15-20 miles per week, with a corresponding 20% reduction in vehicle miles travelled.[82] Further, a CoMoUK survey found "shared e-bike schemes support users to cycle to work more frequently."[83]

Data on the health benefits of e-bikes is limited, but some studies have noted health benefits similar to those of walking. A 2018 study[84] noted that there was no significant difference between e-bikes set to high power assistance and walking.[85] The use of an e-bike may also assist in making longer trips and carrying goods, such as shopping trips that might be unpleasant to walk but on an e-bike would be easily achieved. Making e-bike trips easier, by providing safe infrastructure and end-of-trip parking and charging facilities, would encourage modal shift from cars to e-biking.

Figure 0-1: Production of scientific papers in relation to e-bikes, 1973-2017 (Source: Energies, 2018)[86]




According to consultancy Deloitte, more than 130 million electric cycles are expected to be sold worldwide between 2020 and 2023, with unit sales reaching 40 million in 2023. This compares with an estimate of 12 million electric cars and lorries expected to be sold in 2025. In 2018, there were 5.1 million electric vehicles in circulation, while e-bikes exceeded 200 million in number with an expectation of that rising to 300 million by 2023.[87]

## 4.1 INCLUSIVITY AND ADAPTED CYCLES

(We gratefully acknowledge the contribution to this section of the Wheels for Wellbeing organisation, authors of the **Guide to Inclusive Cycling**.)

Figure 0-2: Cyclists on adapted cycles (Image courtesy of Wheels for Wellbeing)

People with disabilities are more likely to be physically inactive and socially isolated. Some 75% of disabled cyclists find cycling easier than walking, with the same proportion using their cycle as a mobility aid. Often this is because cycling is non-weight bearing, reduces pressure on the joints, aids balance and relieves breathing difficulties.

Electrical assistance helps disabled and older people cycle longer distances and in greater comfort, by reducing the amount of physical effort required. Tricycles, handcycles, tandems and wheelchair tandems and others are available as 'e-assist,' or can be retrofitted as such.

While many disabled people find cycling easier than walking, under existing legislation cycles are not listed as a mobility aid, unlike wheelchairs and mobility scooters. This means that disabled cyclists may be asked to dismount in designated non-cycling zones, despite the fact that walking, wheeling or lifting a cycle might be physically impossible for some.[88]

Wheels for Wellbeing found that amongst those who use their cycle as a mobility aid, 45% have been asked to dismount and walk/wheel their cycle, often in places where wheelchairs and mobility scooters are permitted (and accepted by the public), but cycles and cycling are not. This problem also extends to public transport, such as trains, where travelling with non-standard cycles is almost universally prohibited.

These issues must be recognised and addressed when developing micromobility infrastructure to enable people with disabilities to use these modes. We note that Britain, unlike the Netherlands, does not currently permit mobility scooters to use infrastructure designated for cycles. Legislation to amend this is required.

# 5. LAST MILE DELIVERY E-CARGO MICROMOBILITIES

**Freight, made up of small and large goods, is vital for the functioning of cities. It is currently moved, however, by diesel vehicles that contribute disproportionately to carbon emissions. HGVs, which account for 5% of the miles travelled in the UK, are responsible for 17% of transport greenhouse gas (GHG) emissions and 21% of NOx emissions. Light goods vehicles, or vans are still predominately diesel-powered, with only an estimated 10,000 vans in the UK being either plug in electric or pure electricity-powered in 2018.**[89]

Van deliveries have doubled over the last 20 years, partly due to the rise of internet shopping and delivery services.[90] In 2016, an estimated 2.7 billion packages were delivered, and e-commerce accounted for around 1.8 billion deliveries and collections.[91] In London, van journeys represented 16% of vehicle miles travelled in 2018.[92]

In addition to the problem of emissions, larger delivery vehicles or HGVs are also over-represented in casualty statistics, accounting for 50%, or more, of cycling fatalities and 20% of pedestrian fatalities in London in recent years despite only accounting for 4% of vehicle miles.[93]

Growth in volume of polluting freight modes, especially in the centres of cities, is unsustainable both environmentally and in terms of the physical space current freight takes up in our streets.

While freight micromobility is limited in the size of loads that can be carried (commercial operators offer payloads of up to 150kg with an additional 150kg if a trailer is used),[94] it offers some of the greatest opportunities for rapid expansion and transformation of the way our cities work. Mode shift of freight from larger diesel vans onto electric cargo bikes and other e-micromobility would carry numerous benefits, including:

- Decarbonising our streets and reducing pollution: lighter electric vehicles don't emit $CO_2$ and produce fewer non-exhaust related particulate matter emissions which contribute to air pollution.
- Making our cities safer: fewer large vehicles would mean fewer serious crashes.
- Greater business efficiency: cargo bikes are the quickest way to deliver freight in London, reducing delays for businesses and customers. Freight micromobility implementation is often combined with last mile consolidation centres (locations where larger vehicles can drop off goods for local delivery, so efficiency is increased).

In 2017, TfL found that "up to 14 per cent of vans could be replaced by cycle freight by 2025."[95] Freight transport is usually not the same as person transport (see Chapter 4), so the concern about micromobility reducing use of active travel modes does not apply here.

We note variants of e-scooters may also be used for some deliveries (with seats,[96] trailers,[97] and other inventive[98] adaptations).

While cycle campaigners may have a preference over different types of vehicle, companies have no such loyalties. They could start promoting mode shift amongst their drivers not just from petrol-powered to electric mopeds,[99] but from non-electric cycles to electric mopeds, potentially using the same system of financial incentives, and penalties, already in place. However, highlighting the potential danger of incentives, the International Transport Federation report argues that “by-the-minute rental can be an incentive to speed or ignore traffic rules.”[100] Responsible micromobility usage, which is safer for the couriers themselves, could be encouraged by a rate of pay non-dependent on speed.

