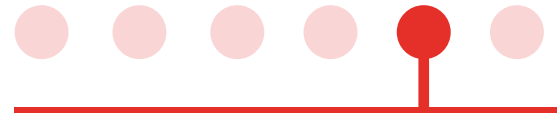


**ACCESSING SHARED AND  
USER-CENTRIC URBAN  
MOBILITY SOLUTIONS  
EFFECTIVELY**



**ACCESSING**

**Getting around in cities can often be inefficient and slow. Today's dominant transport modes have also led to additional challenges, such as air pollution, greenhouse gas emissions, and noise pollution.<sup>1</sup> They can also be price prohibitive, exacerbating social inequalities. However, these challenges can be countered by leveraging innovative technologies and new business models.** The transport of people and goods, materials and by-products is an ongoing activity in every prosperous city, and demand for transportation is only expected to increase.<sup>2</sup> Vehicle automation is also predicted to impact urban mobility systems.<sup>3</sup> However, the outcome of this transformation is entirely dependent on how these new digital solutions are applied. Today's urban mobility system is highly car-dependent, but solutions for people and goods can be diversified to include mass-transit, ridesharing, load-pooling, and low-impact vehicles – all of which can offer a broad range of benefits.

**CASE FOR CHANGE**

**92%**

On average in Europe, cars are parked **92%** of the time and when in use only **1.5 out of 5** seats are occupied<sup>4</sup>



In 2015, US drivers wasted **8 billion hours** stuck in traffic<sup>5</sup>



**20%** of an average European and US household's gross income is spent on car ownership costs<sup>6</sup>



Freight tonnage moved by trucks is forecast to grow **27%** between 2016 and 2027, driven largely by the rise in e-commerce and same-day delivery demand<sup>7</sup>



**20%** of urban traffic is freight, and it accounts for **50%** of urban road transport CO<sup>2</sup> emissions and **60%** of urban road transport air pollution<sup>8</sup>

**“We are required to provide residents of the Moscow agglomeration with fast, comfortable and eco-friendly transport that is a worthy alternative to a personal car, since during peak hours Moscow highways and streets are substantially overloaded at virtually all entrances into the city from the suburbs.”**

Maxim S. Liksutov, Deputy Mayor, Moscow (2018)

**“In social terms, access to jobs, education, health services and other facilities is increased by public transport provision; these are central to social inclusion for the disadvantaged. Furthermore, public transportation also supports community cohesion by increasing the quantity and quality of interactions between people...”**

UN Habitat, Planning and design for sustainable urban mobility: global report on human settlements (2013)



## EXAMPLES OF CIRCULAR ECONOMY OPPORTUNITIES

### Alternative solutions that reduce transport needs

Transport demand for people and goods in cities is forecast to continue increasing,<sup>9</sup> however some of that pressure can be alleviated. Distributed and digital manufacturing (such as 3D printing) can reduce or completely replace freight transport as products or components are made on-site/ close to their users (See *Making* worksheets in *Building, Products, and Mobility*). Conveniently located self-serve parcel lockers where the users collect or drop off parcels can also simplify last-/ first-mile freight transport.<sup>10</sup> Automated vacuum (pneumatic) refuse systems can substitute freight vehicles while being more space, and energy-efficient, and supporting better municipal solid waste recycling.<sup>11</sup> Improved internet access and teleconferencing solutions are also enabling people to work remotely, reduce overall travel needs, and gain back time by skipping the daily commute.<sup>12</sup>

### Active and low-impact mobility solutions

Switching to active transport (walking, biking) and zero-emission and/or lighter vehicles (electric cars, cargo-bikes, scooters, minibuses) is often very compatible with cities and can generate productivity gains, better health, reduce resource demand, and minimise pollution.<sup>13</sup> While such opportunities exist in any city, compact city development can further amplify these benefits. (See *Buildings: Planning and Mobility: Planning*)

### Multimodal transport as one integrated service

Mass-transit, such as metro, rail, and bus rapid transit (BRT), has the benefits of being high capacity and cost- and land-use efficient.<sup>14</sup> However, these modes of transport do not always cover a user's needs, as users look for greater convenience and integration with the city's broader transport system. Mobility-as-a-Service (MaaS) is a type of mobility scheme that blurs the line between public and private transport services. MaaS is characterised by using digital technology to integrate all modes of urban transport – from taxis to ride-shares, and bicycles to mass-transit and support sharing – and optimise use. MaaS schemes also aim to give users access to a diverse set of transport options that offer seamless, multimodal trip planning, dynamic pricing, sharing, e-ticketing, and payment services via one online platform.<sup>15</sup> With the introduction of autonomous vehicles (AVs), MaaS could also offer a platform for shared used of AVs.

