

# How digital platforms are reshaping urban mobility in a time of COVID-19 and after



# How digital platforms are reshaping urban mobility in a time of COVID-19 and after

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## Executive Summary

COVID-19 has caused unprecedented disruption to urban transport systems around the world, at times bringing the vital circulation of people and goods that cities depend upon to a grinding halt. Many municipal governments and transport authorities were already facing major challenges around how to keep cities moving against a backdrop of congestion and air pollution, creaking infrastructure and the need to rapidly decarbonise urban transport. In the context of the global pandemic, debates about the future of urban transport have only intensified, with many questioning whether COVID-19 could usher in a more permanent shift in urban mobility and the ways cities are organised. This report contributes to these debates with a *specific focus on the role of digital platforms* in shaping these dynamics. Drawing on 66 examples of platform-based responses from across the world, the report identifies a series of trends with potentially far-reaching implications for the future of urban transport which raise important questions for urban transport authorities and policymakers.

### COVID-19 as shock to urban mobility

When the pandemic struck in early 2020 urban transport operators and authorities were forced to grapple with the effects of a range of new public health restrictions. Biosecurity measures, especially stay-at-home and social distancing orders have had dramatic impacts on urban travel and put numerous operational constraints on transport systems – most notably for mass public transport. For urban transport authorities this has presented a challenge to the policymaking and operational conventions of recent years dominated by agglomeration thinking which has

prioritised infrastructure designed to support high density economic activity in city centres. To understand what has happened to urban mobility in the context of COVID-19, the report asks how digital platforms and urban transport systems have been experimented with in response to COVID-19, and with what implications for urban mobility? In addressing this question, the report helps us to think more systemically about the changing relationships between urban mobility, infrastructure and the technological interventions of the past 18 months.

### Platform-based responses to the COVID-19 shock to urban mobility

By a process of iterative analysis of the 66 examples, the report highlights six key types of platform-based response to the disruption to urban mobility caused by the coronavirus pandemic:

- 1. Platform sanitisations** refer to the widespread introduction of new cleaning, disinfection and ventilation protocols, the use of ‘contactless’ payment, ticketing and delivery, as well as facemasks and protective screens to minimise transmission and mitigate COVID-19’s impact on existing services.
- 2. Platform monitoring and control** involves the extended use of digital platforms to manage flows of passengers and vehicles across mass transport networks in order to enable social distancing and optimise service provision under new operational constraints.
- 3. Platform substitutions** describe the renewed investment and growth in urban micro-mobility and other

vehicle-sharing platforms positioned as offering 'COVID-safe' alternatives to more risky public transport and taxi services.

- 4. Platform co-ordinations** refer to the use of digital platforms to connect and establish new and bespoke mobility services by redeploying existing vehicles and infrastructure for the 'biosecure' circulation of people and goods for particular purposes.
- 5. Platform inversions** describe the platform-enabled reduction in urban travel via a massive reversal in flows of work, shopping and entertainment to the home rather than vice versa facilitated by the rapid growth of remote working, home entertainment, e-commerce and delivery platforms.
- 6. Platform integrations** involve the integration of different biosecurity measures and mobility services into urban transport systems through single platforms, promoted as building flexibility and resilience to the new demands of public health and other shocks to urban mobility.

## Implications for the future of urban mobility

It will be some time before the full impacts of these responses – which are likely to play out unevenly within and between cities – are properly understood. However, there are several key trends identified in the report which have significant implications for policymakers and urban transport authorities.

**1. The global pandemic and platform responses to it pose serious challenges to agglomeration thinking.** COVID-19 created a crisis in

agglomeration thinking with measures to combat the pandemic leading to a sudden and prolonged emptying out of city centres. Most platform-based responses have been orientated towards mitigating or circumventing new public health constraints on urban travel to sustain existing agglomeration flows. However, these have only been partially successful. Platform inversions meanwhile have facilitated a dramatic shift to more uneven and decentralised geographies of 'biosecure' economic activity and service provision. The pandemic and platform responses to it have foregrounded uncertainties about how urban geographies are and might be organised in the future. Finding effective ways of responding to this uncertainty is a pressing strategic concern for urban transport authorities and urban policymakers generally.

**2. The global pandemic has accelerated and intensified the reshaping of urban mobility by digital platforms.** The use of digital platforms to adapt to COVID-19 has unfolded in a broadly reactive and piecemeal way, but has nevertheless intensified four pre-existing trends:

- (i) growing pressures on public transport operators, with platform-based mobility services offering ready alternatives to gaps in provision;
- (ii) intensified surveillance and datafication of urban transport, which presents both opportunities and concerns and raises questions about the governance of urban mobility data;
- (iii) an increasingly fragmented landscape of work, mobility flows and transport provision as an important factor in widening urban inequality,

where many key workers continue to rely on degraded public transport services while others experiment with remote and hybrid working arrangements;

(iv) further experimentation with alternative forms of private platform-based mobility provision such as micro-mobility platforms in wealthier urban areas and demand-responsive transport services on the urban fringe. Without strong regulation and co-ordination these risk exacerbating problems of unequal geographical coverage and digital exclusion.

The pandemic and platform responses to it have accelerated and intensified pressures, risks and opportunities for the organisation of urban mobility systems. Urban transport authorities will need to develop effective ways to anticipate, track and respond to rapidly evolving and often contradictory pressures.

### **3. COVID-19 has shone light on opportunities for transport authorities to mobilise platforms for the common good.**

A key question for policymakers and regulators is whether they can purposively reshape urban mobility in a post-pandemic world. Transport authorities clearly need significantly greater power, resources and expertise to meet today's mobility challenges and create truly integrated urban transport systems. The rapid introduction of biosecurity measures has demonstrated the scope for greater intervention and regulation of urban transport systems for the public good. In shaping urban mobility on a more systemic level, the integrative capacities of mobility-as-a-service (MaaS) platforms could be crucial. However, there remain critical questions about how these mobility

platforms and urban mobility data are governed, and specifically who owns and operates the system and for what purpose. If place-based urban transport authorities had control over integrative MaaS platforms, it would provide them with new opportunities to strategically govern a mix of private and public transport providers to facilitate progress towards municipal goals. This model allows the urban transport authority to intervene more strategically and to selectively integrate different mobility providers around public transport networks. The capacity and capability to achieve this needs to be developed but must also be informed by cities' strategic objectives and the pursuit of universal service provision. This requires a substantial amount of collaborative work between urban transport authorities and platform companies but also, and crucially, requires commitment from governments and public funding.

## Introduction

The COVID-19 pandemic led to major disruptions to urban transport systems and upended existing patterns of urban mobility around the world. People's ability to travel, work, shop, meet and access services have been dramatically altered by lockdowns, social distancing rules and risk of viral infection. Public transport and taxi services were hit especially hard by sudden and unprecedented falls in passenger numbers and revenues<sup>1</sup>. Some networks faced threats of being mothballed, with operators forced to reduce services and seek government bailouts<sup>2</sup>. At the same time, bike sales and renting schemes rose sharply<sup>3</sup>. So too did the proportion of private car journeys, adding to existing problems of congestion and emissions<sup>4</sup>.

In this context, questions about the future of urban mobility and its geographical implications – many pre-dating COVID-19 – have intensified. Visions such as that of the '15-minute city' have come to the fore in debates over what post-pandemic urban life could and should look like<sup>5</sup>.

More immediately, the protection of workers, passengers and public health have taken on heightened significance for transport authorities. The need for urgent adaptation has spurred numerous experiments with profound impacts on urban mobility<sup>6</sup>. This includes everything from new disinfection regimes to the rapid deployment of pop-up infrastructure for 'active travel' to the large-scale but uneven shift to remote working and service provision. More than a year on from initial lockdowns, a key question is whether the pandemic marks a temporary or more enduring reconfiguration of urban mobility and related transport systems.