There is already a trend for the merging of micromobility rental and food delivery business models, so the delivery company rents a fleet of micromobility devices exclusively to their own employees, thus passing the costs of the vehicle onto the worker. Deliveroo has started doing this in London,[101] by renting out e-mopeds to their own workers – it is feasible that Deliveroo could switch their current fleet[102] of hardware from electric motorbikes to lighter e-scooters, potentially with racks or seats.

In Buenos Aires,[103] parent company Maxi Mobility owns both Glovo food delivery business and the new Movo public e-scooter rental business (and Cabify taxi business), so it is feasible that Glovo employees will start to use the Movo e-scooters to deliver food. The influence of firms like Deliveroo could be considerable – cycle campaigners would want to ensure leading companies are fully supportive of the improved cycle infrastructure that needs to accompany all micromobility growth.

Figure 5.1: Domino’s-branded cycles in the City of London, February 2020 (Image courtesy of Pearl Ahrens)

## 5.1 ADAPTED OR LARGE MICROMOBILITY AND INFRASTRUCTURE

A continuation of the upsurge in electric bicycle freight, in its many forms, can benefit cities and lead to productive alliances on improved infrastructure. We note that some delivery companies are already using e-assist cargo bikes in London (DHL, CitySprint), and some food companies are running their own e-bike deliveries (the Co-op supermarket, Dominoes) all accompanied by the rise of mobility hubs.[104] There are also companies springing up specifically contributing to this trend. Alternatives to motorised freight in the centre of London are a positive development, especially when they are human-powered.

The requirements of cycle freight, especially on an expanded scale, could be one of the main drivers of more, and wider, cycle lanes in the coming years. A coalition of personal users of micromobility, in the wider sense, and commercial e-cargo freight users could be a strong force lobbying for wider, or multiple, lanes to suit all users.

In London, design guidance such as the London Cycle Design Standards could provide opportunities to mainstream the inclusion of adapted or extra-large cycles. Elsewhere in the UK, without segregated lanes in the first place, making the case for wider lanes and overcoming traffic modelling arguments are some of the challenges commonly faced by cycling activists. Emphasising freight cycles' increased accessibility thanks to wider lanes and the potential freight mode shift resulting from this could add weight to the argument.

Figure 0-2: PedalMe cargo bike (Image courtesy of Tom Bogdanowicz)

Adaptations to (normally electric) cycles can make the categorisation of micromobility more complex, with trailers, extra seats and extra wheels meaning that they exceed regulatory boundaries and do not fit on any particular lane on the road.

Figure 5-3: Cargo bikes illustrating different configurations (Image courtesy of Tom Bogdanowicz)

This raises important questions about the functionality of segregated cycle lanes, and the inclusion of larger types of commercial micromobility potentially at the expense of more vulnerable cyclists, such as young children. Authorities are often in favour[105] of a move to increased cycle freight,[106] and consolidation centres,[107] without guidance about where on the road these vehicles are meant to travel. This is important because Type C and D size vehicles (see Chapter 2) could become quite wide and long (cycle campaign groups are well placed to do research and analysis on this issue). Consideration must be given to the dimensions of cargo e-bikes allowed into standard and extra-wide cycle tracks and whether there should be timed exceptions to any restrictions.

Parking and charging facilities that can accommodate these types of vehicles will also require some regulation. In dense city centres, kerbside space is valuable and options around regulation of cycle lanes and loading times could be explored, including restrictions and timed deliveries. For instance, freight deliveries on Type D vehicles could be restricted to early mornings or mid-day, while HGV trips into city centres can be minimised by using consolidation and transfer centres on the periphery.

The LCC *Climate Safe Streets* report includes a section devoted to decarbonising freight, consolidation centres and freight hubs.[108]

Figure 0-4: UPS electric delivery cycle (Source: Post & Parcel, 2015)[109]

# 6. REGULATING MICROMOBILITY

- Regulations should be applied to micromobility, and regulation has already been developed in a number of places. Usually, a national definition of mode is used to decide where on the road those vehicles can travel, while regulations about sharing operations are applied at a local authority level.
- The rapid uptake of some e-micromobility modes as a novelty could lead to overstating the risks involved, and consequent over-regulation of all micromobility – including cycling.
- The ’novelty’ of e-micromobility modes, combined with the ease of access through an app, may encourage constituencies who do not cycle to try out micromobility.

**There is widespread agreement that regulation of e-micromobility by local and national authorities is necessary[110] to make the products safe, to decarbonise our streets, and to make sharing operations work for everyone. The ITF report on micromobility makes the point that “natural prerogatives of local government include the definition of low-speed zones and parking rules. Vehicle design, however, is best addressed at the national or international level, not least to promote competition.”[111] There remains significant debate regarding the extent to which these regulations can control private sector business and how enforcement affects individual users.[112]**

This chapter makes some suggestions about the way forward for e-micromobility regulations in the UK. It should be borne in mind whilst reading it that the Department for Transport’s consultation on the Future of Mobility[113] was released in 2019 and contains specific questions about e-scooters.[114]

To get to a stage where decarbonisation of roads can be achieved on a substantial scale, there must be changes to legislation. E-scooters and some other e-micromobility vehicles are currently illegal for use on the road and footway due to the Road Traffic Act 1988 (Section 185), together with the Highway Act 1935, which provides the law with the definition of a motor vehicle. Through this definition, confirmed by case law, the law prohibits riding an e-scooter on the road or pavement (Section 34), and prohibits “causing or permitting” e-micromobility use without a licence (Section 87).[115]

On a regional level, the London Cycle Design Standards (LCDS) should consider a wider range of e-micromobility in its next update. Widths of cycle lanes and tracks, in particular, should be reconsidered, as well as the possibility of charging facilities at parking places. Kerbs and upstands (raised sections of kerb at driveways and ramps) that accommodate smaller wheels, such as those on e-scooters, should also be carefully considered in any LCDS update.

"An EAPC [electric assist pedal cycle] must have pedals that can be used to propel it. It must show either:

- the power output
- the manufacturer of the motor

It must also show either:

- the battery's voltage
- the maximum speed of the bike

Its electric motor:

- must have a maximum power output of 250 watts
- should not be able to propel the bike when it's travelling more than 15.5mph

An EAPC can have more than 2 wheels (for example, a tricycle)."