### Optimising freight capacity through shared solutions and distributed centres

When managing the load capacity of freight vehicles, pooling, sharing and intelligent logistics systems can maximise vehicle utilisation and minimise freight kilometres. Digital platforms that support the consolidation of freight services, for example load-pooling platforms that match freight companies with available load-capacity, support best use of space and reduce trips.<sup>16</sup> Crowd-delivery/collection can also achieve similar outcomes, particularly with last- or first-mile delivery.<sup>17</sup>

## RELEVANT CASE EXAMPLES

### Copenhagen: A bicycle city

In Copenhagen, around 40% of daily commutes are made by bicycle. The city's bicycling infrastructure means it is often perceived as the most convenient transport option. In addition to supporting the city's 2025 carbon neutrality target, bicycling also generates a net profit for society through increased productivity and health (EUR 228 million in 2009). To further increase bicycling rates, the city has implemented a range of initiatives, including an electric city-bicycling scheme, dedicated cargo-bicycle parking,<sup>18</sup> bicycling highways, and green bicycling routes creating shortcuts across the city. The regional trains also support the increased bicycle use by allowing users to bring bicycles on, free-of-charge, in specifically adapted carriages making first- and last-mile transport more convenient for longer-distance commuters.<sup>19</sup>

### Whim: one operator for public, private, and active transport modes

In Helsinki, the West-Midlands and Antwerp, *Whim* offers access to (almost) all types of transport through an integrated MaaS scheme. Via one platform, travellers can get access to everything from bikes to cars, taxis, and public transport on either a pay-as-you-go basis or through a range of tailor-made monthly subscription packages. The user enters their destination in the MaaS app and selects the preferred route of getting there, which will cover one or several modes of transport.<sup>20</sup>



## ACCESSING

**Ride hailing as a community asset in Austin**

RideAustin is a non-profit ride-hailing company specifically designed for and by the local community. It offers similar services as Uber and Lyft who left the city in 2016, but due to its small-scale and non-profit business model it manages to keep overheads down and prices low, while improving pay conditions for drivers. It is powered by donations and volunteers, predominantly from Austin's local tech community, who also provide technology support for the RideAustin app. A special donation system also allows customers to round up to the nearest dollar, donating the extra money to local charities. Two years in, the company has carried out millions of trips and raised over USD 250,000 for charities.<sup>21</sup>

**Inner-city delivery solutions with Cubicycle**

In 2017, DHL introduced the 'City Hub' in Frankfurt and Utrecht for inner-city deliveries. It uses a customised trailer to carry up to four containers attached to a single delivery vehicle, which replaces two standard delivery vehicles. Once in the city, the four containers are individually loaded onto a DHL Cubicycle - a customised electric cargo bicycle. The Cubicycles complete the last-mile inner-city delivery, and can be reloaded for outbound shipments. This enables the completion of twice as many deliveries per hour as normal vehicles, and costs DHL less than half of what a delivery van would during its lifetime.<sup>22</sup>

**EXAMPLES OF WHAT URBAN POLICYMAKERS CAN DO**

Bringing together a multimodal mobility system entails foresight and clear **roadmaps and strategies** to provide a vision and ensure effective alignment in the longer term. Such strategies can also bring together multiple levers, such as **urban planning**, that are appropriate to the city's mobility context. City governments can also partner with others, such as higher tiers of government and the private sector, to bring together the **financial support** for infrastructure changes, and amend **regulations and fiscal incentives**, such as those linked to specific vehicle types.

To explore further see **Policy Levers**

**EXAMPLES OF LINKS TO OTHER SYSTEMS AND PHASES**

**Mobility: Planning** There are great potential benefits from a circular economy perspective in consolidating the infrastructure that supports urban freight (such as warehouses and logistics hubs).

**Mobility: Planning and Buildings: Planning** Compact urban development can be a key opportunity to reduce travel distances and encourage active transport.