Drawing on a database of 66 examples gathered from around the world, this report highlights the importance of **digital platforms** in shaping the future of urban mobility and transport through responses to the pandemic. Digital platforms were already having significant impacts on urban mobility prior to COVID-19. **Digital mobility platforms** now offer a wide range of 'on-demand' services in cities

**Digital platforms** mediate exchanges of goods, services and information and are designed for organising and controlling the interactions and data of their users. Platforms have become increasingly pervasive digital infrastructures which mediate how people shop, work, communicate, travel and access services, as well as how industrial and logistical processes are organised. Often backed by large-scale venture capital funds, the dominant platform business model is based on the competitive and ever-expanding capture, algorithmic processing and monetisation of data. This extractive model tends towards monopolisation and concentration of power and wealth in private companies such as Google, Amazon, Facebook and Uber – a process which has come under growing scrutiny in recent years.

**Digital mobility platforms** refer to the application of digital platforms to mediate transport services. Mobility platforms generally make use of location tracking of vehicles and users and other urban mobility data to organise a range of services like ride hailing (Uber and Didi Chuxing), car, bicycle, and scooter sharing (BlaBlaCar, Lime and Bird), journey planning, ticketing and integrated 'mobility-as-a-service' systems (Google Maps and Moovit). In terms of their business models, digital mobility platforms often rely upon and feed off the network effects produced through urban agglomeration and density.



where mobility has long been organised primarily around public transport and private cars. Platforms such as Uber, Lime and Citymapper have largely focused on urban centres where they compete or collaborate with established operators to varying degrees. At the same time, digital platforms like Netflix, Zoom, Amazon and Deliveroo have been facilitating remote working, home entertainment, online shopping and delivery. Although not explicitly related to transport systems, these platforms are reshaping patterns of mobility and work in important ways with knock-on implications for urban infrastructure and transport provision.

As the report shows, some of these trends have intensified in the context of the pandemic, as witnessed in the huge growth of remote working and home delivery platforms. Platforms have been used in efforts to mitigate viral transmission across existing transport networks, in order to maintain services as far as possible. With many people avoiding public transport and taxi services, shared bike and scooter platforms have been given a new lease of life. In other cases, platforms have enabled transport providers to rapidly redeploy vehicles and networks for new purposes, such as local deliveries and demand-responsive worker transport. There are also efforts to integrate these diverse responses on a more systemic level, often via 'mobility-as-a-service' (MaaS) platforms.

Taken together, these interventions are creating a complex and sometimes contradictory landscape for urban transport authorities to manage. Despite ongoing vaccination programmes, the limited and uneven recovery of passenger numbers and potential for periodic outbreaks make long-term financial and operational planning of public transport networks particularly challenging. There

has been a growing reliance on platforms and new mobility providers to fill gaps and operate and maintain key elements of urban transport systems. Yet these platforms are often driven by a relatively narrow set of interests and investors with deep pockets and competing priorities. Some moreover operate outside the regulatory scope of urban transport authorities. Regulating and integrating this multiplicity of platforms with existing transport systems while meeting various strategic objectives presents real dilemmas.

Overall, this points to a need for deepening our understanding of the ways in which digital platforms have adapted to and responded to the pandemic and the implications of this for urban transport systems and urban mobility. This report draws on international evidence and insight to contribute to addressing this gap in our knowledge. The report is primarily aimed at those working in urban and national transport authorities in the UK who are responding to the challenges of the pandemic, but also to urban policymakers as well as a general audience interested in the implications of digital platforms for urban life.

The report is structured in three sections. The next section summarises the disruptive shock that COVID-19 has provided to existing patterns of urban mobility. Following this, digital mobility platform responses to the pandemic are analysed and organised into thematic categories. The final section of the report sets out key implications of platform responses under pandemic conditions, for urban transport systems and the future of urban mobility.



## COVID-19 as shock to urban mobility

When the global pandemic struck in early 2020, lockdowns were imposed in many cities around the world in efforts to contain the spread of COVID-19. Minimising human contact through social distancing and travel restrictions were key elements of strategies to reduce transmission in urban areas, alongside new disinfection regimes, shielding for vulnerable groups, compulsory use of facemasks and systems for testing, tracing and quarantining individuals exposed to the virus. These measures have had dramatic impacts on urban mobility and transport systems. Millions were compelled (or chose) to work or stay at home. Many others – including numerous ‘key workers’ keeping essential services running – were forced to continue navigating the city as best as they could despite the risks. How to manage and adapt urban transport systems to ensure both **biosecurity** and new mobility needs were met has been a serious challenge facing urban transport authorities.

Urban transport systems enable and constrain mobility. Most travel is undertaken on the basis of derived demand, meaning journeys are usually taken to enable other activities such as

**Biosecurity** refers to efforts to reduce the impact and incidence of threats to life through regulation. Today biosecurity is most commonly associated with risks related to the transmission of infectious diseases such as COVID-19. Biosecurity measures include prescribed actions designed to keep harmful viruses and bacteria out of particular spaces (e.g. through lockdowns) but also rules and protocols for enabling ‘safe’ forms of movement and circulation which minimise infection risks.



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work, leisure, and meeting friends and family. In recent decades, policies at national and metropolitan levels in the UK have prioritised investment in transport infrastructure that supports urban **agglomeration** and the movement of people into and around dense city centres. At the same time, central government austerity has significantly reduced public transport provision since 2010. Funding for buses for instance had been cut by 40% and 3,000 routes were lost or reduced in England by 2019<sup>7</sup>. While geographically uneven, these policies hit services outside of city centres particularly hard.

The sudden shock of COVID-19 in many ways upended this dominant model. During the initial phase of lockdowns and

**Agglomeration** describes the spatial concentration of economic activities in cities, which has become the dominant vision behind urban infrastructure policies in the UK in recent decades. Through national policymaking and local responses, agglomeration thinking has increasingly prioritised dense urban centres as sites for financial investment (and extraction) via land and property development resulting in high concentrations of city centre apartments and office blocks<sup>17</sup>.



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biosecurity measures, journeys by car, bus and rail were all greatly reduced. While there has been a significant rebound effect, this has been unevenly distributed both geographically and in terms of some modes of transport faring better than others<sup>8</sup>. In the UK, private car use has largely surpassed pre-pandemic levels<sup>9</sup>. Cycling and other forms of active travel have generally increased, but social distancing rules and concerns about sharing enclosed forms of passenger transport have constrained the recovery of bus and rail networks<sup>10</sup>. The types of journeys taken have also changed, especially among those not commuting, while the growth of home delivery services has impacted patterns of urban mobility.

The implications of these shifts are likely to reverberate for some time. While making predictions about the future of urban mobility remains difficult, our

understanding can be guided by thinking through three key questions:

**1: What kind of challenge does COVID-19 pose to agglomeration thinking?**

Over the course of the pandemic, lockdowns and social distancing measures led to the closure of many city centre offices, shops and other workplaces<sup>11</sup>. Amid this disruption, there is some evidence of people and organisations moving out of these areas, presenting a challenge to the existing model of agglomeration<sup>12</sup>. At various moments, there have been strong and coordinated efforts by governments and commercial property interests to bring workers and businesses back to city centres. Yet many have been reluctant to do so, having seen economic and personal benefits during 18 months of enforced experimentation with new ways of working. Major questions include whether

and how frequently social distancing measures may need to be reintroduced and whether a logic of biosecurity begins to inform urban development. This could, for example, lead to more decentralised spatial arrangements and investment in local economies, which would have major implications for urban mobility and transport planning<sup>13</sup>.