Electric bikes: licensing, tax and insurance, UK Department for Transport, 2020.[116]

In the UK, e-bikes are regulated as electrically assisted pedal cycles (EAPC). These regulations are generally considered adequate by the larger transport community and by this paper. Notable also is the minimum age requirement of 14. Similar restrictions could be proposed for new e-micromobilities, such as e-scooters.

Mobility scooters are a different category of powered travel, and have their own legal set-up. They are not normally included in transport discussions in the same way as other-powered modes. As noted above, legislation should be changed to allow them access to cycle infrastructure, as well as roads and pavements. It is becoming increasingly accepted that adapted cycles may provide just as much of a mobility aid as mobility scooters, and the conversation around this should be expanded on by government, as well as the cycling and mobility impaired communities.

On private land in the UK, the restrictions on e-scooters noted above do not apply in the same way. Hence, the London Legacy Development Corporation, which is both the landowner and Local Planning Authority in Stratford, has been running a successful e-scooter pilot programme since November 2018.[117]

A number of countries in Europe and Latin America, as well as some states in the US, have developed regulations in a variety of formats.[118] In June 2019, the German government passed legislation defining e-scooters according to size, weight, speed and hand-steering capability.[119] According to this legislation, legal use entails that: e-scooters use cycle paths but not pavements; the minimum rider age is 14; it is not obligatory to wear a helmet or to have a driving licence; and scooters will be restricted to a maximum speed of 20kph (12mph) (while e-bikes are restricted to 25kph). The law features many reasonable restraints such as not mandating helmet use. As the ITF report mentions, given that Germany has its own product testing facilities, it pursued an evidence-based course in developing the legislation.[120]

In the UK, the Bicycle Association[121] and Sustrans[122] have published positions on future e-scooter regulation.

Most regulatory frameworks follow the same format,[123] notably:

1. **Defining the micromobility mode**: Definition is difficult because, as the ITF report states, "Micro-vehicles are polymorphic devices that do not share a common form factor. They cannot be defined by the number of wheels, nor by the riding position, which can be seated or standing. Micro-vehicles may be powered by muscular energy, electric batteries, a fuel tank or a combination of these. Defining micro-vehicles by a specific power source is, therefore, of little value."[124] Additionally the fast pace of technological innovation in this area makes it difficult to predict future developments. While putting sensible markers on what is essentially a continuum of mass and speed (see Chapter 2) is always going to be challenging, it is essential in order to determine where on the road they can travel, which is the second step.
2. **Using the definition to determine where on the road vehicles can travel**. It is well established that pavements are for pedestrians, roads are for motor vehicles, and, relatively recently, cycle tracks are for cyclists. But where do e-micromobility vehicles go? That is, which of these three groups are they closest to, or are they their own fourth group? Addressing this categorisation leads directly to infrastructural and spatial questions, where cycle campaigning groups have a unique advantage. In Section 3.2 on infrastructure preference, we discussed where on the road existing e-scooter users and other road users want to travel, and found that most of them have a preference for lanes protected from motor traffic. The issue of infrastructure is further developed in Chapter 7.
3. **Regulating sharing scheme operating companies**. This step necessarily comes after the others, and is normally through some form of permit or agreement between a city authority and an operating company. Further discussion of this follows below.

There is the possibility of regulation being over-extended. The rapid uptake of some e-micromobility modes as a novelty could lead to overstating the risks involved, and consequent over-regulation of all micromobility – including cycling. This risk can be minimised by careful analysis of existing safety data and as far as is reasonably practicable, "aligning the requirements placed on micro-vehicles with existing frameworks."[125] With respect to specific requirements such as insurance, helmets, and clothing requirements, authorities "must decide […] the extent to which such a requirement might discourage the use of bicycles."[126] Authorities could bear in mind the similarities between micromobility modes laid out in Chapter 2, and should consider "regulating micromobility in a way that is adapted to the indeterminate boundaries of the sector."[127]

## 6.1 REGULATING SHARED MICROMOBILITY

Sharing companies – companies that rent e-scooters for people to use in the street – are big business. One of the largest companies, Bird, was valued at $2 billion as it launched operations in more than 120 cities worldwide[128] and Lime has rented out e-scooters in 121 cities and 28 university campuses in the USA.[129] Opportunities for entrepreneurship have also flourished, with much support for smaller companies[130] and franchises available.[131] Some companies share features with – or even actually are the same company as – existing dockless bike or taxi/shared car companies, which is an area of further possible research, and is discussed later in this chapter.

As far as this paper's research has extended, we have not identified any municipal or public operators, and instead the role of government and local authorities lies mainly in granting permits or penalising private operators. We note that LCC's *Climate Safe Streets* report advises a common regulatory platform for a full range of existing and likely future services.[132] Regulation of sharing operations is complex, but it is possible to reach an equitable, transparent, permit arrangement that benefits all parties. Accreditation is also advised, particularly as the UK already has a sophisticated shared mobility organisation that offers accreditation in order to uphold standards: CoMoUK.[133]

While privately owned e-micromobility should not be regulated any more than privately owned bicycles already are, shared operations are another matter. This should happen at the level of local authorities due to the necessary spatial aspect of operations: local authorities and local campaigns are best placed to know how and where sharing schemes will function most effectively within the city in the context of local transport strategies. The rationale for regulation of sharing schemes by local authorities is clear, and it is important for the UK to learn the lessons from existing sharing regulations.

In London, councils have already learnt the lesson of non-regulation: the sudden introduction of dockless cycles led to ad hoc reactions from various London councils. London Councils (an organisation representing all boroughs) is currently working with TfL to address the gap in legal structures and to create a London-wide byelaw[134] on dockless cycles, enabling councils to designate permitted parking places and prohibiting operators from running unapproved schemes. This byelaw would equally apply to shared e-scooter operations as and when they are legalised. It would clearly be helpful if the byelaw were applied in a consistent way by all London highway authorities. For cities in the UK without a regional sub-structure, legislation should be developed setting up a local authority permit structure.