**EXAMPLES OF BENEFITS****ECONOMIC PRODUCTIVITY****Increasing footfall and retail sales**

Making streets more pedestrian friendly can boost footfall and trading by up to 40%.<sup>23</sup>

**Reducing heavy vehicle use**

Load-pooling reduces the number of heavy vehicles on the road and delivery-related mileage by up to 30%.<sup>24</sup>

**Commercial cost savings**

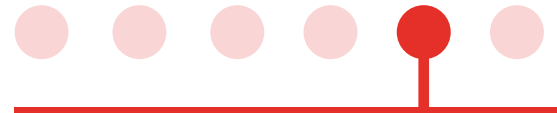
Reducing business and freight road travel time in the UK by 5% could produce up to GBP 2.5 billion commercial cost savings every year.<sup>25</sup>

**Generating positive socio-economic returns**

In the US, for every USD 1 invested in public transportation approximately USD 4 is generated in economic returns.<sup>26</sup>

**Gaining time and saving costs**

In the US, employers can save over USD 11,000 per half-time telecommuter per year while half-time telecommuters gain back 11 days a year - time they would have otherwise spent commuting.<sup>27</sup>



ACCESSING



**JOBS, SKILLS, AND INNOVATION**

**Increasing creative output**

A person's creative output increases by an average of 60% when walking indoors or outdoors.<sup>28</sup>

**Increasing employment**

Data from more than 300 metropolitan areas across the US showed that for every four seats added to railway carriages and buses per 1,000 residents in the city centre, there was a 19% increase in the number of employees per square mile. Adding 85 rail miles delivered a further 7% increase.<sup>29</sup>

**Increasing wages**

Doubling mass-transit seat capacity generated wage increases ranging from 1.1% to 1.8% per metropolitan area in the US.<sup>30</sup>



**HEALTH AND ENVIRONMENT**

**Reducing CO<sup>2</sup> emission with mass transit**

Heavy rail transit, such as subways and metros, produce around 76% less in CO<sup>2</sup> emissions per passenger mile than an average single-occupancy vehicle. Light rail systems produce 62% less and bus transit produces 33% less. The more passengers that are riding a bus or train, the lower the emissions per passenger mile.<sup>31</sup>

**Reducing CO<sup>2</sup> emissions with telecommuting**

In the US, telecommuters reduce greenhouse gas emissions by the equivalent of taking over 600,000 cars off the road for a year. If the work-at-home workforce expanded to include those who could and wanted to telecommute *half of the time*, the GHG savings would equate to taking 10 million cars off the road.<sup>32</sup>

**Improving health statistics**

Cycling to work can reduce the risk of mortality by 39%.<sup>33</sup>

**Increasing active mobility and health**

If every Londoner walked or cycled for 20 minutes a day, it would save the National Healthcare System (NHS) GBP 1.7 billion in treatment costs over the next 25 years. This includes an estimated 85,000 fewer Londoners being treated for hip fractures, 19,200 fewer suffering from dementia, and 18,800 fewer suffering from depression.<sup>34</sup>



**COMMUNITY AND SOCIAL PROSPERITY**

**Supporting inclusive access**

Mass-transit such as metro, rail and bus rapid transit (BRT) is cost-efficient, which supports low-income groups to access services and work.<sup>35</sup>

**Saving household mobility costs**

In the US, a household can save more than USD 10,000 by taking public transportation and living with one fewer car per household.<sup>36</sup>



**RESOURCE USE**

**Reducing the total urban car fleet**

A study suggests that the introduction of shared autonomous vehicles (AVs) integrated with mass-transit could, in theory, meet urban mobility needs while removing 9 out of 10 cars in European cities and freeing up a significant amount of parking space for alternative land use.<sup>37</sup>

**Reducing fuel consumption through public transport**

By reducing vehicle miles travelled, public transportation in the US reduced energy use in 2008 by the equivalent of 4.2 billion gallons (19 billion litres) of gasoline.<sup>38</sup>

**Reducing fuel consumption through telecommuting**

If the work-at-home workforce in the US expanded to include those who could and wanted to telecommute *half of the time*, 114.9 billion miles of vehicle driving could be avoided saving 288 million barrels of oil (of which 36.6% is imported).<sup>39</sup>