**2: Is urban mobility being radically reconfigured under COVID-19?** A second question asks whether these changes represent a set of temporary and bespoke responses to the pandemic, or if there is a more enduring and systemic shift taking place – and if so, in whose interests? The impact of COVID-19 has widely been recognised to exacerbate social inequalities, including in the domain of mobility<sup>14</sup>. While a significant minority were able to work from home in relative safety, essential workers in sectors such as healthcare, manufacturing, logistics and transport were not<sup>15</sup>. A key issue is whether urban transport systems can be made biosecure while maintaining and extending provision to all communities who rely upon them. Alternatively, will urban mobility futures follow a more individualised path involving a mix of remote working, private car use and new mobility providers serving more wealthy urban areas alongside an increasingly degraded public transport infrastructure for those with few other choices?

**3: Can urban mobility be purposively remade?** The active reshaping of urban mobility would partly depend on how urban transport systems are organised. One way to think about this is to see the innovative remaking of urban mobility and transport systems as a ‘mission’<sup>16</sup>. This suggests a far more interventionist role for national government and combined authorities in pursuit of place-based priorities than has been the case in the

UK since the 1980s. Although combined authorities have gained some additional powers over urban transport through the ‘devolution’ agenda of the past decade, this has been accompanied by drastic cuts in funding which have heavily constrained transport authorities’ capabilities. A key question then is whether the new language of ‘levelling up’ and mobilisation of ‘local industrial strategies’ – combined with the widespread use of government interventions in public health and the economy in the context of COVID-19 – represent a renewed set of opportunities for a more interventionist approach in urban transport systems.

COVID-19 has generated a major shock to urban mobility and transport systems. There are key questions about the implications of this for existing modes of urban development, how urban mobility is being reshaped under COVID-19, how enduring these changes are likely to be, and whether and how government can intervene to steer urban mobility in pursuit of particular ends. Underlying these questions is the issue of whether the ‘shock’ of COVID-19 will inform a radical shift in urban mobility patterns and urban transport systems and, if so, what this will look like. In the next section, we look at how digital platforms have been deployed and experimented with in response to COVID-19, paying particular attention to the issues raised above.



## **Experimenting with digital platforms in response to COVID-19**

Digital platforms were quickly adopted as tools for the reorganisation of cities around biosecurity and new mobility needs. Platforms have not only enabled various forms of remote working, leisure and service delivery, they have also been used to adapt and diversify the provision of urban transport to keep people and goods moving.

Digital platforms are, of course, increasingly powerful actors in society. In recent years, the so-called techlash has seen growing scrutiny of platform firms around issues of surveillance, algorithmic discrimination, monopoly

power and employment practices<sup>18</sup>. There is now a large if fragmented literature on the relationships between urban transport and a multiplicity of new digital mobility platforms. However, this emerging landscape is still not well understood at a systemic level, where changes are unfolding which will have lasting implications for urban mobility and the social, environmental and economic objectives of urban transport authorities.

Prior to the COVID-19 pandemic, digital platforms were impacting urban transport systems and mobility patterns in numerous ways. Academic work reviewing



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200 digital mobility platforms argues that the **'platformisation'** of urban transport and its implications are best understood in terms of different trajectories<sup>19</sup>.

It is through this notion of platformisation that we ask *how digital platforms and urban transport systems are being experimented with in response to COVID-19, and with what implications for urban mobility?* To do this, we draw on 66 global examples of digital platforms and the ways they have been mobilised or repurposed during the pandemic. The summary table of the 66 examples and details of how they were selected are attached in the Appendix.

Through an iterative process of analysis, this database was used to identify patterns and six different kinds of platform response. These are summarised below, with illustrative examples.

**Platformisation** in relation to urban transport describes a diverse set of processes through which digital platforms become embedded in cities and transport systems in the real world. Trajectories of platformisation are not simply determined by the type of technology, but are shaped by different social interests and organisations involved, the local institutional and regulatory context and existing infrastructural landscape. Nor are the trajectories fixed. Rather, they mutate and evolve over time in response to changing conditions, interventions and experimentation – meaning more deliberate forms of reconfiguration are possible.



## Platform sanitisations

One of the most widespread responses among mobility providers has been the introduction of new sanitisation regimes. This follows emerging public health regulations and guidance and includes new cleaning, disinfection and ventilation protocols, the use of 'contactless' forms of payment, ticketing and delivery, as well as facemasks and protective screens.

The overall aim of these measures has been to maintain services while minimising viral transmission through person-to-person contact, aerosols and surfaces within vehicles and across infrastructure networks – as well as to reassure users about the safety of transport services. In this sense, platform sanitisations are best described as efforts to mitigate the effects of COVID-19 on existing operations and services.

Sanitisation regimes have been implemented across all kinds of mobility services. Micro-mobility platforms for instance rolled out enhanced cleaning practices for disinfecting vehicle fleets and docking stations<sup>20</sup>. Similar protocols became the norm for delivery services, including the widespread introduction of 'contactless' drop-offs<sup>21</sup>. However, the enclosed environments of mass public transport and taxi services have been the greatest source of concern, with operators

forced to implement more comprehensive measures<sup>22</sup>. This has included regular health checks and testing of drivers, the use of facemasks inside vehicles and stations, keeping windows open for ventilation, the use of protective screens, as well as digital payment and ticketing systems<sup>23</sup>.

These measures have required the installation of equipment, additional cleaning work for staff and establishing new behaviours among users. Digital systems have been equally important. Payment and ticketing platforms have been expanded to enable travel without

Chinese ride-hailing giant **Didi Chuxing**, which has over 500m registered users worldwide, saw its daily use fall by two-thirds in March 2020<sup>26</sup>. Beginning in China in January 2020, the platform introduced a range of sanitisation measures aimed at adapting existing services to the coronavirus crisis:

- Protective screens between drivers and passengers
- Cleaning and disinfection of vehicles before each trip
- Temperature checks for drivers
- Mandatory wearing of facemasks for drivers and passengers

Didi provided plastic screens for its drivers and established a network of vehicle sanitation stations. Drivers were required to report their body temperature and upload images of the cleaning process and themselves wearing a mask. This was done through a new 'Health-Guard' feature created for the Didi app, which used facial recognition and artificial intelligence to verify sanitisation protocols had been completed<sup>27</sup>.



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At the height of COVID-19 lockdowns French public transport company **Transdev** (which operates primarily in Europe, North America and Australasia) saw ridership fall by as much as 90% in some of its urban networks and overall revenue drop by 8.9% in 2020<sup>28</sup>. In response to new public health rules and to regain the confidence of passengers, the company established sanitisation protocols across its operations<sup>29</sup>, including:

- Daily disinfection of vehicles
- Protective screens for drivers
- Introduction of mobile phone and bankcard based contactless payment systems
- Additional responsibilities for staff to supervise mask-wearing by passengers
- Availability of hydroalcoholic gel for handwashing in vehicles and stations

These measures have varied from place to place in relation to specific national regulations, certification schemes and transport authorities.

the need for handling cash, tickets or touching of machines. User-facing apps have been used to communicate updates about hygiene processes and prompt users to observe new protocols through digital checklists and verification procedures<sup>24</sup>. Several ride-hailing firms introduced pre-journey selfies – designed to verify that a face covering is being worn – as a condition for confirming a booking, with users locked out if they failed to do so<sup>25</sup>. Users have also been encouraged to report transgressions through the app, with noncompliance potential grounds for suspending user accounts. Taken together, this has meant a sizeable role for digital platforms and increased datafication



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in implementing and regulating new sanitisation regimes.