### 6.1.1 PERMITS, FINES

Local authorities should be equipped with the powers to make e-micromobility sharing schemes work for their city. Cities should start from a position where operators need permission to run an e-micromobility sharing scheme. At the same time, local authorities should be open-minded about regulating different aspects of schemes, and should conduct research and impact assessments where they require more evidence. Funding should be given to local authorities to conduct scheme testing that would otherwise be too costly to administer.

Permits could include specifications on equity and data (see below), along with other reasonable requirements such as rebalancing plans,[135] minimum[136] or maximum[137] numbers of devices, and restrictions around operational areas such as through geofencing or a curfew.[138] The length of contract or permit could be crucial in minimising waste and lengthening the life of shared e-scooters as objects; sharing operators on short contracts are not incentivised to rent more durable e-scooter hardware.

The move towards longer contracts and more durable hardware is mutually supportive, for example if a permit/contract with a local council lasts one year, companies purchase e-scooter hardware, “and then if it’s not renewed the next year I gotta find something else to do with this hardware,”[139] as Sanjay Dastoor, CEO of e-scooter sharing operator Skip, says. Some e-scooter companies are now requesting longer contracts, to give them predictability and thus encourage more durable e-scooter production.

In this way, regulation of e-scooter hardware (discussed above and in Chapter 1) goes hand-in-hand with regulation of e-scooter sharing schemes. Longer contracts may assist with enforcing other aspects of operation that can be stipulated as part of the permit application, such as type and length of employee contracts, installing parking places and reliability of service.

Local authorities might want to consider the aims and marketing of any sharing scheme, and what kind of change they would like to see in their city. This process, which should include other road users such as cycle groups and pedestrian groups, would help local authorities determine appropriate application and permit fees charged to operating companies. Fines for companies diverging from the permit requirements have been administered across the USA,[140] and should be set sufficiently high to deter even large e-scooter companies from failing to fulfil their requirements.

### 6.1.2 EQUITABLE ACCESS TO SCHEMES

Access to schemes is a vital aspect to regulate, and not only in the legal form of local authorities’ equality duty. The variety of e-micromobility could widen access to people who are reluctant to try standard non-powered cycles, or cannot safely store a vehicle of their own.

Financial equity: Cities in the US have been using permits as a means to put conditions on sharing schemes to ensure wider access. Chicago is exemplary in this respect, with the terms of its permit schemes ensuring that operators are “providing scooter sharing access to individuals without a bank account (unbanked) or without a smart phone."[141] This enables not just tourists from abroad, but people without bank accounts or smartphones due to age, poverty or lack of a fixed address, to access the scheme on the same terms as everyone else. It should be noted that the Santander Cycles scheme in London does not currently meet this criteria, so local authorities should bear this in mind when assessing the benefits of a financially equitable micromobility scheme.

Physical equity: Options for vehicle designs other than e-scooters should also be explored, for instance the use of seats in San Antonio (see Figure 6-1). Powered assistance can increase equity where non-powered bike sharing schemes have so far struggled: London's Santander Cycles recently changed[142] the frame and wheel size to allow a greater range of users. The weight of sharing cycles is known to help prevent vandalism and increase durability but can create manipulation problems: a balance should be reached to ensure accessibility for a wider range of people.

Spatial equity: E-micromobility sharing schemes should be promoted in areas of cities that are not currently well served by public transport networks. Instead of solely implementing schemes where there is already a good network of segregated cycle routes, authorities could trial schemes in areas which are in need of segregated routes, and utilise the new riders as further evidence to support cycle network development.

A sharing scheme based around a train station in a low-density suburban area, for example, could be productive. Sometimes low-income areas are also poorly served by public transport and take-up of sharing schemes could be higher without competing transport options. As noted above, the duration and terms of permits could be a way of preventing operators withdrawing vehicles from streets without notice, leaving residents suddenly without a micromobility option, and reluctant to trust[143] new modes in the future.

### 6.1.3 DATA

> "The collection of micromobility data could transform the management of urban transportation."[144]
>
> *Safe Micromobility,* International Transport Forum, 2020. p.73

Data is important for an authority to be able to make good decisions about how e-scooters fit into the rest of the city, and to ensure that they are being used equitably. According Mason Herrman who has done research on e-scooter use, "Data sharing on utilisation rates is necessary when cities or companies wish to increase or decrease a scooter fleet size, rebalance scooters to a new location in the city, or change scooter functions on behalf of survey data."[145]

Without a formal arrangement with a municipality, data from operating companies can be erratically released, opaque, or in an unusable or incomparable format. The ongoing dispute on data sharing between Uber and the Los Angeles Department of Transportation[146] may have significant impact for the future of data, who owns it and when,[147] and may be fundamental to the development of shared e-micromobility and even shared transport schemes in general. TfL already has many data transparency policies, which allow not only the municipality, but the public to view data about train and bus times, their own Oyster journey history, locations of fixed infrastructure, etc.

Arrangements about data with e-micromobility operators should be made to maximise transparency along these lines, while not putting any individual e-micromobility user at risk of identification. Some local authorities have very strict pre-agreed arrangements (e.g. Portland);[148] others have set data sharing requirements for companies but have faced difficulties with compliance (e.g. Los Angeles);[149] and others have retrospectively applied data sharing agreements to companies' operations (e.g. Paris).[150]

The ITF report makes specific suggestions regarding collection of accident data from hospitals and police services,[151] and also regarding formatting and privacy concerns.[152] In the UK, useful data for operators to collect from the outset of sharing operations, and provide to local authorities could include:

- Which infrastructure was used (to within a few metres);
- Parking locations;
- Speed throughout route, and variations in speed;
- Age of users;
- Income of users;
- Gender of users (for instance, in Brisbane, a study noted 75.6% male and 24.4% female users ,[153] and the ITF report noted a higher injury rate for male users[154]);
- Distance travelled;
- Time and location at start and end of journey;
- Vehicle hardware problems;
- Number of vehicles on the streets;
- Numbers of riders per time period;
- User injuries;
- User complaints.