## ENDNOTES

- 1 UN Habitat, *Planning and design for sustainable urban mobility: global report on human settlements* (2013)
- 2 McKinsey, *Urban mobility at a tipping point* (2018)
- 3 McKinsey, *Urban mobility at a tipping point* (2018)
- 4 Ellen MacArthur Foundation, SUN and McKinsey Center for Business and Environment, *Growth Within: a circular economy vision for a competitive Europe* (2015) p. 54
- 5 INRIX, *INRIX 2015 Traffic Scorecard Sets Benchmark for U.S. Cities as Federal Government Accelerates Smart City*, inrix.com (March 15 2016)
- 6 Ellen MacArthur Foundation, SUN and McKinsey Center for Business and Environment, *Growth Within: a circular economy vision for a competitive Europe* (2015) p. 54, A. Stutzer & B. S. Frey, *Stress That Doesn't Pay: The Commuting Paradox* (2004) p. 4
- 7 Deloitte, *The future of freight*, Deloitte Insights (June 28 2017) <https://www2.deloitte.com/insights/us/en/focus/future-of-mobility/future-of-freight-simplifying-last-mile-logistics.html>
- 8 P. Rode et al., *Accessibility in cities: transport and urban form*, LSE Cities (2014) p. 7, UN Habitat, *Planning and design for sustainable urban mobility: global report on human settlements* (2013) p. 58, 68
- 9 Analysts expect continuous growth in e-commerce and increasing demand for rapid delivery. In a circular economy goods and material will also circulate more and locally..
- 10 See for example Deloitte's description of 'smart lockers': Deloitte, *The future of freight*, Deloitte Insights (June 28 2017) <https://www2.deloitte.com/insights/us/en/focus/future-of-mobility/future-of-freight-simplifying-last-mile-logistics.html>
- 11 ENVAC, [www.envacgroup.com](http://www.envacgroup.com)
- 12 Ellen MacArthur Foundation, SUN and McKinsey Center for Business and Environment, *Growth Within: a circular economy vision for a competitive Europe* (2015) p. 85
- 13 DHL, *Press release: DHL expands green urban delivery with City Hub for cargo bicycles* (January 3 2017) [http://www.dhl.com/en/press/releases/releases\\_2017/all/express/dhl\\_expands\\_green\\_urban\\_delivery\\_with\\_city\\_hub\\_for\\_cargo\\_bicycles.html](http://www.dhl.com/en/press/releases/releases_2017/all/express/dhl_expands_green_urban_delivery_with_city_hub_for_cargo_bicycles.html)
- 14 UN Habitat, *Planning and design for sustainable urban mobility: global report on human settlements* (2013) p. 3
- 15 Deloitte, *The rise of mobility as a service* (2017) p. 114 <https://www2.deloitte.com/content/dam/Deloitte/nl/Documents/consumer-business/deloitte-nl-cb-ths-rise-of-mobility-as-a-service.pdf>
- 16 DHL, *Fair and Responsible Logistics* (2015), UPS/GreenBiz, *The Road to Sustainable Urban Logistics* (2017)
- 17 CrowdToGo, *Video: What is Crowd to Go?* <https://crowdtogo.com/#introduction-crowd-delivery>, Kabadiwalla Connect <https://www.kabadiwallaconnect.in/>
- 18 17% of Copenhagen families own cargo bikes for shopping and transporting children, 25% of which are a direct replacement for cars. City of Copenhagen, *Good, Better, Best The City of Copenhagen's Bicycle Strategy 2011-2025* (2011) ,
- 19 City of Copenhagen, *Good, Better, Best The City of Copenhagen's Bicycle Strategy 2011-2025* (2011) , DSB, *Cykel i S-tog*, dsb.dk
- 20 WHIM, [whimapp.com/uk](http://whimapp.com/uk) <https://whimapp.com/uk/>
- 21 RideAustin, FAQ <http://www.rideaustin.com/faq/>, D. Solomon, *Hailing a Different Ride in Austin*, MIT Technology Review (7 March 2017) <https://www.technologyreview.com/s/603792/hailing-a-different-ride-in-austin/>
- 22 DHL, *Press release: DHL expands green urban delivery with City Hub for cargo bicycles* (January 3 2017) [http://www.dhl.com/en/press/releases/releases\\_2017/all/express/dhl\\_expands\\_green\\_urban\\_delivery\\_with\\_city\\_hub\\_for\\_cargo\\_bicycles.html](http://www.dhl.com/en/press/releases/releases_2017/all/express/dhl_expands_green_urban_delivery_with_city_hub_for_cargo_bicycles.html)