The implementation of new sanitisation regimes represented a key form of adaptation to the constraints of biosecurity across urban transport systems aimed at sustaining existing services and mobility flows. Although some of these measures have been relaxed in certain contexts, new waves of COVID-19 could lead to their periodic reintroduction, while debates about the use of digital vaccine passports for domestic travel also continue. There are likely to be other impacts which outlast the pandemic itself. The platformisation of sanitisation measures has accelerated the integration of digital payment and ticketing platforms into public transport and traditional taxi services. The more routine need to use mobile phone apps to access transport raises particular questions relating to digital exclusion. At the same time, it has increased the volume of user and mobility data generated and harvested by digital mobility platforms which is of considerable commercial and strategic value to those with access to it. This includes more intrusive forms of surveillance such as the use of highly controversial facial recognition technology and the collection of personal health data which have been widely justified on grounds of public health without serious public scrutiny.



## Platform monitoring and control

A second kind of response involves the extended use of digital platforms to monitor, analyse and control vehicle and passenger flows across public transport networks. This has been a key strategy deployed by established bus and rail operators as a way of enabling social distancing and minimising overcrowding and viral transmission risk. It involves a greater role for transport software and data services platforms for elements of network planning, operational and fleet management.

The primary logic of platform monitoring and control was initially about adapting existing services to new public health constraints with a growing emphasis on 'data-driven' solutions and economic efficiency. The approach relies on intensified surveillance and analysis of urban mobility data to monitor and anticipate peaks in travel demand on bus and rail services. This processed data was then used as the basis for interventions in the network. In the earliest days of the pandemic some operators introduced compulsory pre-booking and capacity limits through ticketing platforms at moments and locations of potential crowding<sup>33</sup>. Through user-facing apps and other digital interfaces, many platforms



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**Cityswift** is a relatively new platform company offering software and data services to bus operators, including National Express West Midlands and Go-Ahead Group. In the summer of 2020, Cityswift began rolling out its predictive vehicle occupancy feature as a way for passengers to see how crowded particular journeys might be<sup>30</sup>.

Cityswift's 'data engine' aggregates information from networked sensors and traffic monitors, location-tracked buses, journey requests, weather forecasts, scheduled local events and social media mining<sup>31</sup>. Using artificial intelligence, the company claims it can predict bus occupancy levels stop-by-stop up to two weeks in advance. During the pandemic this was used to encourage passengers back onto buses or to use quieter services to maintain social distancing. In addition, it enables operators to replan provision and implement dynamic scheduling in response to changing patterns of mobility brought about by the pandemic – with the cost-saving efficiencies of data-driven solutions promoted as a key benefit for operators<sup>32</sup>.

soon introduced new features to update passengers with information such as live scheduling, occupancy levels, and alternative route options<sup>34</sup>. Such measures were intended to spread demand to quieter services and minimise bottlenecks.

On the supply side, the same data has been used to rapidly adjust timetables in response to radically new and unpredictable patterns of urban mobility. The goal for cash-strapped public transport operators has been to



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optimise the capacity of reduced services to meet demand while allowing for social distancing. Platforms have been instrumental in the rapid redesign of bus networks in some cities<sup>35</sup>. There have been a number of trials with demand-responsive transport (DRT) designed either to respond to moments of high demand or replace low-demand services in peripheral parts of the network<sup>36</sup>.

Sitting beneath platform monitoring and control as a set of responses are a broader physical and digital infrastructure for scaling up the collection, aggregation and analysis of data on passenger numbers and movements, as well as live tracking and mapping public

transport fleets around the network<sup>37</sup>. This includes the use of vehicle GPS trackers and monitoring of mobile phone locations<sup>38</sup>, networked cameras and in-app questionnaires for counting people<sup>39</sup>, driver-operated clickers<sup>40</sup> and ticketing and journey-planning searches<sup>41</sup>.

Urban mobility data – including location data, historical and real-time journey-planning searches and ticket purchases – is a valuable resource being used by public transport operators and authorities to reconfigure existing networks and services. However, platform monitoring and control raises questions about data privacy and the normalisation of surveillance practices which are unlikely to be rolled back. Moreover, the processed data is often privatised in the hands of platform companies and competing interests which could ultimately be used in ways that undermine more universal forms of public transport provision.

In February 2020, the **Beijing Subway** introduced a range of app-based measures to minimise crowding in trains and stations in order to minimise the risk of infections<sup>42</sup>. These included:

- Pre-trip reservations at major stations during peak times
- 'Health code' and body temperature checks on entry
- On-board QR code check-ins to monitor passenger numbers and enable contact tracing
- 'Metro Full Capacity' app for passengers to see occupancy levels and adjust travel plans

## Platform substitutions

Since mid-2020, there has been significant investment alongside numerous trials and expansion plans for shared micro-mobility schemes in cities around the world. These platforms offer access to shared fleets of bikes, scooters and mopeds through mobile phone apps. In the context of COVID-19, they have provided alternatives to the risks associated with buses, urban rail and other enclosed forms of passenger transport. Despite the initial closure of many existing schemes and large-scale layoffs<sup>43</sup>, anxieties about public transport and taxi services provided fresh market opportunities for micro-mobility firms. The same has been true for car-sharing and rental platforms, some of which have seen remarkable growth over the course of the pandemic<sup>44</sup>.

Platform substitutions have also been actively encouraged by governments



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through investment in infrastructure for active travel and support for local trials<sup>45</sup>. This partly reflects longer-term pressures to reduce car use and experiment with more low-carbon forms of urban transport. However, the greater openness shown by many transport authorities to collaborating with micro-mobility platforms has been driven too by the immediate challenge of keeping cities and 'essential

US micro-mobility platform **Bird** is one of the largest in the world, active in over 300 cities. Bird both operates its own fleets of dockless e-scooters and licenses its platform for independent operators for a service fee. In response to the initial shock of COVID-19, the company laid off almost a third of its staff<sup>49</sup>. In June 2020, it shut down its Middle Eastern operations and many others in North American and European cities<sup>50</sup>.

After the easing of restrictions however, Bird moved to capitalise on cities' renewed interest in facilitating new micro-mobility trials and people's reluctance to risk infection on public transport:

- Announced \$150m of investment in March 2021 for European expansion and aims to launch in 50 new cities<sup>51</sup>
- Introduced shared e-bikes into schemes in 250 cities in June 2021<sup>52</sup>
- Co-founded and co-chairs new Micro-Mobility for Europe coalition, created to influence policy and regulation
- Increased direct sales to consumers and revenue through licensing software and older scooters to independent operators

Although Bird missed out on permits in key cities including Paris and London, the platform achieved significant growth during the pandemic. The company saw its revenue rise by 43% and to record levels in the second quarter of 2021 compared to 2019 – despite the collapse in income in the same period in 2020<sup>53</sup>.



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workers' moving. Firms themselves have been increasingly proactive in trying to shape regulation through newly created lobbying coalitions, especially in Europe<sup>46</sup>. Although many were facing considerable financial difficulties in early 2020, there has been a resurgence in venture capital investment and a wave of expansion plans as platform interests seek to capture new urban markets<sup>47</sup>.

The growth of shared micro-mobility platforms as a form of biosecure urban mobility has largely been based on the expansion of existing technologies and infrastructures. This includes docked or 'dockless' location-tracked bikes, scooters and mopeds; mobile apps for locating and unlocking vehicles; and fleet management software and systems for monitoring, maintaining, and redistributing vehicles – the most costly and labour-intensive element of micro-mobility schemes. Urban mobility data is generated from user profiles and location tracking, and is used to 'optimise' vehicle distribution and identify gaps in transport provision as potential areas of future investment.