It may be worth some data being collected before further sharing schemes are implemented in the UK, in order to be able to observe changes in usage patterns. Most importantly, in-person or in-app surveys could collect data about previous modes used, and multi-modal journeys. This is crucial to developing broader policy and strategies about implementation, and evaluating public benefit.

### 6.1.4 REGULATING MOBILITY AS A SERVICE?

Mobility as a Service (MaaS) is described on Wikipedia as "combining transportation services from public and private transportation providers through a unified gateway that creates and manages the trip, which users can pay for with a single account."[155] Uber is the most well-known example of the Mobility as a Service (MaaS) model. In addition to its app-based taxi service, in the US, Uber's services has expanded to e-scooters, e-bikes and one stop transport apps. Uber is moving to become a full service transport provider.

For example, Uber offers a monthly pass in the US which includes discounted Uber travel, free use of Jump (its e-scooter and e-bike service), and connection to Uber

Eats,[156] with users also able to plan their whole journey including public transport in the Uber app.[157] In London, the Citymapper app offers one card for both private and public transport.[158]

The implications of this are significant. For example, this trajectory and associated policies could lead to more fluid multi-modal journeys. In San Antonio, Texas, a small study (281 respondents), found that 17.8% of respondents used e-scooters to access a bus at least once a week.[159] A study in Denver found that 37% of respondents used e-scooters in conjunction with public transport occasionally, but less than once a week.[160] The shared model of micromobility means it could be one mode offered as part of a package, alongside other modes. It is notable that in London the popular docked bike sharing scheme (Santander) is not yet integrated with the Oyster public transport access payment card.

The 'novelty' of e-micromobility modes, combined with the ease of access through an app, may encourage constituencies who do not cycle to try out micromobility. The Portland Bureau of Transportation reported that "e-scooters attracted new people to active transportation: 74 percent of local users reported never riding BIKETOWN [Portland's bike share scheme] and 42 percent never bicycling."[161]

Similarly high proportions of 'novice' users have also been seen with other schemes, for instance in San Antonio, where the Transportation Department uses seated e-scooters.

Figure 6-1: E-scooters with seats in San Antonio (Source: Rivard Report)[162]


"If and when e-scooters are integrated in MaaS platforms, some form of financial incentive should remain for people to walk short journeys."[163]

*Safe Micromobility,* International Transport Forum, 2020, p.72.

However, the implications of MaaS are not all positive. In its current form, it relies heavily on private sector, commercial providers, whose venture capital and innovation comes from the technology world. These commercial providers are not obligated to provide service in areas they deem unprofitable or high risk, and their business model may necessitate a quick turnover of modes. There is no guarantee that the large gaps in the bus and cycle networks in UK cities will be resolved by private sector providers. While the ability to swap one mode for another may be initially appreciated by users, this can be undermined when one mode is withdrawn overnight by the operator – as happened in the case of Mo-bikes in Manchester.[164]

Not all modes are equivalent in terms of carbon emissions and active travel: Uber's facilitation of taxi hire has led to drivers spending hours cruising UK cities for passengers,[165] an inefficient[166] use of street space compared to Uber's smaller vehicles such as Jump bikes which remain parked until users need them. This kind of inequality between modes is exacerbated by the differing health effects of some modes – the ITF report recommends, after further research, a price differential encouraging use of active modes.[167]

# 7. INFRASTRUCTURE AND DESIGN FOR MICROMOBILITY

**In order to get a decarbonised road system in London, we will need to rapidly shift away from cars towards a range of active travel modes and different e-micromobilities. Resilient, quick and flexible city and street design will be required to adapt to changes in transport trends and technologies. Infrastructure can reinforce a framework of sociability and environmental sustainability, as well as an equitable, accessible, and humane urban environment. Our streets should work for everyone, from children playing or going to the local shop to cycle couriers who need to deliver 30 pints of blood across town.[168]**

Changes to the city's layout and planning could assist in creating a future of active travel and e-micromobility, including freight. Ideas like consolidation centres use the spatial form of the city to make deliveries more efficient: by switching to smaller, lighter modes as space decreases in city centres. There may be a need to plan for private cycling and e-micromobility trips, as well as longer, faster freight and other utility trips. In other words, how do people cycling to work and those popping to the shops on e-scooters and freight cargo bikes with trailers best share route sections, assuming they are already separated from fast-moving and high volumes of motor traffic?

Increased pressure on cycle routes is not a bad thing – it indicates the need for more road space reallocation. E-micromobility couriers on e-bikes, e-assist cargo bikes (potentially with trailers), e-mopeds and e-scooters could be *at work* in the carriageway or cycle tracks, and so their main priority will be moving at speed through the city. Their differing interests necessitate lanes wide enough to enable qualitatively different types of micromobility travelling at once – or potentially splitting into two lanes.

Cycle campaigners should consider planning strategies to take advantage of the changing composition of London's cycling constituency, and use the wider base of riders to argue for improved infrastructure.

## 7.1 STREET DESIGN

To balance e-micromobility, walking and cycling with buses, logistics and freight, different streets will have to serve different purposes. UK cities must do what New York, Barcelona and Paris have been doing: emphasising neighbourhoods and making cities more walkable. This means making sure the things we need every day – shops, schools, parks – are not just in walking and cycling distance, but that walking and cycling routes are safe and pleasant for all kinds of people. In this city vision, neighbourhoods are connected to each other and the wider fabric of the city, through segregated cycleways, car-free streets and robust public transport networks.

Regulating traffic through timed restrictions on specified vehicles can make this possible at limited cost. In New York, the municipality's effort to change 14th Street to bus and lorry only at certain times[169] show that it is possible to retain necessary motor traffic in a way that does not dominate the streets. London's bus and cycle only pilot at Bank junction was deemed such a success it has been made permanent.[170] Barcelona's two 'Superblocks' show, through urban realm changes, that cars do not have to dominate streets: benches, art, plants and play parks have transformed four streets in each superblock into a space primarily for relaxation and play.