- 23 Arup, *Cities Alive: Towards a walking world* (2016) p. 55
- 24 McKinsey, *Urban commercial transport and the future of mobility* (September 2017) <https://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/urban-commercial-transport-and-the-future-of-mobility>
- 25 Centre for Cities, *Delivering change Making transport work for cities* (2014) p. 6 <http://www.centreforcities.org/wp-content/uploads/2014/08/14-05-01-Delivering-change-Making-transport-work-for-cities.pdf>
- 26 National Alliance of Public Transportation Advocates, *Infographics*, [publictransportation.org](http://publictransportation.org) <https://www.publictransportation.org/Pages/default.aspx>
- 27 Global Workforce Analytics, Flexjobs, *2017 State of Telecommuting in the U.S. Employee Workforce* (2017) p. 3
- 28 Arup, *Cities Alive: Towards a walking world* (2016) p. 57
- 29 E. Jaffe, *Public Transit Is Worth Way More to a City Than You Might Think*, City Lab (August 14 2013) <https://www.citylab.com/life/2013/08/public-transit-worth-way-more-city-you-think/6532/>, D. G. Chatman and R. B. Noland, *Transit service, physical agglomeration, and productivity in US metropolitan areas*, Transportation Research Board (2013) p. 1 [http://ced.berkeley.edu/downloads/pubs/faculty/chatman\\_2003\\_how-workplace-land-use-affects-personal-commercial-travel-and-commute-mode-choice.pdf](http://ced.berkeley.edu/downloads/pubs/faculty/chatman_2003_how-workplace-land-use-affects-personal-commercial-travel-and-commute-mode-choice.pdf)
- 30 D. G. Chatman and R. B. Noland, *Transit service, physical agglomeration, and productivity in US metropolitan areas*, Transportation Research Board (2013) p. 1 [http://ced.berkeley.edu/downloads/pubs/faculty/chatman\\_2003\\_how-workplace-land-use-affects-personal-commercial-travel-and-commute-mode-choice.pdf](http://ced.berkeley.edu/downloads/pubs/faculty/chatman_2003_how-workplace-land-use-affects-personal-commercial-travel-and-commute-mode-choice.pdf)
- 31 U.S. Department of Transportation Federal Transit Administration, *Public Transportation's Role in Responding to Climate Change* (2010) <https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/PublicTransportationsRoleinRespondingToClimateChange2010.pdf>
- 32 Global Workforce Analytics, Flexjobs, *2017 State of Telecommuting in the U.S. Employee Workforce* (2017) p. 3
- 33 UN Habitat, *Planning and design for sustainable urban mobility: global report on human settlements* (2013) p. 164
- 34 Mayor of London, *London set to become the world's most walkable city*, [www.london.gov.uk](http://www.london.gov.uk) (July 19 2018) <https://www.london.gov.uk/press-releases/mayoral/mayor-launches-londons-first-ever-walking-plan>
- 35 UN Habitat, *Planning and design for sustainable urban mobility: global report on human settlements* (2013) p. 3
- 36 American Public Transportation Association, *Facts at a glance*, [publictransportation.org](http://publictransportation.org) <https://www.publictransportation.org/news/facts/Pages/default.aspx>
- 37 OECD, *Urban Mobility System Upgrade How shared self-driving cars could change city traffic* (2015) p. 5 [https://www.itf-oecd.org/sites/default/files/docs/15cpb\\_self-drivingcars.pdf](https://www.itf-oecd.org/sites/default/files/docs/15cpb_self-drivingcars.pdf)
- 38 ICF International, *The Broader Connection between Public Transportation, Energy Conservation and Greenhouse Gas Reduction*, American Public Transportation Association (2008) p. 2 [https://www.apta.com/resources/reportsandpublications/Documents/land\\_use.pdf](https://www.apta.com/resources/reportsandpublications/Documents/land_use.pdf)
- 39 K. Lister, *Telecommuting Benefits: The Bottom Line*, [TeleworkResearchNetwork.com](http://TeleworkResearchNetwork.com) (2010) p. 23

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