Experimentation and efforts to facilitate more biosecure forms of urban mobility has seen greater emphasis by micro-mobility platforms on regulatory concerns and collaboration with transport authorities than was previously the case. Nevertheless, there remain significant

**Hellobike** was one of the survivors of the wave of bankruptcies which hit Chinese bike-sharing platforms in 2019. The platform operates in over 360 cities with over 300m registered users. It provides a range of mobility services and claims to have captured 80% of monthly e-bike users<sup>54</sup>.

During the pandemic, bike use has been increasingly favoured as a COVID-safe alternative over buses and other public transport<sup>55</sup>. Hellobike was a significant beneficiary of this. Like many other micro-mobility platforms around the world, Hellobike provided free rides to healthcare and other frontline workers as well as an increase in longer-term and longer-distance bike rentals<sup>56</sup>. When the first lockdown in Wuhan ended, the platform reported a tenfold increase in use compared to the day before the city was sealed off in January 2020<sup>57</sup>. The company began making profit through bike-sharing from March 2020, reporting 30% monthly growth<sup>58</sup>.

questions about the business models and benefits of such schemes as part of the urban transport mix. High unit costs, especially associated with fleet maintenance, mean most urban micro-mobility platforms run at a loss but are sustained by financial investors. This raises the issue of how many will ultimately prove viable<sup>48</sup>, and whether schemes continue to be skewed towards dense and already well-served areas and social groups. Despite being promoted as an alternative to private car use the evidence remains ambiguous as to whether micro-mobility platforms augment or compete with public transport services. These issues mean there remain major questions for urban transport authorities about the platformisation of active travel policies.



## Platform co-ordinations

A fourth type of response involves the use of digital platforms to establish new and bespoke forms of urban mobility provision to enable the continued movement of people and goods in and around urban areas within the constraints of COVID-19. Through diverse forms of platform coordination, digital mobility platforms have been promoted as highly adaptable technologies for creating resilience and reducing pressure on urban transport systems.

The overall logic of platform co-ordinations is about purposively building new infrastructure links between transport and service providers to meet the mobility needs created by the pandemic. Social distancing resulted in new logistical challenges for keeping urban services and businesses running. For instance, there has been a need to establish safer and more reliable ways of travelling for 'at risk' groups and key workers, where mass public transport services have been reduced or may present particular risks. New forms of delivery also became vital in maintaining the circulation of goods and provision of services.

Across many domains, the public health crisis has been the basis for a range of real-world experiments with urban



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mobility platforms to connect people with services, workers with workplaces and businesses with consumers. Examples are diverse but have generally involved using digital platforms to repurpose existing mobility provision for new uses. By integrating the right platform features and functions through mobile phone apps for location tracking, route-planning and so on, a minibus operator can almost instantaneously convert a fleet of vehicles and drivers into a delivery service to meet new needs. In this way, platforms have been used to establish on-demand and bespoke passenger transport for key workers<sup>59</sup>, set up urban

UK-based **Zeelo** provides software services for designing and operating bespoke bus routes with local operators. Starting in April 2020, it quickly repurposed its platform to offer 'COVID-safe' group transport for key workers, making use of unused buses and coaches<sup>63</sup>. Zeelo presents an alternative to potentially unreliable, inadequate or crowded public transport services, offering<sup>64</sup>:

- Pre-booking systems for capping numbers, maintaining social distancing and contact tracing
- Ad hoc journeys, vehicle tracking and flexible routing, pick-up and drop-off points for workers
- Regular sanitisation measures

Since the start of the pandemic, Zeelo has created group transport for specific workplaces in the UK, US, South Africa and Italy such as the NHS, Amazon, Ocado and Investec. Over that period, the platform saw its revenue grow by 600% and recently raised an additional \$12m in venture capital funding for further expansion<sup>65</sup>.



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logistics operations<sup>60</sup> and enable mobility providers and drivers to offer collection and delivery services to businesses and individuals without other or safe means of transport<sup>61</sup>. For ride-hailing platforms and their drivers, the ability to instantaneously switch function from passenger to delivery service has helped absorb the impact of the pandemic on income<sup>62</sup>.

The implications of platform co-ordinations will partly depend on what endures beyond the moment of experimentation. Some will have primarily been about showcasing technology. Others may continue to operate as parallel and private forms of infrastructure layered onto – and competing with – existing transport systems. Even if temporary experiments, platform interests will have benefited from developing new relationships and knowledge and generating valuable data. What might be more enduring is an optimistic view of digital mobility platforms as critical and endlessly adaptable tools for building resilience into urban transport systems and other domains. However, there is a risk that in the enthusiasm for ‘innovative’ technology solutions, questions get lost about whether they are really the most appropriate, equitable and sustainable options in the long-term and possible impacts on existing forms of provision.

**Wunder Mobility** is a German platform which provides software to launch and manage new mobility services and shared vehicle fleets. When lockdowns were rapidly imposed in spring 2020, Wunder teamed up with the World Economic Forum to launch #WeAllMove<sup>66</sup>. In the context of widespread disruption to urban transport and mobility services, keeping essential services running was a major problem and created a range of new mobility needs. Launched in a matter of weeks, this open digital platform and public database has enabled essential services and SMEs to connect with 130 mobility operators in 300 cities and access vehicles and mobility services for a range of purposes.

Examples of services provided #WeAllMove have included<sup>67</sup>:

- Free or discounted transport for healthcare and other essential workers
- COVID-safe group transport services for particular workplaces
- Use of vehicle fleets by healthcare providers and local authorities
- Alternative commuting options for at-risk groups or general public
- Use of vehicles for ‘contactless’ food, retail and other delivery services

#WeAllMove was possible in part because of Wunder Mobility’s existing partnerships and relationships with its software and services used by over 900 cities and companies around the world.

## Platform inversions

A fifth set of responses has seen an inversion of urban flows where work, shopping and entertainment 'travel' to the home rather than vice versa. Platform inversions have been critical in enabling the large-scale shift to home-working which minimised the need for urban travel.

This has been facilitated by a combination of digital platforms somewhat outside of the domain of urban transport, but that heavily impact patterns of urban mobility. They include online collaboration, videoconferencing and home entertainment platforms which have enabled remote working and service provision, as well as a range of e-commerce and on-demand home delivery platforms. In one sense, platform inversions have amplified trends underway well before the pandemic. Yet the acceleration of these processes has been unprecedented in terms of the growth rates and financial investment in leading platforms. In the context of COVID-19, this bundle of platforms has been crucial in reconstituting the home as a biosecure site of work, urban service delivery and consumption.

Platforms like Zoom, Slack and Netflix have provided remote digital alternatives to many of the shared urban spaces of daily life in ways not previously possible. They



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Teleconferencing platform **Zoom** is perhaps the most emblematic of the software companies able to capitalise on public health measures imposed during COVID-19. In spring 2020 the company's daily users jumped thirtyfold from 10m to 300m<sup>76</sup>. Over the course of 2020 its sales revenue quadrupled to \$2.65bn with growth only tailing off in the middle of 2021<sup>77</sup>. Its impact has been so significant in reshaping urban mobility that its name has been attached to a geographical process labelled 'Zoomshock'<sup>78</sup>.

Offering digital facilities for content-sharing, instant messaging and a variety of additional features for paid subscribers on top of videocalls, Zoom has been used as a digital substitute venue for everything from birthday parties to business meetings to political rallies to live exercise classes. The company is investing and planning for further expansion with the expectation that many services will continue to be delivered remotely even as the pandemic recedes. This includes opening up its software ecosystem through Zoom Apps and Marketplace and a \$100m investment fund for third party developers to build new applications on its platform, designed for specific purposes such as education and healthcare<sup>79</sup>. It is also creating new subscription services and offering its videoconferencing software as a white label product<sup>80</sup>.

have enabled large numbers of people to work, socialise, access services, consume entertainment and participate in civic life from the relative safety of their own homes, reducing the need for various kinds of physical travel.