Figure 0-1: Poblenou Superblock in Barcelona (Source: Public Space)[171]

The implications of greater mode share for all micromobility may be significant: roads free from motor traffic, larger cycle tracks, and freight delivered by smaller electric vans rather than diesel-powered HGVs. Using the types of micromobility defined in Chapter 2 – A to D classified according to mass and speed – the sections below discuss how micromobility might open up new, safe and equitable layout options for UK streets.

### 7.1.1 LOW TRAFFIC NEIGHBOURHOODS – MAJORITY OF STREETS

Low Traffic Neighbourhoods (LTNs) are essentially residential areas where 'ratruns' and through motor traffic routes have been 'filtered' (by use of bollards for example) so that cars cannot drive through from one side to another. They invariably create calmer streets: locals are able to enjoy them safely whether they are walking, cycling or using another means of travel.

LTNs use a series of modal filters, road closures, landscape, and pedestrian priority crossings to reduce traffic levels (and resultant air pollution[172]) significantly. In the first low traffic neighbourhood in Waltham Forest's mini-Holland, motor traffic levels fell by over half inside the residential area and by 16% even when including the main roads.[173] Motor traffic levels went down by over 5% on the main road nearest the second scheme.

All modes can share the same space here, including Type A and Type D, and there is often a very low speed limit. LTNs can connect to train and bus interchanges for multi-transit journeys and strategic cycleways for longer commutes to major employment centres.

### 7.1.2 DESIGNS FOR MAJOR ROADS

**Strategic cycleways**

Strategic cycleways are segregated cycleways that provide separation between motor vehicles and Type A and B mobility. With LTNs on either side, cycleways on main roads provide the necessary links to popular, but more distant destinations thereby enabling safe cycle access to shops, places of employment, transport interchanges and more.

If the standard width of cycleways changes in the future, there is potential that Type C vehicles could be permitted on strategic cycleways, potentially with speed restrictions. Being located on major roads, motor vehicles, buses and Types C and D would have to share the space next to the segregated cycleways, but if a bus lane is present, Type C and D could occupy that space.

Delivering 50% of TfL's planned strategic cycle network by 2024, as recommended in the *Climate Safe Streets* report,[174] would accelerate the uptake of e-micromobility.

**Commercial e-micromobility lanes: heavier and faster types**

Commercial e-micromobility that identifies as Type B, C or D may benefit from a network of its own lanes. If good first and last mile freight transport, reduction in heavy goods vehicles, and mainstreaming of commercial cycle freight all come to fruition, commercial e-micromobility freight and delivery services will increase in number, especially in denser city centres. Providing space for these vehicles to get around speedily, whilst reducing unneeded space for larger delivery vehicles, will increase the space efficiency of the city.

If these types have to mix with motor traffic, it should be at lower speeds or within bus lanes where their delivery times will not be reduced.

**Micromobility and buses: car-free streets**

Existing infrastructure does not have to change substantially in order to provide car-free streets. Bank Junction in London, for example, is already bus and cycle-only from 7am to 7pm on weekdays. The size and speed of buses should allow micromobility of all types to exist in the same space – albeit with separations for Types A and B.

### 7.1.3 CONNECTING THE INFRASTRUCTURE: THE SMALL THINGS MATTER

**Dropped kerbs**

Vertical kerbs with a drop to carriage level can be a major impediment to accessibility. Individuals may struggle to leave their house if they cannot cross a street due to a lack of a sloped, or dropped kerb or raised table. This is often the case for wheelchair users, the elderly, mobility scooter users, those with visual impairments, people pushing prams, and many others.

Consensus on kerb designs that support these groups is required. One option is “blended crossings”, designed to slow vehicles entering/exiting side roads and encourage vehicles to give way to those crossing, reinforcing the Highway Code.

**Wheelbase movement: bollards, barriers and corners**

When considering widths, current cycling infrastructure offers the best guidance: 1.5m gaps are generally considered best practice between bollards and other physical barriers, building line to building line, for micromobility specific infrastructure. This ensures private motor cars cannot generally use such infrastructure, but that it is wide enough for side-by-side tandems and loaded cargo e-bikes to pass through.

Care will need to be taken around not just around kerb design to ensure inclusive mobility, as above, but also other elements around micromobility infrastructure and the variation of vehicles in use. Cargo e-bikes using long wheelbase trailers have larger turning circles thane-scooters, while camber drainage gulleys and surface defects will affect different micromobility vehicles markedly differently.

## 7.2 PARKING

Good parking may be the key to the success of e-micromobility’s acceptance into the wider transport landscape. One of the main objections people have to shared e-scooters and shared e-bikes is that they ’clutter’ the pavement when parked. While the same argument is not made about parked cars, the central argument is valid in that, in general, footways should be protected, and their effective width conserved. It is in the interest of all micromobility users that pedestrians can get around easily, safely and quickly.

It is important to highlight the scale of the changes that could occur: planning policies may need to be adjusted to provide space to securely park (and in some cases charge) significant numbers of micromobility devices, both at home and at various destinations. Without some forward planning and consideration of regulations on the part of councils, the scale and speed of technology change in e-micromobility, particularly shared schemes, could overtake current street design.

In terms of decarbonisation, good parking practices may hold the key to reducing the carbon emissions of shared e-micromobility schemes to zero. We noted above that juicing – mass recharging of shared e-scooters, often undertaken by van – is the main contributor to shared e-scooters' carbon emissions once they are in use in the city.

An alternative approach could be charging in situ: parking facilities that charge the e-scooters while they remain on the streets, similar to how electric cars are charged. This would eliminate the need to carry out mass recharging of e-scooters, leaving only rebalancing needs which can be undertaken using the e-scooters themselves to get around. The technological facilities for charging in situ already exist and are being proposed in Paris.[175] In the UK, the specifics of which e-scooter operating companies can use the charging stations, and who benefits, will need to be resolved by operators and highway authorities.

Getting parking right is difficult but crucial: both for sharing schemes and for personal e-micromobility vehicles. The UK has the advantage of coming late to the regulatory sphere in that it can draw on the successes of other countries' e-micromobility parking solutions, making use of best practice and trying out new options. It is possible that, in the era of user charging, some parking will charge fees, especially those that provide charging facilities. The same incentive and equity issues apply to both charging for journeys and for parking.

It is sometimes argued that there is not enough road space to have adequate amount and type of parking facilities for various types of micromobility. Such arguments overlook the significant allocation of road space to car parking and the very real prospect that demand for parking will fall radically as decarbonisation and MaaS progress. On-street car parking bays are a remarkably inefficient use of street space,[176] and their removal could provide many more micromobility parking spaces than car parking spaces. A change in the allocation of space also opens up the street for a variety of alternative uses, and we should seek to be inventive about uses of street space for more than just the storage of objects.

Just as different kinds of streets require different types of infrastructure, different destinations need different kinds of parking. Train stations, homes, workplaces and high streets each serve a different purpose in our lives and have differing space restrictions. The variety of micromobility parking options is as endless as the variety of forms of micromobility described in previous chapters. This section contains some suggestions for a micromobility parking strategy.

## 7.2.1 AT HOME

Figure 0-2: Car Bike Port (Source: CycleHoop)[177]

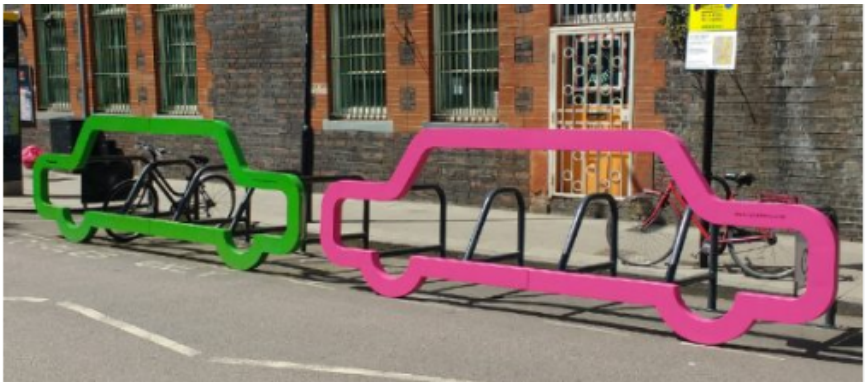


Figure 0-3: Bike Hangar (Source: CycleHoop)[178]

Currently, the majority of on-street parking pace is dedicated to car parking, which as the image in Figure 0-2 illustrates, is an inefficient use of space, with one spot for a car taking the same space as 8 to 10 parking spots for bikes.[179] Cycle hangars and racks are already in use across London, and any residential street that currently has car parking spaces lining the kerb could have some of them replaced with cycling parking units. The car outline in the image does not just make the point about space efficiency but also provides some physical protection from passing vehicles, keeping parked bikes safe from damage. Bike hangars (Figure 0-3) provide both security and weather protection.

One advantage of e-scooters over e-bikes and pedal cycles is that they can be more easily stored in the home, reducing the need for street parking. Scooter parking bays are already common in many UK school playgrounds – the physical stands are necessary because non-electric scooters do not usually have kickstands (.

Figure 0-4). An age limit of 14 would prevent small children from using e-scooters, as is currently the case with e-bikes. Older children travelling from rural areas into town to go to school or college might be using e-scooters or e-bikes, so adequate parking provision for these should be considered.

Many products already exist: bays holding 6 scooters, locked by their necks (for an example, see Figure 0-5), can be placed on the road just as easily as Sheffield stands.

Figure 0-4: Example of e-scooter parking (Source: NBB School Shelters)[180]


Figure 0-5: Example of e-scooter parking bay (Source: Ground Control Systems)[181]

There are other options for physical parking bays for e-scooters that may be placed easily on the road or footway. These can have the benefit of reserving space for e-micromobility users to access them whenever they need, in contrast to bays that are simply painted lines and can be encroached upon by other vehicles.

A category of e-micromobility that particularly demands secure storage is the cargo bike. Recent cargo bike thefts in London indicate that on-street and off-street storage needs to be designed and installed to serve both domestic users and gig-economy cycle freight couriers who might not be provided with secure overnight storage by their employers. Theft prevention for e-micromobility vehicles is doubly important when it is your livelihood, as well as your mode of transport, that is at stake.

### 7.2.2 AT WORK

Workplaces may have their own land to use for parking. Bigger workplaces may also have underground car parks, which are secure, covered locations for micromobility parking. For this reason, workplaces may be a good location for electric charging stations, where the expensive charging infrastructure would be protected.

In this scenario, the vehicles being charged would belong to the employees and so the provision of electricity is less contentious than for on-street juicing of shared vehicle operations. Benefits of this arrangement might be that people are encouraged to make longer journeys and to switch from driving to riding an e-bike or e-scooter. This would certainly be the case if parking bays at work were replaced with e-micromobility charging infrastructure, or if employers were offered incentives to switch modes. Local authorities should consider charging facilities for cargo bikes, e-bikes and e-scooters in planning applications just as they already do for electric cars.

It is important to note there is a potential for solar panels to be fitted onto charging bays. Charging stations that produce their own electricity would contribute significantly to neutralising the effect of shared e-micromobility services on the climate.

Figure 0-6: Charge charging/parking stations (Source: Charge)[182]


City of London has introduced painted parking bays for various types of electric and standard dockless cycles. Although they are located on the footway,

Figure 0-7 shows they are not located directly in the flow of pedestrian traffic.