A huge expansion of online shopping, logistical infrastructure and home delivery has been the other key element of this shift enabling large parts of the population to avoid urban centres. Major beneficiaries have included a range of e-commerce and online grocery platforms<sup>68</sup>. 'Q-commerce' platforms offering near-instant local delivery in under 30 minutes have also boomed<sup>69</sup>. These companies have increasingly moved beyond takeaway food to groceries and other everyday items, allowing a range of retailers, shops and wholesalers to rapidly outsource online sales and the logistics of home delivery<sup>70</sup>.

Sitting beneath platform inversions are a complex array of devices, software, human labour and urban infrastructure. Home-working platforms and especially video streaming have put significant strain on energy use, broadband networks and data servers<sup>71</sup>. The growth of home delivery services has relied on an extended web of physical and digital infrastructures for managing and optimising supply chains, inventory and distribution. Scaling up these operations has not only been achieved by rapidly employing new warehouse pickers, drivers and other workers, but by making efficiencies through centrally controlled and increasingly automated warehouse and logistical operations<sup>72</sup>. Q-commerce platforms meanwhile primarily make use of gig economy workers with their own vehicles, with jobs and deliveries organised using mobile phone apps, route-planning algorithms and locational tracking for optimising distribution from local outlets or urban micro-fulfilment centres. Platform inversions rely on and generate significant volumes of user and locational data which support targeted advertising, local investment and product development to increase sales and subscriptions, speed up logistical processes and achieve operational efficiencies to reduce costs.



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The impact of platform inversions on patterns of urban mobility, agglomeration and transport systems could be profound. As with other responses, a key question is about the degree to which these changes are reversed as the public health crisis recedes. Many people are returning to workplaces in city centres, but there remain intense debates and struggles over the future of work and the nine-to-five office job<sup>73</sup>. The technological potential for expanded remote working has been proven during the pandemic. Yet so have its limits and costs, especially in terms of the social and mental health impacts of physical remoteness and so-called 'Zoom fatigue'<sup>74</sup>. However, it should be stressed that even in 'advanced' economies like the UK, working-from-home was unevenly distributed and only available to a minority of mostly middle-class professionals<sup>75</sup>.

The other side of platform inversions has been the raised expectations of cheap and near-instant delivery. The impact of Amazon on the high street has been a concern for cities for many years only amplified by the pandemic. Whether 10-minute delivery can be made profitable remains questionable, but investment continues on the basis that money can be extracted from platform users and workers in dense and wealthier urban areas. Despite occasional recognition of their role as key workers during the pandemic, this has only intensified the



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pressure on the growing number of precarious and low-paid warehouse pickers, delivery drivers and other logistics workers. Perhaps the biggest challenge for municipal governments and transport authorities is how these platforms can be regulated and what alternatives might be possible to foster.

Spanish platform **Glovo** is one of the leading firms offering rapid urban delivery carried out by bike and moped riders. Glovo exited many Latin American and other markets in this increasingly competitive domain in early 2020 and laid off a quarter of its workforce. However, rising demand for 'instant' home delivery precipitated by the pandemic has since helped the company achieve major growth and investment and is pursuing aggressive expansion plans in Eastern Europe and Africa:

- Year-on-year revenue growth of 100% in 2020<sup>81</sup>
- \$528m new funding raised in April 2021 for investment in new markets, technology and logistics hubs<sup>82</sup>
- €100m investment by real estate firm Stoneweg in a new European network of q-commerce 'dark stores' – 100 of which Glovo plans to have operational by the end of 2021<sup>83</sup>
- €170m spent on acquisitions of Ehrana in Slovenia and Delivery Hero's foodpanda (Romania and Bulgaria), Donesi (Serbia, Montenegro, Bosnia and Herzegovina) and Pauza (Croatia)<sup>84</sup>
- €75m for expansion in Nigeria, Ghana, Kenya, Côte d'Ivoire and Tunisia<sup>85</sup>

Much of Glovo's apparent success in capitalising on COVID-19 has turned on the growth of its q-commerce division which delivers for major brands such as Unilever, IKEA, Nestle and L'Oréal, and supermarkets Carrefour, Continente, and Kaufland and saw a 300% rise in orders in 2020. It also introduced new services such as 'Deliver Anything' allowing users to pay riders as personal couriers for delivering everything from lost keys to homemade cakes.

However, the platform has faced severe criticism for the high fees charged to struggling restaurants, retailers and customers for its services. Glovo has also faced growing protests and strikes over pay and conditions and lost a major court case in Spain ruling its riders are employees rather than self-employed, which has since been legislated through the new 'Rider Law'<sup>86</sup>.

## Platform integrations

The final set of responses involve integrating different biosecurity measures into urban transport systems, typically through single mobility-as-a-service (MaaS) platforms. Platform integrations bring together elements of platform sanitisations, monitoring and control, substitutions and coordinations. In doing so they are the most ambitious in scope and clearest efforts to reconfigure urban transport systems as a whole. The overall logic is promoted as building flexibility and resilience into these systems so they can more easily adapt to the new demands of public health and other shocks to urban mobility.

MaaS platforms which relied on user subscriptions or small percentage fees paid per trip were hit hard by the collapse in urban mobility and public transport in particular. However, although revenues fell, these platforms were quickly able to introduce occupancy features and alerts onto their apps for public transport users, using real-time data collected through location tracking. In addition, by adapting the core function of enabling multi-modal travel by connecting different urban transport services in a single platform, MaaS providers were able to offer 'COVID-safe' journey-planning options for users



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**Moovit** runs its own MaaS app in cities across the world and provides white label software for public transport operators and authorities. It has moved to integrate a range of COVID-19 responses across its platforms since spring 2020<sup>92</sup>, including:

- Sanitisations – expanding contactless payment options with partner providers and communicating up-to-date hygiene protocols to users
- Monitoring and control – using urban mobility data and platform to offer services including live scheduling, service status info, real-time occupancy levels, pre-booking for public transport, as well as on-demand solutions for operators
- Substitutions – integrated shared micro-mobility and car services from Lime, Spin, Beryl, Beam, Helbiz and Getaround, enabling users to locate and plan multi-modal journeys through the Moovit platform<sup>93</sup>
- Coordinations – introduced Emergency Mobilization On-Demand service enabling bus operators to transform unused vehicles into a flexible on-demand service for essential workers<sup>94</sup>

In the early months of the pandemic, Moovit was bought by Intel in May 2020 for \$900m, primarily for its urban mobility data to support Mobileye – another Israeli company purchased by Intel in 2017 to lead its mobility and autonomous vehicle division<sup>95</sup>.



During 2020, **Siemens Mobility** assembled a stack of platforms and products for increasing the resilience of public transport to COVID-19<sup>96</sup>. Different services include:

- HaCon/HAFAS MaaS platform – COVID-safe low occupancy and intermodal journey planning, AI-based mobility analytics
- XiXo ticketing – contactless tickets and occupancy monitoring
- Padam Mobility – demand-responsive transport and first/last mile micro-transit services
- Siemens automatic doors, HVAC systems with ‘anti-COVID’ technology and UV-based disinfection services
- Occupancy detection hardware and software, user apps, on-board and station-based information systems for communicating up-to-date rules and managing passenger flows, monitoring and forecasting occupancy levels
- Traffic monitoring, optimisation and fleet management software and systems for flexible management of roads and shared bike schemes
- Aimsun software – simulation and predictive analytics for modelling and scheduling post-COVID multi-modal transport systems
- Sitraffic Symphony Mobility Operating System – overall control of mobility landscape for transport operators and authorities
- Siemens Mobility offers a potentially integrated suite of products (assembled in part through acquisitions of existing platforms) to transport operators and authorities for reconfiguring existing systems in response to COVID-19.

by adding new filters based on particular infection risks<sup>87</sup>. This has enabled users for instance to avoid busy routes or particular modes of transport altogether.

It is primarily the flexibility of this model which MaaS providers have promoted as a way of balancing biosecurity with the need to keep cities moving. For users, MaaS providers are offering on-demand access to a range of ‘COVID-safe’ transport options including micro-mobility, car-sharing and on-demand micro-transit services<sup>88</sup>. They emphasise the flexibility and convenience of integrated journey-planning, booking, payment and ticketing through a single platform. To transport authorities, the platform is promoted as a way of organising and managing urban transport as an integrated system. In the context of the pandemic, this enables a greater degree of systemwide control and adaptation in response to changing public health conditions.

The challenges of establishing urban MaaS systems are well documented<sup>89</sup>. Yet in terms of shaping more systemic and enduring change in the configuration of urban mobility, platform integrations may prove to be the most important response to COVID-19<sup>90</sup>. In a context where digital urban infrastructure increasingly comes more to the fore, the question of who controls the digital nervous system of urban transport becomes more pronounced<sup>91</sup>. A key question is about the modes of governance of urban MaaS projects, how they are regulated and the degree of collaboration and openness between MaaS platforms, urban transport authorities and mobility providers.

## Implications

The global pandemic and the need for new biosecurity measures have caused severe disruption to urban mobility and transport systems, the effects of which are ongoing. As shown in this report, digital platforms have developed responses designed to mitigate the impact of COVID-19 on existing urban transport infrastructure and mobility flows.

COVID-19 and associated platform-based responses are likely to have long-term impacts on urban mobility and transport systems, with implications for urban policymakers and transport authorities. Below, we reflect on the three guiding questions outlined in Section 2, based on the 66 examples reviewed for this report.

### **1. The global pandemic and platform responses to it pose serious challenges to agglomeration thinking.**

Although early predictions of an 'end of the city' look increasingly hyperbolic, COVID-19 initially created a major crisis for the prevailing organisation of urban space and infrastructure based on agglomeration thinking. The high concentration of people and activities in city centres was viewed as a major public health risk. Measures to combat the transmission of coronavirus including lockdowns, travel restrictions and social distancing led to the closure of many offices, shops and other workplaces. Urban transport systems built around urban agglomeration were severely affected by both the dramatic fall in demand, concerns about the safety of existing services and new regulations designed to minimise infections spreading through transport networks.

There have been various efforts to mitigate the effects of this disruption on existing services, as detailed in the sections on platform sanitisations and monitoring and

control. In addition, digital platforms have been widely used to create alternative forms of 'COVID-safe' transport provision as described in examples of platform substitutions and co-ordinations. Each of these responses have involved adapting or augmenting urban transport systems in order to sustain pre-pandemic city life as far as possible – which was equally important to the trajectories of many digital mobility platforms. These efforts at making agglomeration biosecure have however only been partly successful.

Even as restrictions have been lifted the return of activity to the city centre has been slow and incomplete. Of all the responses surveyed in this report, the role of platform inversions and the forces driving them are most significant in this respect. Digital platforms have facilitated a mass experiment in remote working and service provision – intensifying and accelerating a trend that preceded the pandemic. For employers in certain sectors this now offers a serious opportunity for reducing the overheads of city centre workplaces which remain at risk of periodic outbreaks of the disease. At the same time, many workers are reluctant to return to daily commuting because of the risks of catching COVID-19, but also due to personal and financial benefits of home-working.

Combined with the growing shift to online shopping and entertainment these trends undermine the logic of agglomeration in certain ways, threatening city centre retail and commerce and associated commercial and residential property interests. The outcome of these tensions will vary from place to place but will ultimately depend on how the pandemic continues to evolve and how struggles between different interests get resolved.

The pandemic and platform responses to it have foregrounded uncertainties about how urban geographies are and might be organised in the future. Finding effective ways of responding to this uncertainty is a pressing strategic concern for urban transport authorities and urban policymakers generally.

## **2. The global pandemic has accelerated and intensified how digital platforms are reshaping urban mobility.**

COVID-19 has undoubtedly driven change in patterns of urban mobility, with biosecurity putting new constraints on transport systems. As this report shows, digital platforms have played an important role in efforts to minimise or circumvent the pandemic's impact on urban mobility as a whole. Platform sanitisations and monitoring and control have been deployed to mitigate its effects on existing services and flows of people. Platform substitutions and co-ordinations have helped establish new and bespoke mobility services which have filled gaps and offered alternatives to public transport provision. Platform inversions meanwhile have perhaps been the most significant driver of the decline in commuting and city centre shopping trips – with the circulation of goods rather than people through urban logistics networks growing and intensifying. The overall picture is an acceleration and amplification of pre-existing trends.

**(i) Pressures on public transport.** The introduction of biosecurity measures detailed in platform sanitisations and monitoring and control represent new challenges for transport operators. Against a backdrop of long-term pressures on public transport, the measures themselves, anxieties about the safety of buses and trains and the growth of remote working all contributed to a sharp fall in

passenger numbers which has not fully recovered. The effect has been a further squeezing of revenues and profits and a risk of public transport becoming an increasingly residual service, with private platforms offering ready alternatives to fill the gaps in provision.

### **(ii) Surveillance of urban mobility.**

Biosecurity imperatives have broadened and accelerated the datafication and monitoring of urban transport systems. This trend was already well underway before the pandemic with the growing role of digital platforms and on-demand services in urban transport. COVID-19 has given fresh impetus to efforts to use real-time urban mobility data to both control mobility flows and drive cost-saving efficiencies in existing services, further embedding the interests and logics of digital platforms. Whether or not social distancing is required over the medium to long-term, it seems likely that the digital infrastructure and interests supporting platform monitoring and control are here to stay. A key issue going forward is what this infrastructure and data will be used for and to whose benefit. There are tremendous opportunities for using urban mobility data to predict and respond to changes in urban travel, to identify and address gaps in provision and to inform more strategic planning and integration. Yet it can equally be used as a tool for competitive practices which undermine public provision. Technologies like facial recognition remain highly controversial and there are wider issues around privacy, civil liberties and the normalisation of mass surveillance by government and private companies.

### **(iii) Polarising geographies of work.**

Perhaps one of the most impactful shifts will depend on the extent to which remote working and the reduction of

commuting endures. Evidence so far suggests an uneven return to places of work as restrictions ease and furlough schemes end. The pandemic has normalised a pre-existing trend in some sectors and workplaces towards more remote and hybrid ways of working – especially among the professional class. This presents a challenge for urban transport authorities in terms of adapting services to changing commuter patterns. It also made visible a continued reliance on a range of other (often vulnerable and precarious) ‘essential workers’ such as those employed by the rapidly expanding e-commerce and urban logistics sector highlighted in the platform inversions section. In the context of COVID-19 the stakes of this relationship took on new significance through the polarising divide between those able to work in the relative safety of their own homes and those whose jobs have necessitated continued travel and risk of infection.

#### **(iv) Experimentation with new platform mobility services.**

COVID-19 has provided a context for experimentation with alternative forms of platform-based transport provision. In some cities, this has meant options of using a range of new mobility services in the face of constraints and anxieties about the safety of public transport. Renewed interest and investment in the micro-mobility schemes highlighted in platform substitutions and the bespoke transport services created through platform co-ordinations are emblematic of this trend. Although the long-term viability of these experimental schemes remains uncertain, they appear to point towards greater fragmentation of urban transport systems, adding further competitive pressures on public transport without meaningfully extending provision to underserved

urban areas and communities. Without strong regulation and co-ordination these risk exacerbating problems of unequal geographical coverage and digital exclusion.