Figure 0-7: Dockless parking bay, City of London, Autumn 2019 (Image courtesy of Pearl Ahrens)


Given that most models of e-bikes, e-cargo-bikes and e-scooters have a kickstand, not all parking for e-micromobility needs to consist of physical stands. Bays can be painted squares on the ground, marked out so people can see where to park their vehicles. Local councils might prefer this type of bay because it can easily be suspended, for instance in a town square that hosts a food market a few days a week. On streets containing both residential properties and businesses, permits could control use of painted bays by different users in the daytime and in the evenings. Cycle couriers who only need to stop for a few minutes might appreciate a painted bay.

Figure 0-8: Dockless parking corrals, Arlington Washington DC (Source: GGWash)[183]

Other items may be placed in the space when it is not being used for parking, preventing micromobility users parking there. Another important downside of painted bays is that changeable street space use can be confusing for visually impaired pedestrians, who often need predictable physical landmarks to navigate around. However, if a solution is found that overcomes these problems, painted bays have the benefit of being used by many types of micromobility at once, not just e-scooters or e-bikes alone. For real-world examples, see Arlington, Washington DC (Given that most models of e-bikes, e-cargo-bikes and e-scooters have a kickstand, not all parking for e-micromobility needs to consist of physical stands. Bays can be painted squares on the ground, marked out so people can see where to park their vehicles. Local councils might prefer this type of bay because it can easily be suspended, for instance in a town square that hosts a food market a few days a week. On streets containing both residential properties and businesses, permits could control use of painted bays by different users in the daytime and in the evenings. Cycle couriers who only need to stop for a few minutes might appreciate a painted bay.

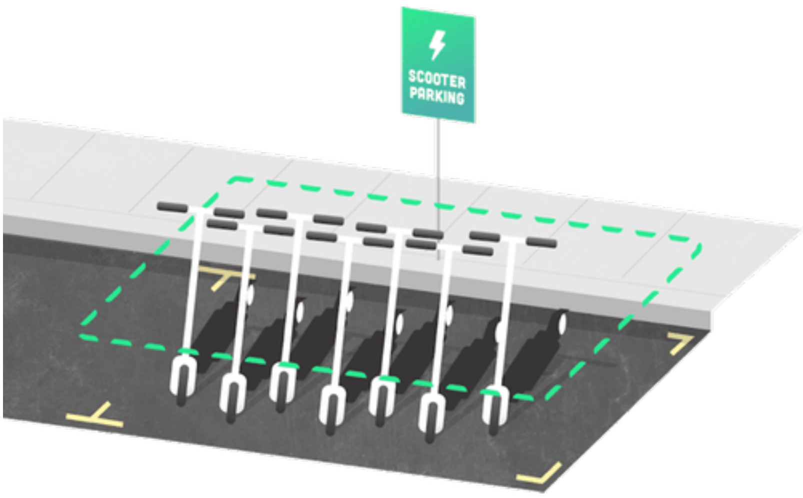
Figure 0-8).

### 7.2.3 LINKING WITH OTHER TRANSPORT

Covered parking facilities are becoming more popular at railway stations and large cycle hubs. Charging facilities in these locations must be managed, typically by charges, to prevent people leaving vehicles in place for extended periods and stopping others from accessing the charging points. At some Dutch rail stations, cycle parking is free for a day and chargeable thereafter. LCC's *Climate Safe Streets* report advises the implementation of ten larger shared mobility hubs across London at destinations, including railway stations, by 2024.

For shared micromobility schemes, geofencing may be used for bays. Geofencing means the sharing company setting up a 'fence' on a map, which connects to the GPS/RFID device in each e-scooter. It is currently technologically possible to encourage good parking behaviour to within a few metres using geofencing, as is already being used in Austin, Texas.[184]

Figure 0-9: E-scooter geofence parking (Source: Charge 2019)[185]



With the addition of this technology, e-micromobility offers new information on existing usage patterns of shared mobility schemes, all collected by trackers in the devices themselves. Instead of the standard 300 to 500m distance between docks used by Santander Cycles[186] and other docked shared cycle schemes, enhanced parking data could be used to locate place-specific docking stations based on existing usage patterns. Councils or other authorities could then make better decisions about where to place parking bays in the city, or even lead by example through providing docking stations in lesser-used areas of the city.

Such data-led spatial planning is already being trialled by the municipality in Paris. In July 2019, the municipality announced[187] that it had commenced a Good Conduct Agreement with 12 e-scooter operators, whereby data on the locations of e-scooters in the city will be shared with the municipality, and used to decide the locations of upcoming e-scooter parking bays. Bays could be geofenced, as mentioned above and shown in

Figure 0-9, or they could be physical bays.

# 8. NEXT STEPS

When road space is reallocated to efficient active and smaller transport modes, users can walk, scoot, cycle or use public transport to reach their destination in safety and without unnecessary delay. Mode shift is in a mutually supportive dynamic with road space reallocation: when car journeys are replaced by individual or freight micromobility, additional road space is freed up leading to faster overall journeys.

This discussion paper sets out some directions for a UK regulatory and road space allocation framework for e-micromobility and active modes in general. It defines e-micromobility based on mass and speed, provides an evidence review of infrastructure preference of e-micromobility users (coincident with cyclists' preferences), and makes recommendations about decarbonisation and equitable application of shared e-micromobility schemes. It is intended to spark conversation and further discussion about e-micromobility in the UK, amongst cycling communities, academics, local authority officers and councillors, policy makers and anyone interested in the future of mobility.

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## ABOUT LCC

London Cycling Campaign (LCC) is a charity with more than 20,000 supporters, of whom over 11,000 are fully paid-up members. We speak up on behalf of everyone who cycles or wants to cycle in Greater London; and we speak up for a greener, healthier, happier and better-connected capital.

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- I travel from Stratford to Euston and it takes me about 30 minutes. My knees though can feel locked and it is too long to ride the scooter. I also still have to work out (runs) because I don't feel that I am getting much exercise.

- I don't feel any difference between this and when I travelled by bus and walking.
- I don't get sweaty anymore, I used to walk about 1.5 miles.
- My balance has improved.
- I don't do it for the exercise. It is quicker.

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