The pandemic and platform responses to it have accelerated and intensified pressures, risks and opportunities for the organisation of urban mobility systems. Urban transport authorities will need to develop effective ways to anticipate, track and respond to rapidly evolving and often contradictory pressures.

**3. COVID-19 has shone light on opportunities for transport authorities to mobilise platforms for the common good.** Despite the platform responses to COVID-19 discussed in this report being largely piecemeal and fragmented, the pandemic has also created various pressures, openings and opportunities for urban transport authorities to reshape urban transport systems.

The rapid introduction of biosecurity measures has demonstrated the scope for greater intervention and regulation of urban transport systems for the public good. Similarly, the spate of shared bike and scooter trials have shown cities and transport authorities exercising greater control over micro-mobility platforms than in previous years. The extent to which these efforts can steer these schemes towards extending provision to poorly served areas and communities, meeting infrastructure gaps and integrating rather than competing with public transport networks remains to be seen – but will depend on the capabilities of urban transport authorities to fund, co-ordinate and cross-subsidise such schemes at a more systemic level. At the same time, investment and interventions in road infrastructure for encouraging cycling and



active travel have proved very successful and could be extended and made permanent as could the promotion of car free streets and cities.

In terms of shaping urban mobility on a more systemic level, mobility-as-a-service platforms could still hold the key. Although MaaS systems remain aspirational in most contexts the capacity for integrating different modes of transport and infrastructure has considerable potential. The critical issue is how these platforms are governed – especially who owns and operates the system and for what purpose. This also relates to opportunities to make strategic use of platform-generated urban mobility data, where much of the required expertise and capacity is currently in the hands of private operators. Under more privately operated platforms there are commercial pressures to selectively incentivise the most profitable journeys and restrict sharing of urban mobility data. An alternative model involves the urban transport authority maintaining operational and decision-making control over a platform provided by a third-party developer – the model followed, for example, by Berlin's Jelbi system built upon Trafi's MaaS platform.

This model allows the urban transport authority to intervene more strategically and to selectively integrate different mobility providers around public transport networks. The capacity and capability to achieve this needs to be developed but must also be informed by cities' strategic objectives and the pursuit of universal service provision. This requires a substantial amount of collaborative work between urban transport authorities and platform companies but also, and crucially, requires commitment from governments and public funding.

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## Appendix

We began the research process with a search for and review of 'grey' literatures, policy documents, promotional material, company documents, and newspaper articles to scope out a general level response to the question: how are digital mobility platforms in urban context responding to the challenges posed by COVID-19? From this initial search we sketched out six thematic categories of response. These were intended as propositional categories that could orientate a systematic search and review of urban digital mobility platforms but where the categories could be refined and revised as we systematically reviewed platforms.

We searched for and built a global database of 66 urban digital mobility platforms. These were organised in relation to six propositional categories: 'sanitisations', 'monitoring and control', 'substitutions', 'co-ordinations', 'inversions', 'integrations'. In many instances platforms approximated to more than one category.

The database was populated via online searches using key terms and 'snowballing' from articles and documents, between January and June 2021. The database was organised in relation to the three layers of our urban stack: urban service, urban socio-technical organisation, urban data, and sub-categories within these categories. This adapted and extended a previous database that two of the authors were involved in constructing. These categories were used to discern and organise relevant material from a broad range of source material related to the 60 platforms. This included: online news articles, specialist magazines/websites (e.g. Intelligent Transport, City Transport and Traffic Innovation, TechCrunch), publicly available reports, white papers and webinars, company

profiles on Crunchbase and LinkedIn, and websites, blogs and promotional materials. Populating the database took place via the headings of the database orientating the process of content analysis and via a continuous process of writing and team reflection in meetings.

Though we drew on a range of sources, we recognise the limits of the data we used. The documentary material we used was exclusively written in the English language and, in doing so, foreclosed a wide variety of perspectives on urban platformisation. The focus of the database privileged larger corporate platform examples over grassroots and civic modes of platform organisation. This was primarily a consequence of our decision to prioritise a broad understanding of 66 platforms over a narrower sample. This involved some trade-off of depth for breadth. Many of the corporate platforms also had multiple sources of documents that focused on their platforms. In short, material in relation to these platforms was often much more accessible than for grassroots platforms.

Platform/transport operator	COVID-19 responses
Amazon	Platform inversions
Autocab	Platform sanitisations
Autocorb	Platform monitoring and control
Beat	Platform sanitisations, co-ordinations
Beijing Subway	Platform sanitisations, monitoring and control
Bestmile	Platform monitoring and control
Bird	Platform sanitisations, substitutions
BlaBlaCar	Platform sanitisations, co-ordinations
CO-APS	Platform monitoring and control
Careem	Platform sanitisations
CitySwift	Platform monitoring and control
Citymapper	Platform integrations
Citymobil	Platform sanitisations, inversions
Cityway	Platform monitoring and control, integrations
Cool	Platform co-ordinations
Cosmic Go	Platform sanitisations, substitutions
Dance	Platform substitutions
Didi Chuxing	Platform sanitisations, inversions
DoorDash	Platform sanitisations, inversions
Getaround	Platform sanitisations, substitutions
Getir	Platform sanitisations, inversions
Glovo	Platform sanitisations, inversions
Google Maps	Platform monitoring and control, integrations
Gorillas	Platform sanitisations, inversions
Grab	Platform sanitisations, co-ordinations, inversions
Hacon	Platform monitoring and control, integrations
Hellobike	Platform sanitisations, substitutions
HopOn Mobility	Platform monitoring and control
Hopon	Platform sanitisations
Ioki	Platform monitoring and control, co-ordinations
Iomob	Platform monitoring and control, integrations
Kolonial/Oda	Platform sanitisations, inversions
Kyte	Platform substitutions
Lime	Platform sanitisations, substitutions
Lyft	Platform sanitisations, substitutions, co-ordinations

MaaS Global	Platform integrations
Meituan Bike	Platform sanitisations, substitutions
Moovit	Platform monitoring and control, integrations
Netflix	Platform inversions
Neuron	Platform sanitisations, substitutions
Nuvemshop	Platform inversions
Padam Mobility	Platform monitoring and control, co-ordinations and integrations
Rapido	Platform sanitisations, inversions
Remix	Platform monitoring and control
Santander Cycles	Platform sanitisations, substitutions
Shift2MaaS	Platform integrations
Shotl	Platform monitoring and control, co-ordinations
Siemens Mobility	Platform integrations
SkedGo	Platform monitoring and control, integrations
Slack	Platform inversions
Superpedestrian	Platform sanitisations, substitutions
Swoop	Platform sanitisations, co-ordinations
Trafi	Platform integrations
Transdev	Platform sanitisations, monitoring and control
Transit	Platform monitoring and control, integrations
TransportAPI	Platform monitoring and control
Turo	Platform sanitisations, substitutions
Uber	Platform sanitisations, co-ordinations, inversions
VOI Technology	Platform sanitisations, substitutions
Via/ViaVan	Platform monitoring and control, co-ordinations
Yulu	Platform sanitisations, substitutions
Wunder Mobility/#WeAllMove	Platform co-ordinations
Zeelo/Busrapido	Platform monitoring and control, co-ordinations
Zipabout	Platform monitoring and control, integrations
Zomato	Platform sanitisations, inversions
Zoom	Platform inversions